

# WHO Essential Medicines List Antibiotic Book



## Infographics


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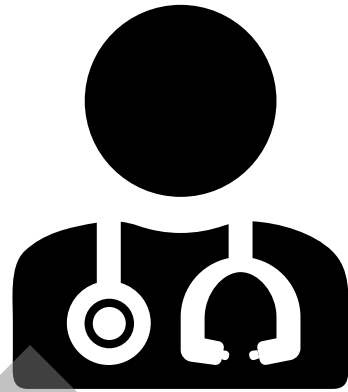
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# Primary Health Care

# Bronchitis

## ? Definition

A self-limiting inflammation of the trachea and bronchi characterized by persistent cough +/- fever usually caused by a viral infection

## 🦠 Most Likely Pathogens

### Respiratory viruses:

- Rhinovirus
- Influenza virus (A and B)
- Parainfluenza virus
- Coronavirus (including SARS-CoV-2)
- Respiratory syncytial virus
- Metapneumovirus
- Adenovirus

## 🔍 Diagnosis

### 🔍 Clinical Presentation

- Acute onset (<2 weeks) of cough lasting > 5 days +/- sputum production and shortness of breath (colour of the sputum does not indicate bacterial infection) +/- fever
- Generally a mild condition; cough usually lasts 10-20 days (can last longer)

**Important:** Symptoms can overlap with pneumonia and this can lead to inappropriate treatment with antibiotics. This should be avoided with a careful patient assessment

• **Bronchitis:** Less severe presentation, usually self-limiting (but cough may take weeks to resolve)

• **Pneumonia (see "Community-acquired pneumonia" infographic):** More severe presentation with shortness of breath and systemic signs of infection (e.g. increased heart and respiratory rate)

### 🔬 Microbiology Tests

Usually not needed; consider testing for Influenza virus or SARS-CoV-2 (e.g. during influenza season or outbreaks based on local epidemiological risk/situation/protocols)

### 🧪 Other Laboratory Tests

Usually not needed

### 📷 Imaging

Usually not needed

## ℞ Treatment

### 🔒 No Antibiotic Care

- Symptomatic treatment
- Bronchodilators (in case of wheezing), mucolytic or antitussive agents, can be considered based on local practices and patient preferences

Patients should be informed that:

- Great majority of cases are self-limiting and of viral origin
- Cough can persist for several weeks

### ℞ Symptomatic Treatment

Ibuprofen 200-400 mg q6-8h (Max 2.4 g/day)

OR

Paracetamol (acetaminophen) 500 mg-1 g q4-6h (max 4 g/day)  
• **Hepatic impairment/cirrhosis:** Max 2 g/day

### ℞ Antibiotic Treatment

Antibiotic treatment is **not recommended and should be avoided** as there is no evidence of a significant clinical benefit and there is a risk of side effects of antibiotics

# Bronchitis

## ? Definition

A self-limiting inflammation of the trachea and bronchi characterized by persistent cough +/- fever usually caused by a viral infection

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- Acute onset of cough lasting > 5 days, usually with runny nose and mild fever, with no clinical signs of pneumonia
- Generally a mild condition, cough usually lasts 1-3 weeks

**Important:** Symptoms can overlap with pneumonia and this can lead to inappropriate treatment with antibiotics. This should be avoided with a careful patient assessment

- **Bronchitis:** Less severe presentation, usually self-limiting (but cough may take weeks to resolve)
- **Pneumonia (see "Community-acquired pneumonia" infographic):** More severe presentation with shortness of breath and systemic signs of infection (e.g. increased heart and respiratory rate)

### 🔬 Microbiology Tests

Usually not needed; consider testing for Influenza virus or SARS-CoV-2 (e.g. during influenza season or outbreaks based on local epidemiological risk/situation/protocols)

### 🧪 Other Laboratory Tests

Usually not needed

### 📷 Imaging

Usually not needed

## 🦠 Most Likely Pathogens

### Respiratory viruses:

- Rhinovirus
- Influenza virus (A and B)
- Parainfluenza virus
- Coronavirus (including SARS-CoV-2)
- Respiratory syncytial virus
- Metapneumovirus
- Adenovirus

## ℞ Treatment

### 🔒 No Antibiotic Care

- Symptomatic treatment
- Bronchodilators (in case of wheezing), mucolytic or antitussive agents, can be considered based on local practices and patient preferences

Patients/parents should be informed that:

- Great majority of cases are self-limiting and of viral origin
- Cough can persist for several weeks

### ℞ Symptomatic Treatment

- Ibuprofen (do not use if <3 months of age)
  - **Pain control/antipyretic:** 5-10 mg/kg q6-8h
  - **Oral weight bands:**
- |           |                |
|-----------|----------------|
| 6-<10 kg  | 50 mg q8h      |
| 10-<15 kg | 100 mg q8h     |
| 15-<20 kg | 150 mg q8h     |
| 20-<30 kg | 200 mg q8h     |
| ≥30 kg    | Use adult dose |

OR

- Paracetamol (acetaminophen)
  - **Pain control/antipyretic:** 10-15 mg/kg q6h
  - **Oral weight bands:**
- |           |                |
|-----------|----------------|
| 3-<6 kg   | 60 mg q6h      |
| 6-<10 kg  | 100 mg q6h     |
| 10-<15 kg | 150 mg q6h     |
| 15-<20 kg | 200 mg q6h     |
| 20-<30 kg | 300 mg q6h     |
| ≥30 kg    | Use adult dose |

### ℞ Antibiotic Treatment

Antibiotic treatment is **not recommended and should be avoided** as there is no evidence of a significant clinical benefit and there is a risk of side effects of antibiotics

# Acute Otitis Media

## ? Definition

Infection of the middle ear that occurs mostly in children under 5 years of age and is rare in adults, often as a complication of a viral upper respiratory tract infection

## 🔬 Diagnosis

### 🔍 Clinical Presentation

Acute onset of ear pain (unilateral or bilateral), fever ( $\geq 38.0^{\circ}\text{C}$ ), +/- ear discharge

### 🔬 Microbiology Tests

- Not needed unless a complication is suspected
- Cultures of pus from perforated ear drums should not be used to guide treatment

### 🧪 Other Laboratory Tests

Not needed unless a complication is suspected

### 📷 Imaging

Not needed unless a complication (e.g. mastoiditis, brain abscess) is suspected

### 👁️ Otoscopy

**Required for definitive diagnosis if available:**  
Bulging, inflamed/congested tympanic membrane (may be opaque/show decreased mobility)

## 🦠 Most Likely Pathogens

### Respiratory viruses (most cases):

- Respiratory syncytial virus
- Rhinovirus
- Coronavirus (including SARS-CoV-2)
- Influenza virus (A and B)

### Bacteria (rarely bacterial superinfections can occur):

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- *Streptococcus pyogenes* (group A *Streptococcus*)

## 👐 Prevention

Overlaps with prevention of upper respiratory tract infections; hand hygiene, vaccination against *S. pneumoniae*, *H. influenzae* and influenza viruses can be useful

## ℞ Treatment

### ☰ Clinical Considerations

**Important:** Most non-severe cases can be managed symptomatically with **no antibiotic treatment**

- Instruct patients to monitor symptoms and report back in case they worsen/persist after few days

Antibiotics should be considered if:

- Severe symptoms (e.g. systemically very unwell, severe ear pain, fever  $\geq 39.0^{\circ}\text{C}$ )

### ℞ Symptomatic Treatment

Ibuprofen 200-400 mg q6-8h (Max 2.4 g/day)

OR

Paracetamol (acetaminophen) 500 mg-1 g q4-6h (Max 4 g/day)  
• **Hepatic impairment/cirrhosis:** Max 2 g/day

### ℞ Antibiotic Treatment

*Antibiotic treatment is not required in the great majority of cases (see "Clinical Considerations" when antibiotics may be indicated)*

*All dosages are for normal renal function*

#### First Choice

ACCESS Amoxicillin 500 mg q8h **ORAL**

#### Second Choice

ACCESS Amoxicillin+clavulanic acid 500 mg+125 mg q8h **ORAL**

### 🕒 Antibiotic Treatment Duration

5 days



# Acute Otitis Media

Page 1 of 2

## ? Definition

Infection of the middle ear that occurs mostly in children under 5 years of age, often as a complication of a viral upper respiratory tract infection

## Most Likely Pathogens

### Respiratory viruses:

- Respiratory syncytial virus
- Rhinovirus
- Coronavirus (including SARS-CoV-2)
- Influenza virus (A and B)

### Bacteria (rarely bacterial superinfections can occur):

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- *Streptococcus pyogenes* (group A *Streptococcus*)

## Prevention

Overlaps with prevention of upper respiratory tract infections; hand hygiene, vaccination against *S. pneumoniae*, *H. influenzae* and influenza viruses can be useful

## Diagnosis

### Clinical Presentation

Acute onset of ear pain (unilateral or bilateral), fever +/- ear discharge

### Microbiology Tests

- Not needed unless a complication is suspected
- Cultures of pus from perforated ear drums should not be used to guide treatment

### Other Laboratory Tests

Not needed unless a complication is suspected

### Imaging

- Not needed unless a complication (e.g. mastoiditis, brain abscess) is suspected

### Otoscopy

**Required for definitive diagnosis if available:**  
Bulging, inflamed/congested tympanic membrane (may be opaque/show decreased mobility)

# Acute Otitis Media

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## Rx Treatment

### Clinical Considerations


**Important:** Most non-severe cases can be managed symptomatically with no antibiotic treatment, especially in children >2 years of age

- Instruct caregivers to monitor symptoms and report back in case they worsen/persist after few days

Antibiotics should be considered if:

- Severe symptoms (e.g. systemically very unwell, severe ear pain, fever  $\geq 39.0^{\circ}\text{C}$ )
- Immunosuppressed children
- Bilateral acute otitis media in children <2 years


### Rx Symptomatic Treatment

 Ibuprofen (do not use if <3 months of age)

- **Pain control/antipyretic:** 5-10 mg/kg q6-8h
- **Oral weight bands:**

6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
$\geq 30$ kg	Use adult dose

OR

 Paracetamol (acetaminophen)

- **Pain control/antipyretic:** 10-15 mg/kg q6h
- **Oral weight bands:**


3-<6 kg	60 mg q6h
6-<10 kg	100 mg q6h
10-<15 kg	150 mg q6h
15-<20 kg	200 mg q6h
20-<30 kg	300 mg q6h
$\geq 30$ kg	Use adult dose

### Rx Antibiotic Treatment

Antibiotic treatment is not required in the great majority of cases (see "Clinical Considerations" when antibiotics may be indicated)

All dosages are for normal renal function

#### First Choice


 **Amoxicillin 40-50 mg/kg/dose q12h ORAL**

ACCESS

- **Oral weight bands:**

3-6 kg	125 mg q12h
6-10 kg	250 mg q12h
10-15 kg	500 mg q12h
15-20 kg	750 mg q12h
20-<30 kg	1000 mg q12h
$\geq 30$ kg	Use adult dose

#### Second Choice

 **Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h ORAL**

ACCESS

- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
$\geq 30$ kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution

### Antibiotic Treatment Duration

5 days

# Pharyngitis

## ? Definition

Inflammation of the pharynx characterized by sore throat and painful swallowing

## 🔬 Diagnosis

### 🔍 Clinical Presentation

Sore throat and painful swallowing

- **Viral:** Symptoms coincide with those of a viral upper respiratory tract infection (URTI) with cough, headache and myalgia
- **Bacterial:** More severe presentation, fever (>38.0°C), tender cervical lymph nodes and pharyngeal exudates (see "Centor Clinical Scoring System")

### 🔬 Microbiology Tests

- **Low likelihood of Group A Streptococcus (GAS) (Centor score 0-2):** Tests usually not needed
- **Higher likelihood of GAS (Centor score 3-4):** Rapid antigen test or throat culture could be considered, especially in countries where rheumatic fever (RF) and rheumatic heart disease are frequent. Test should only be performed if antibiotic treatment is considered if positive

### 🧪 Other Laboratory Tests

Blood tests usually not needed

### 📷 Imaging

Usually not needed unless a complication is suspected

## 🦠 Most Likely Pathogens

### Viruses (> 80% of cases):

- Respiratory viruses (most cases)
- Epstein Barr virus
- Other viruses of the herpes virus family

### Bacteria:

- Group A *Streptococcus* (5-10% in adults)
- Streptococci (group C and G)

### Other Infectious Causes:

- Acute HIV-infection and other sexually transmitted diseases (syphilis, gonorrhea)
- Acute toxoplasmosis
- Diphtheria

### Non Infectious (rare):

- Pollution
- Allergens
- Smoking

## ☑️ Centor Clinical Scoring System

This system can help indicate infection origin (bacterial or viral) and whether antibiotics are necessary. However even with a high score of 4, the probability of GAS infection is only 50% and this score has only been validated in high-income settings

### Signs & Symptoms (1 point each)

- Fever > 38.0°C
- No cough
- Tender anterior lymphadenitis
- Tonsillar exudates

### Score 0-2

- GAS pharyngitis unlikely
- **Symptomatic treatment only**

**Score 3-4** - In case of low risk of RF (e.g. countries with **low** prevalence of RF)

- **Antibiotic treatment can be withheld** even in cases of likely GAS pharyngitis

**Score 3-4** - In case of high risk of RF (e.g. countries with **med/high** prevalence of RF)

- Antibiotic treatment is recommended

## ℞ Treatment

### 🕒 Antibiotic Treatment Duration

Depending on the local prevalence or previous history of rheumatic fever:

- Low Risk of RF: **5 days**
- High Risk of RF: **10 days**

*Note: when clarithromycin or cefalexin are used treatment duration is always 5 days*

### ℞ Antibiotic Treatment

*The only clear indication for antibiotic treatment is to reduce the probability of developing rheumatic fever in endemic settings (however, after 21 years of age the risk of RF is lower)*

*All dosages are for normal renal function*

#### First Choice

ACCESS Phenoxyethylpenicillin 500 mg (800 000 IU) q6h **ORAL**

OR

ACCESS Amoxicillin 500 mg q8h **ORAL**

#### Second Choice

WATCH Clarithromycin 500 mg q12h **ORAL**

OR

ACCESS Cefalexin 500 mg q8h **ORAL**

*GAS remains universally susceptible to penicillin. However, resistance to macrolides is common in some communities*

# Pharyngitis

## ? Definition

Inflammation of the pharynx characterized by sore throat and painful swallowing

## 🔬 Diagnosis

### 🔍 Clinical Presentation

Sore throat and painful swallowing

- **Viral:** Symptoms coincide with those of a viral URTI with cough, headache and myalgia
- **Bacterial:** More severe presentation, fever (>38.0°C), tender cervical lymph nodes and pharyngeal exudates

### 🔬 Microbiology Tests

- **Low likelihood of Group A *Streptococcus* (GAS) (Centor score 0-2):** Tests usually not needed
- **Higher likelihood of GAS (Centor score 3-4):** Rapid antigen test or throat culture could be considered, especially in countries where rheumatic fever (RF) and rheumatic heart disease are frequent
  - Negative rapid antigen test could be confirmed with a throat culture if available

### 🧪 Other Laboratory Tests

Blood tests usually not needed

### 📷 Imaging

Usually not needed unless a complication is suspected

## ☑️ Centor Clinical Scoring System

This system can help indicate infection origin (bacterial or viral) and whether antibiotics are necessary. However even with a high score of 4, the probability of GAS infection is only 50% and this score has only been validated in high-income settings

### Signs & Symptoms (1 point each)

- Fever > 38.0°C
- No cough
- Tender anterior lymphadenitis
- Tonsillar exudates

#### Score 0-2

- GAS pharyngitis unlikely
- **Symptomatic treatment only**

**Score 3-4** - In case of low risk of RF (e.g. countries with **low** prevalence of RF)

- **Antibiotic treatment can be withheld** even in cases of likely GAS pharyngitis

**Score 3-4** - In case of high risk of RF (e.g. countries with **med/high** prevalence of RF)

- Antibiotic treatment is recommended

## 🦠 Most Likely Pathogens

### Viruses (> 80% of cases):

- Respiratory viruses (most cases)
- Epstein Barr virus
- Other viruses of the herpes virus family

### Bacteria:

- Group A *Streptococcus* (20-30% in children)
- Streptococci (group C and G)

### Other Infectious Causes:

- Acute toxoplasmosis
- Diphtheria

### Non Infectious (rare):

- Pollution
- Allergens
- Smoking

## ℞ Treatment

### 🕒 Antibiotic Treatment Duration

Depending on the local prevalence or previous history of rheumatic fever:

- Low Risk of RF: **5 days**
- High Risk of RF: **10 days**

*Note: when clarithromycin or cefalexin are used treatment duration is always 5 days*

### ℞ Antibiotic Treatment

*The only clear indication for antibiotic treatment is to reduce the probability of developing rheumatic fever in endemic settings*

*All dosages are for normal renal function*

#### First Choice

ACCESS Phenoxymethylpenicillin: 15 mg/kg/dose (24 000 IU/kg/dose) q6h **ORAL**

OR

ACCESS Amoxicillin 40-50 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	500 mg q12h
15-<20 kg	750 mg q12h
20-<30 kg	1000 mg q12h
≥30 kg	Use adult dose

#### Second Choice

WATCH Clarithromycin 7.5 mg/kg/dose q12h **ORAL**

OR

ACCESS Cefalexin 25 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

*GAS remains universally susceptible to penicillin.*

*However, resistance to macrolides is common in some communities*

# Sinusitis

## ? Definition

A symptomatic inflammation of the paranasal sinuses and nasal cavity

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- Diagnosis is made clinically; symptoms of bacterial and viral sinusitis overlap considerably
- Symptoms usually last 10-14 days and are self-limiting
- Main symptoms are nasal drainage, nasal obstruction or congestion, unilateral dental or facial pain, facial fullness or pressure, and sometimes cough
- Location of pain depends on involved sinuses
- Acute bacterial sinusitis suspected when:
  - Signs/symptoms persist  $\geq 10$  days without improvement; OR
  - Significant worsening of symptoms after initial mild phase

### 🔬 Microbiology Tests

Usually not needed

### 🧪 Other Laboratory Tests

Usually not needed

### 📷 Imaging

Usually not needed unless a complication or an alternative diagnosis is suspected

## 🦠 Most Likely Pathogens

### Respiratory viruses:

- Influenza virus (A and B)
- Rhinovirus
- Coronavirus (including SARS-CoV-2)
- Respiratory syncytial virus (RSV)

### Bacteria (rarely):

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*

## ℞ Treatment

### 🔒 No Antibiotic Care

- Treatment is to improve symptoms, but **antibiotics have minimal impact on symptom duration in most cases**
- Symptomatic treatment includes antipyretic and analgesic medications, nasal irrigation with a saline solution and topical intranasal glucocorticoids or decongestants
- Most guidelines recommend using disease severity (duration and intensity of symptoms) to direct treatment

**Mild to Moderate Presentation** (<10 days duration and improving):

- Watchful waiting approach with symptom relief and **no antibiotic treatment**

### 📋 Clinical Considerations

Antibiotics should be considered if:

- Severe onset of symptoms
- **Severe onset:** Measured fever  $\geq 39.0^{\circ}\text{C}$  & purulent nasal discharge or facial pain for at least 3-4 consecutive days
- Patients with chronic underlying comorbid diseases (deciding on a case-by-case basis)
- Patients at increased risk of complications
- “Red flag” signs/symptoms suggestive of complicated infection such as systemic toxicity, persistent fever  $\geq 39.0^{\circ}\text{C}$ , periorbital redness and swelling, severe headache, or altered mental status

### 🕒 Antibiotic Treatment Duration

5 days


### ℞ Antibiotic Treatment

*Antibiotic treatment is not required in the great majority of cases (see “Clinical Considerations” when antibiotics may be indicated)*

*All dosages are for normal renal function*

 Amoxicillin 1g q8h **ORAL**

OR

 Amoxicillin+clavulanic acid 500 mg + 125 mg q8h **ORAL**

# Sinusitis

Page 1 of 2

## ? Definition

A symptomatic inflammation of the paranasal sinuses and nasal cavity. Much less common than in adults because sinuses are not fully developed.

## Most Likely Pathogens

### Respiratory viruses:

- Influenza virus (A and B)
- Rhinovirus
- Coronavirus (including SARS-CoV-2)
- Respiratory syncytial virus (RSV)

### Bacteria (rarely):

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*

## Diagnosis

### Clinical Presentation

- Diagnosis is made clinically; the symptoms of bacterial and viral sinusitis overlap considerably
- Symptoms usually last 10-14 days and are self-limiting
- Main symptoms are purulent nasal drainage, nasal obstruction or congestion, unilateral dental or facial pain, facial fullness or pressure, and cough
- Location of pain depends on involved sinuses
- Acute bacterial sinusitis suspected when:
  - Signs/symptoms persist  $\geq 10$  days without improvement;
  - OR
  - Significant worsening of symptoms after initial mild phase

### Microbiology Tests

Usually not needed

### Other Laboratory Tests

Usually not needed

### Imaging

Usually not needed unless a complication or an alternative diagnosis is suspected

# Sinusitis

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## Rx Treatment



### No Antibiotic Care

- Treatment is to improve symptoms, but **antibiotics have minimal impact on symptom duration in most cases**
- Symptomatic treatment includes antipyretic and analgesic medications, nasal irrigation with a saline solution and topical intranasal glucocorticoids or decongestants
- Most guidelines recommend using disease severity (duration and intensity of symptoms) to direct treatment

**Mild to Moderate Presentation** (<10 days duration and improving trend of symptoms):

- Watchful waiting approach with symptom relief and **no antibiotic treatment**



### Clinical Considerations

Antibiotics should be considered if:

- Severe onset of symptoms
- **Severe onset:** Measured fever  $\geq 39.0^{\circ}\text{C}$  and purulent nasal discharge or facial pain for at least 3-4 consecutive days
- Patients with chronic underlying comorbid diseases (deciding on a case-by-case basis)
- Patients at increased risk of complications
- “Red flag” signs/symptoms suggestive of complicated infection such as systemic toxicity, persistent fever  $\geq 39.0^{\circ}\text{C}$ , periorbital redness and swelling, severe headache, or altered mental status



### Antibiotic Treatment Duration

5 days



### Antibiotic Treatment

*Antibiotic treatment is not required in the great majority of cases (see “Clinical Considerations” when antibiotics may be indicated)*

*All dosages are for normal renal function*



Amoxicillin 40-50 mg/kg/dose q12h **ORAL**

• **Oral weight bands:**

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	500 mg q12h
15-<20 kg	750 mg q12h
20-<30 kg	1000 mg q12h
$\geq 30$ kg	Use adult dose

OR



Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **ORAL**

• **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
$\geq 30$ kg	Use adult dose

*Amox = amoxicillin*

*Oral liquid must be refrigerated after reconstitution*

# Dental Infections

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Only dental infections where antibiotic treatment is usually required are reported

## Dental Infections Definitions

- **Dental Abscess:** Localized collection of pus, which can be categorized as
  - *Apical Abscess* (more common): Infection at the apex of the dental root that originates from within the dental pulp usually as a consequence of an untreated dental caries
  - *Periodontal Abscess* (less common): Infection originates around the tooth usually as a consequence of a serious gum disease
  - *Abscess with Spreading Infection:* When there are associated signs of systemic involvement
- **Dental Caries:** Localized destruction of dental hard tissue (enamel or dentine) by acid-producing plaque bacteria in the presence of dietary sugar, which can lead to the formation of cavities (i.e. small holes in the tooth)
- **Pulpitis:** Inflammation of dental pulp, that usually occurs as a consequence of the progression of dental caries
- **Periodontal Disease:** A group of inflammatory diseases affecting the tissues that surround and support the teeth (alveolar bone and gums), which includes
  - *Gingivitis:* Gum inflammation
  - *Necrotizing Ulcerative Gingivitis:* Severe gum infection characterized by necrosis and ulcerations
  - *Periodontitis:* Inflammation within the alveolar bone supporting the teeth (categorized as periapical/apical when the inflammation within the alveolar bone is located around the apex of a tooth)

## Dental Terminology Definitions

- **Alveolar Bone:** Part of the jawbones that surrounds and supports the teeth
- **Dental Pulp:** The inner part of the tooth that contains blood vessels and nerves
- **Gingivae (Gums):** Soft tissue covering the alveolar bone
- **Plaque:** Biofilm of microbes, mainly bacteria, which sticks to the teeth and contributes to oral diseases such as caries and periodontal disease

## Most Likely Pathogens

**Important:** most dental infections are caused by conditions that favour the growth of pathogens in the mouth, including an abundance of sugars (e.g. sucrose) and reduced saliva flow (dry mouth)

### Bacteria associated with caries:

- Acidogenic bacteria such as *Streptococcus* spp. (e.g. *S. mutans*), *Lactobacillus* spp. and *Actinomyces* spp.

### Bacteria associated with periodontal disease:

- Mostly anaerobes such as *Capnocytophaga* spp., *Prevotella* spp., *Aggregatibacter* spp., *Porphyromonas* spp.

## Diagnosis

### Clinical Presentation

#### Temporal order of progression:

1. Caries → 2. Pulpitis → 3. Apical periodontitis →
4. Apical abscess

#### Dental caries and progression to pulpal disease:

- Untreated caries can lead to pulpitis, which presents with acute pain / discomfort with drinking hot or cold beverages (initially) and then pain present all the time
- If tooth pain stops consider necrosis of the dental pulp

#### Dental abscess:

- Acute severe and persistent localized toothache that can radiate to the ear, jaw and neck
- Tooth tenderness (e.g. with chewing) and swelling of the cheek above the affected tooth are often present
- If left untreated, the infection can spread and present with signs of cellulitis around the eye or throat, fever (>38.0°C), tachycardia and lymphadenopathy

#### Periodontitis:

- Generally painless and progresses slowly (years) below the gums
- When symptoms occur they include dull throbbing in the area around the affected tooth (mouth and jaw), soreness while biting (due to a dead tooth) and halitosis

### Microbiology Tests

**Mild cases:** Usually not needed

**Severe cases requiring hospitalization:** Consider doing blood cultures

### Other Laboratory Tests

**Mild cases:** Usually not needed

**Severe cases requiring hospitalization:** White blood cell count, C-reactive protein and/or procalcitonin

### Point-of-Care Tests

**Point-of-care tests** can be done to establish the source of the dental pain/infection and make appropriate treatment decisions, for example:

#### • Tapping the tooth to evaluate response to percussion:

- Tenderness indicates that the pain originates in the bone and may be due to pulpal necrosis or to an abscess

#### • Checking response to a cold stimulus:

- Sensitivity of the tooth to cold indicates a vital pulp; this may indicate pulpitis
- No response to cold indicates a non-vital pulp that need to be treated before the condition progresses to an infection


### Imaging

Dental radiographs should be undertaken wherever possible as part of the diagnosis to differentiate between the various causes of dental pain



# Dental Infections

Page 2 of 2

 **Prevention**

- Minimize sugar consumption
- Prevent the accumulation of dental plaque with regular dental cleaning and good oral hygiene; fluoride is important because it strengthens the tooth enamel making it more resistant to caries
- Promote smoking cessation

**Rx Treatment**


**Rx Symptomatic Treatment**

Ibuprofen 200-400 mg q6-8h (Max 2.4 g/day)

OR

Paracetamol (acetaminophen) 500 mg-1 g q4-6h (Max 4 g/day)

- **Hepatic impairment/cirrhosis:** Max 2 g/day

 **Clinical Considerations**


**Important:**

- Most dental infections and dental pain can be treated without antibiotic treatment by removal of the cause and drainage of the infection using a dental procedure (e.g. extraction of the tooth)
- Antibiotics do not prevent severe complications and cannot replace local surgical treatment
- Antibiotics should not be used before a dental procedure to “calm an infection”, to “decrease inflammation”, to relieve pain or to prevent surgical site infections

- Regular use of mouthwashes with an antiseptic product (e.g. chlorhexidine) is not necessary for the control of dental infections; rinsing with salty water is usually adequate
- Common dental procedures are beyond the scope of this guidance

**Antibiotic treatment is not needed in most cases** but can be considered (always complementary to dental procedures):

- In patients with severe, spreading infections with systemic signs (e.g. facial swelling, inability to open the mouth, severe pain, fever >38.0°C, tachycardia)
- In severely immunosuppressed patients and patients with uncontrolled diabetes (higher risk of complications)

 **Antibiotic Treatment Duration**

If adequate source control achieved: **3 days**

If adequate source control **not** achieved: **5 days**

*Note: patients should be reassessed before the end of treatment to check the resolution of the infection*

**Rx Antibiotic Treatment**

*Antibiotic treatment is not required in the great majority of cases (see “Clinical Considerations” when antibiotics may be indicated)*

*For the treatment of infections of dental soft tissues (e.g. pericoronitis or necrotizing ulcerative gingivitis), metronidazole is usually used*

*All dosages are for normal renal function*

ACCESS Amoxicillin 500 mg q8h **ORAL**

OR

ACCESS Phenoxymethylpenicillin 500 mg (800 000 IU) q6h **ORAL**

# Dental Infections

Page 1 of 2

Only dental infections where antibiotic treatment is usually required are reported

## Dental Infections Definitions

- **Dental Abscess:** Localized collection of pus, which can be categorized as
  - *Apical Abscess* (more common): Infection at the apex of the dental root that originates from within the dental pulp usually as a consequence of an untreated dental caries
  - *Periodontal Abscess* (less common): Infection originates around the tooth usually as a consequence of a serious gum disease
  - *Abscess with Spreading Infection:* When there are associated signs of systemic involvement
- **Dental Caries:** Localized destruction of dental hard tissue (enamel or dentine) by acid-producing plaque bacteria in the presence of dietary sugar, which can lead to the formation of cavities (i.e. small holes in the tooth)
- **Pulpitis:** Inflammation of dental pulp, that usually occurs as a consequence of the progression of dental caries
- **Periodontal Disease:** A group of inflammatory diseases affecting the tissues that surround and support the teeth (alveolar bone and gums), which includes
  - *Gingivitis:* Gum inflammation
  - *Necrotizing Ulcerative Gingivitis:* Severe gum infection characterized by necrosis and ulcerations
  - *Periodontitis:* Inflammation within the alveolar bone supporting the teeth (categorized as periapical/apical when the inflammation within the alveolar bone is located around the apex of a tooth)

## Dental Terminology Definitions

- **Alveolar Bone:** Part of the jawbones that surrounds and supports the teeth
- **Dental Pulp:** The inner part of the tooth that contains blood vessels and nerves
- **Gingivae (Gums):** Soft tissue covering the alveolar bone
- **Plaque:** Biofilm of microbes, mainly bacteria, which sticks to the teeth and contributes to oral diseases such as caries and periodontal disease

## Most Likely Pathogens

**Important:** most dental infections are caused by conditions that favour the growth of pathogens in the mouth, including an abundance of sugars (e.g. sucrose) and reduced saliva flow (dry mouth)

### Bacteria associated with caries:

- Acidogenic bacteria such as *Streptococcus* spp. (e.g. *S. mutans*), *Lactobacillus* spp. and *Actinomyces* spp.

### Bacteria associated with periodontal disease:

- Mostly anaerobes (*Capnocytophaga* spp., *Prevotella* spp., *Aggregatibacter* spp., *Porphyromonas* spp.)

## Diagnosis

### Clinical Presentation

#### Temporal order of progression:

1. Caries → 2. Pulpitis → 3. Apical periodontitis →
4. Apical abscess

#### Dental caries and progression to pulpal disease:

- Untreated caries can lead to pulpitis, which presents with acute pain / discomfort with drinking hot or cold beverages (initially) and then pain present all the time
- If tooth pain stops consider necrosis of the dental pulp

#### Dental abscess:

- Acute severe and persistent localized toothache that can radiate to the ear, jaw and neck
- Tooth tenderness (e.g. with chewing) and swelling of the cheek above the affected tooth are often present
- If left untreated, the infection can spread and present with signs of cellulitis around the eye or throat, fever (>38.0°C), tachycardia and lymphadenopathy

#### Periodontitis:

- Generally painless and progresses slowly (years) below the gums
- When symptoms occur they include dull throbbing in the area around the affected tooth (mouth and jaw), soreness while biting (due to a dead tooth) and halitosis

### Microbiology Tests

**Mild cases:** Usually not needed

**Severe cases requiring hospitalization:** Consider doing blood cultures

### Other Laboratory Tests

**Mild cases:** Usually not needed

**Severe cases requiring hospitalization:** White blood cell count, C-reactive protein and/or procalcitonin

### Point-of-Care Tests

**Point-of-care tests** can be done to establish the source of the dental pain/infection and make appropriate treatment decisions, for example:

#### • Tapping the tooth to evaluate response to percussion:

- Tenderness indicates that the pain originates in the bone and may be due to pulpal necrosis or to an abscess

#### • Checking response to a cold stimulus:

- Sensitivity of the tooth to cold indicates a vital pulp; this may indicate pulpitis
- No response to cold indicates a non-vital pulp that need to be treated before the condition progresses to an infection

### Imaging

Dental radiographs should be undertaken wherever possible as part of the diagnosis to differentiate between the various causes of dental pain

# Dental Infections

Page 2 of 2



## Prevention

- Minimize sugar consumption
- Prevent the accumulation of dental plaque with regular dental cleaning and good oral hygiene; fluoride is important because it strengthens the tooth enamel making it more resistant to caries
- Promote smoking cessation



## Clinical Considerations

### Important:

- Most dental infections and dental pain can be treated without antibiotic treatment by removal of the cause and drainage of the infection using a dental procedure (e.g. extraction of the tooth)
  - Antibiotics do not prevent severe complications and cannot replace local surgical treatment
  - Antibiotics should not be used before a dental procedure to “calm an infection”, to “decrease inflammation”, to relieve pain or to prevent surgical site infections
  - Regular use of mouthwashes with an antiseptic product (e.g. chlorhexidine) is not necessary for the control of dental infections; rinsing with salty water is usually adequate
  - Common dental procedures are beyond the scope of this guidance
- Antibiotic treatment is not needed in most cases** but can be considered (always complementary to dental procedures):
- In patients with severe, spreading infections with systemic signs (e.g. facial swelling, inability to open the mouth, severe pain, fever >38.0°C, tachycardia)
  - In severely immunosuppressed patients and patients with uncontrolled diabetes (higher risk of complications)



## Antibiotic Treatment Duration

If adequate source control achieved: **3 days**  
 If adequate source control **not** achieved: **5 days**  
*Note: patients should be reassessed before the end of treatment to check the resolution of the infection*

## Rx Treatment

### Rx Symptomatic Treatment

- Ibuprofen (do not use if <3 months of age)
- **Pain control/antipyretic:** 5-10 mg/kg q6-8h
  - **Oral weight bands:**
- |           |                |
|-----------|----------------|
| 6-<10 kg  | 50 mg q8h      |
| 10-<15 kg | 100 mg q8h     |
| 15-<20 kg | 150 mg q8h     |
| 20-<30 kg | 200 mg q8h     |
| ≥30 kg    | Use adult dose |

OR

- Paracetamol (acetaminophen)
- **Pain control/antipyretic:** 10-15 mg/kg q6h
  - **Oral weight bands:**
- |           |                |
|-----------|----------------|
| 3-<6 kg   | 60 mg q6h      |
| 6-<10 kg  | 100 mg q6h     |
| 10-<15 kg | 150 mg q6h     |
| 15-<20 kg | 200 mg q6h     |
| 20-<30 kg | 300 mg q6h     |
| ≥30 kg    | Use adult dose |

### Rx Antibiotic Treatment

*Antibiotic treatment is not required in the great majority of cases (see “Clinical Considerations” when antibiotics may be indicated)*

*For the treatment of infections of dental soft tissues (e.g. pericoronitis or necrotizing ulcerative gingivitis), metronidazole is usually used*

*All dosages are for normal renal function*

- ACCESS Amoxicillin 40-50 mg/kg/dose q12h **ORAL**
- **Oral weight bands:**
- |           |                |
|-----------|----------------|
| 3-<6 kg   | 125 mg q12h    |
| 6-<10 kg  | 250 mg q12h    |
| 10-<15 kg | 500 mg q12h    |
| 15-<20 kg | 750 mg q12h    |
| 20-<30 kg | 1000 mg q12h   |
| ≥30 kg    | Use adult dose |

OR

- ACCESS Phenoxymethylpenicillin 15 mg/kg/dose (24.000 IU/kg/dose) q6h **ORAL**

# Localized Acute Bacterial Lymphadenitis

*This guidance excludes management of severe or generalized infections or those caused by viral, fungal or parasitic pathogens*

## Definition

Lymphadenitis refers to the inflammation and acute enlargement (>1-2 cm) of one or several lymph nodes

### Classification based on:

- Number of lymph node regions affected:
  - *Localized* (most cases): 1 lymph node region affected
  - *Generalized*: >1 lymph node region affected
- Location of the affected lymph node (e.g. cervical, axillary)
- Depth of the affected lymph node (superficial or deep)

## Diagnosis

### Clinical Presentation

- Acute onset of a palpable, painful red and inflamed enlarged lymph node (>1-2 cm) +/- fever (>38.0°C), and other signs/symptoms of systemic disease & cellulitis
- Bacterial cause more probable if unilateral involvement, fluctuance and skin drainage of the lymph node

### Microbiology Tests

Usually not needed; consider testing for HIV and tuberculosis if these are suspected

### Other Laboratory Tests

Usually not needed but may be considered in selected cases

### Biopsy

**Excisional biopsy or fine needle aspiration:** Consider when a malignancy is suspected

### Imaging

- Usually not needed
- Ultrasound can be considered to confirm lymph node involvement, to quantify the enlargement and to detect the presence of an abscess; it is not reliable to rule out malignancies (biopsy should be performed)

## Most Likely Pathogens

### Viruses (most cases):

- Epstein-Barr virus, Cytomegalovirus (both viruses can cause infectious mononucleosis)
- Respiratory viruses
- HIV

### Bacteria (more rarely):

- *Staphylococcus aureus* (including MRSA)
- *Streptococcus pyogenes* (group A *Streptococcus*)
- *Mycoplasma pneumoniae*

### Consider in specific situations (based on history and physical examination):

- Sexually transmitted infections (e.g. HIV)
- Zoonoses (e.g. brucellosis, tularemia)
- Mycobacterial infections (mostly tuberculosis)

## Treatment

### Clinical Considerations

**Important:** the great majority of cases of enlarged lymph nodes are caused by viral infections and antibiotics are **not needed**; a watchful waiting approach with follow up is appropriate (except if malignancy is suspected)


If symptoms are consistent with a bacterial infection, empiric treatment against *S. aureus* and *Streptococcus pyogenes* (group A *Streptococcus*) is indicated  
*Note: history is key in order to adapt treatment if necessary*

### Antibiotic Treatment Duration


5 days

### Antibiotic Treatment

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 500 mg+125 mg q8h **ORAL**

OR

 Cefalexin 500 mg q8h **ORAL**

OR

 Cloxacillin or flucloxacillin 500 mg q8h **ORAL**

*Cloxacillin (or flucloxacillin or dicloxacillin) has a narrower spectrum of antibacterial activity while maintaining good efficacy in cases of mild skin infections; it is the preferred option when possible*

# Localized Acute Bacterial Lymphadenitis

Page 1 of 2

*This guidance excludes management of severe or generalized infections or those caused by viral, fungal or parasitic pathogens*

## Definition

- Lymphadenitis refers to the inflammation and enlargement (>1-2 cm) of one or several lymph nodes
- Lymphadenopathy is another term often used

### Classification based on:

- Number of lymph node regions affected:
  - *Localized* (most cases): 1 lymph node region affected
  - *Generalized*: >1 lymph node region affected
- Location of the affected lymph node (e.g. cervical, axillary)
- Depth of the affected lymph node (superficial or deep)

## Most Likely Pathogens

### Viruses (most cases):

- Epstein-Barr virus (can cause infectious mononucleosis)
- Cytomegalovirus (can cause infectious mononucleosis)
- Respiratory viruses

### Bacteria (more rarely):

- *Staphylococcus aureus* (including MRSA)
- *Streptococcus pyogenes* (group A *Streptococcus*)
- *Mycoplasma pneumoniae*

### Consider in specific situations (based on history and physical examination):

- Sexually transmitted infections (e.g. HIV)
- Zoonoses (e.g. brucellosis, tularemia)
- Mycobacterial infections (mostly tuberculosis)

## Diagnosis

### Clinical Presentation

- Acute onset of a palpable, painful red and inflamed enlarged lymph node (>1-2 cm) +/- fever (>38.0°C), and other signs/symptoms of systemic disease and cellulitis
- Bacterial cause more probable if unilateral involvement, fluctuance and skin drainage of the lymph node

### Microbiology Tests

Usually not needed; consider testing for HIV and tuberculosis if these are suspected

### Other Laboratory Tests

Usually not needed but may be considered in selected cases

### Biopsy

Consider when a malignancy is suspected

### Imaging

- Usually not needed
- Ultrasound can be considered to confirm lymph node involvement, to quantify the enlargement and to detect the present of an abscess; it is not reliable to rule out malignancies (biopsy should be performed)

# Localized Acute Bacterial Lymphadenitis

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## Rx Treatment

### Clinical Considerations

#### Important:


- The great majority of cases of enlarged lymph nodes are caused by viral infections and antibiotics are **not needed**
- A watchful waiting approach with follow up is appropriate (except if malignancy is suspected)
- If symptoms are consistent with a bacterial infection, empiric treatment against *S. aureus* and *Streptococcus pyogenes* (group A *Streptococcus*) is indicated
- Note: history is key in order to adapt treatment if necessary

### Antibiotic Treatment Duration

5 days

### Rx Antibiotic Treatment

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **IV/ORAL**

#### • Oral weight bands:

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution


OR

 Cefalexin 25 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

OR

 Cloxacillin or flucloxacillin **IV/ORAL**

- Neonates: 25-50 mg/kg/dose q12h
- Children: 25 mg/kg/dose q6h

#### • Oral weight bands:

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

Cloxacillin (or flucloxacillin or dicloxacillin) has a narrower spectrum of antibacterial activity while maintaining good efficacy in cases of mild skin infections; it is the preferred option when possible

# Conjunctivitis

## Bacterial Eye Infection

### ? Definition

Infection of the conjunctiva (i.e. the mucosa that covers the inside part of the eyelids and the sclera, which is the white part of the eye)

### 🔬 Diagnosis

#### 🔍 Clinical Presentation

- **Most cases are mild and self-limiting**
- Usually the eye is red, watery and itchy and patients have a feeling of “sand in the eye”
- Vision is normal and there is no pain (if pain is present consider corneal involvement)
- Thick purulent eye discharge can be present in bacterial infection

#### **Hyperacute Bacterial Conjunctivitis:**

- Severe infection that presents with decreased vision, purulent eye discharge, eyelid swelling, pain on palpation and preauricular adenopathy
- Consider urgent referral to an ophthalmologist due to risk for rapid progression to corneal perforation

#### 🔬 Microbiology Tests

Usually not needed unless *Neisseria gonorrhoeae* or *Chlamydia trachomatis* are suspected

#### 🧪 Other Laboratory Tests

Usually not needed

#### 📷 Imaging

Usually not needed

### 🦠 Most Likely Pathogens

- Most cases are of viral origin
- Bacterial cases are less common than viruses
- Consider *Chlamydia trachomatis* (serovars D to K) and *Neisseria gonorrhoeae* in the context of sexually transmitted infections (STI) see “STI – *Chlamydia urogenital infections and gonococcal infection*”
- Hyperacute bacterial conjunctivitis is mostly caused by *Neisseria gonorrhoeae*

**Important:** non-infectious causes (mostly allergies) should always be considered

### ℞ Treatment

#### 📋 Clinical Considerations

- Most cases resolve without treatment in 7-10 days
- Antibiotics can be considered in case of suspected bacterial conjunctivitis or conjunctivitis in the context of a sexually transmitted infection

#### 🕒 Antibiotic Treatment Duration

Since treatment duration varies, please refer to the corresponding treatment section

### ℞ Bacterial Conjunctivitis

ACCESS **Gentamicin 0.3% EYE DROPS**  
1 drop in the affected eye q6h  
**Treatment duration: 5 days**

OR

WATCH **Ofloxacin 0.3% EYE DROPS**  
1 drop in the affected eye q6h  
**Treatment duration: 5 days**

OR

ACCESS **Tetracycline 1% EYE OINTMENT**  
1 cm in the affected eye q6h  
**Treatment duration: 5 days**

### ℞ Gonococcal Conjunctivitis

*All dosages are for normal renal function*

WATCH **Ceftriaxone 250 mg IM**  
**Treatment duration: Single dose**

COMBINED WITH

WATCH **Azithromycin 1 g ORAL**  
**Treatment duration: Single dose**

# Conjunctivitis

## Bacterial Eye Infection

### Definition

Infection of the conjunctiva (i.e. the mucosa that covers the inside part of the eyelids and the sclera, which is the white part of the eye)

### Diagnosis

#### Clinical Presentation

- **Most cases are mild and self-limiting**
- Usually the eye is red, watery and itchy and patients have a feeling of “sand in the eye”
- Vision is normal and there is no pain (if pain is present consider corneal involvement)
- Thick purulent eye discharge can be present in bacterial infection

#### Hyperacute Bacterial Conjunctivitis:

- Severe infection that presents with decreased vision, purulent eye discharge, eyelid swelling, pain on palpation and preauricular adenopathy
- Consider urgent referral to an ophthalmologist due to risk for rapid progression to corneal perforation

#### Microbiology Tests

Usually not needed unless *Neisseria gonorrhoeae* or *Chlamydia trachomatis* are suspected

#### Other Laboratory Tests

Usually not needed

#### Imaging

Usually not needed

### Most Likely Pathogens

- Most cases are of viral origin
- Bacterial cases can occur especially in children (although less common than viruses)
- Consider *Chlamydia trachomatis* (serovars D-K) and *Neisseria gonorrhoeae* in neonates after vaginal delivery from infected mothers

**Important:** non-infectious causes (mostly allergies) should always be considered

## Rx Treatment


### Clinical Considerations

- **Most cases resolve without treatment** in 7-10 days
- Antibiotics can be considered in case of suspected bacterial conjunctivitis


### Antibiotic Treatment Duration

Since treatment duration varies, please refer to the corresponding treatment section


## Rx Bacterial Conjunctivitis

 **Gentamicin 0.3% EYE DROPS**  
• 1 drop in the affected eye q6h  
**Treatment duration:** 5 days


OR

 **Ofloxacin 0.3% EYE DROPS**  
• 1 drop in the affected eye q6h  
**Treatment duration:** 5 days

OR

 **Tetracycline 1% EYE OINTMENT**  
• 1 cm in the affected eye q6h  
**Treatment duration:** 5 days

## Rx Gonococcal Ophthalmia Neonatorum

 **Ceftriaxone 50 mg/kg IM**  
**Treatment duration:** Single dose


*Do not administer ceftriaxone in neonates receiving calcium-containing IV fluids and avoid in infants with hyperbilirubinaemia*

## Rx Chlamydial Ophthalmia Neonatorum


 **Azithromycin 20 mg/kg q24h ORAL**  
**Treatment duration:** 3 days

*Topical therapy alone is not effective*

## Rx Prevention of Both Chlamydial and Gonococcal Ophthalmia Neonatorum

 **Erythromycin 0.5% EYE OINTMENT**  
• To be applied to both eyes soon after birth

OR

 **Tetracycline 1% EYE OINTMENT**



# Endophthalmitis

## Bacterial Eye Infection

### ? Definition

- Infection of the intraocular fluids (vitreous and aqueous humor) and the retina
- Most cases occur as a result of penetrating eye trauma, after eye surgery or as a complication of keratitis
- Rare cases are due to bacteremia or fungemia from distant sites of infection (e.g. endocarditis, liver abscess)

### 🔬 Diagnosis

#### 🔍 Clinical Presentation

- Usually painful red eye, blurred vision and trouble looking at bright light
- In cases where pathogens reach the eye through the bloodstream from other sites of infection, signs and symptoms of bacteremia/fungemia can be present although usually ocular symptoms occur first

#### 🔬 Microbiology Tests

- Consider microscopy and culture of a sample of aqueous or vitreous humour aspirate
- Consider blood cultures if a distant source of infection is suspected (i.e. endogenous endophthalmitis)

#### 🧪 Other Laboratory Tests

Consider tests to detect organ dysfunction

#### 📷 Imaging

Usually not needed

### 🦠 Most Likely Pathogens

#### Bacteria:

- Mostly coagulase-negative Staphylococci, less frequently *Staphylococcus aureus*
- *Streptococcus* spp.
- *Klebsiella* spp. (more frequent in Asia)
- *Bacillus cereus* (mostly in case of penetrating trauma)

#### Fungi:

- Mostly *Candida albicans*
- *Fusarium* spp.
- *Aspergillus* spp.

### Rx Treatment

#### 📋 Clinical Considerations

- Endophthalmitis is an ocular emergency because it is a potentially blinding condition
- Systemic antibiotics (in combination with intravitreal antibiotics) should be considered given the severity of this condition, especially when referral to an ophthalmologist is not rapidly available

#### Two common approaches to administer intravitreal antibiotics:

1. “Tap and inject”: first a sample of vitreous humour is collected for culture (through vitreous aspiration), then antibiotics are injected into the vitreous
2. Vitrectomy is performed (i.e. eye surgery to remove some or all the inflamed vitreous from the eye as a form of source control) and during the procedure, the antibiotic is injected into the vitreous

#### 🕒 Antibiotic Treatment Duration


##### Intravitreal: **Single dose**

- If no clinical improvement after 48 hours, the injection can be repeated


Systemic: Depends on underlying source of bacteremia

### Rx Bacterial Endophthalmitis

All dosages are for normal renal function

 Vancomycin 1 mg **INTRAVITREAL INJECTION**


COMBINED WITH

 Ceftazidime 2.25 mg **INTRAVITREAL INJECTION**

IF ENDOGENOUS INFECTION, ADD

 Ceftriaxone 2 g once a day **IV**

COMBINED WITH

 Vancomycin 15-20 mg/kg q12h **IV**

# Endophthalmitis

## Bacterial Eye Infection

### ? Definition

- Infection of the intraocular fluids (vitreous and aqueous humor) and the retina
- Most cases occur as a result of penetrating eye trauma, after eye surgery or as a complication of keratitis
- Rare cases are due to bacteremia or fungemia from distant sites of infection (e.g. endocarditis, liver abscess)

### 🔬 Diagnosis

#### 🔍 Clinical Presentation

- Usually painful red eye, blurred vision and trouble looking at bright light
- In cases where pathogens reach the eye through the bloodstream from other sites of infection, signs and symptoms of bacteremia/fungemia can be present although usually ocular symptoms occur first

#### 🔬 Microbiology Tests

- Consider microscopy and culture of a sample of aqueous or vitreous humour aspirate
- Consider blood cultures if a distant source of infection is suspected (i.e. endogenous endophthalmitis)

#### 🧪 Other Laboratory Tests

Consider tests to detect organ dysfunction

#### 📷 Imaging

Usually not needed

### 🦠 Most Likely Pathogens

#### Bacteria:

- Mostly coagulase-negative Staphylococci, less frequently *Staphylococcus aureus*
- *Streptococcus* spp.
- *Klebsiella* spp. (more frequent in Asia)
- *Bacillus cereus* (mostly in case of penetrating trauma)

#### Fungi:

- Mostly *Candida albicans*
- *Fusarium* spp.
- *Aspergillus* spp.

### ℞ Treatment

#### 📋 Clinical Considerations

- Endophthalmitis is an ocular emergency because it is a potentially blinding condition
- Systemic antibiotics (in combination with intravitreal antibiotics) should be considered given the severity of this condition, especially when referral to an ophthalmologist is not rapidly available

#### Two common approaches to administer intravitreal antibiotics:

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2. Vitrectomy is performed (i.e. eye surgery to remove some or all the inflamed vitreous from the eye as a form of source control) and during the procedure, the antibiotic is injected into the vitreous

#### 🕒 Antibiotic Treatment Duration

##### Intravitreal: **Single dose**

- If no clinical improvement after 48 hours, the injection can be repeated

Systemic: Depends on underlying source of bacteremia

### ℞ Bacterial Endophthalmitis

All dosages are for normal renal function

WATCH Vancomycin 1 mg **INTRAVITREAL INJECTION**

COMBINED WITH

WATCH Ceftazidime 2.25 mg **INTRAVITREAL INJECTION**

IF ENDOGENOUS INFECTION, ADD

WATCH Ceftriaxone 80 mg/kg/dose q24h **IV**

COMBINED WITH

WATCH Vancomycin **IV**

- Neonates: 15 mg/kg/dose q12h
- Children: 15 mg/kg/dose q8h

# Keratitis

## Bacterial Eye Infection

**?** **Definition**

Infection of the cornea (i.e. transparent covering of the eye)

**🌐 Most Likely Pathogens**

**High Income Countries:**

- Bacteria and viruses are the most common causes

**Low and Middle Income Countries:**

- Fungi predominate (especially in rural settings where eye trauma from plants is a common risk factor)

**Bacteria:**

- *Pseudomonas* spp. (mostly in individuals who wear contact lenses)
- *Staphylococcus epidermidis*
- *Staphylococcus aureus*
- *Streptococcus pneumoniae*

**Fungi:**

- Mostly *Fusarium* spp.
- *Aspergillus* spp.

**Viruses:**

- Reactivation of herpes simplex virus (especially in patients who are immunosuppressed)

**Parasites:**

- *Acanthamoeba* (contact lenses)

**🔬 Diagnosis**

**🔍 Clinical Presentation**

Usually painful eye, decreased vision, more tears and corneal oedema with a feeling of “having something in the eye” and difficulty in keeping the eye open +/- eye discharge

**🔬 Microbiology Tests**

- Consider microscopy and culture of a corneal sample (e.g. corneal scrapings or corneal biopsy)
- Consider nucleic acid amplification testing for herpes simplex virus in patients who are immunosuppressed

**🧪 Other Laboratory Tests**

Usually not needed

**📷 Imaging**

Usually not needed; specialist eye examination may be considered

**📄 Treatment**

**📋 Clinical Considerations**

- Infectious keratitis is an ocular emergency because it is a potentially blinding condition with poor prospects of visual restoration
- Patients with keratitis should stop wearing contact lenses until the infection is healed
- Consider giving cycloplegic eye drops (cyclopentolate 1% or atropine 1%) to reduce photophobia and to reduce the formation of pupillary adhesions to the lens

**🕒 Antibiotic Treatment Duration**

**2 weeks**  
Duration is often personalized to the individual based on clinical improvement

**📄 Bacterial Keratitis**

**🔔 WATCH** Ofloxacin 0.3% **EYE DROPS**

- 1 drop in the affected eye q1h for 48 hours, then q4h until healed

*Drops are preferred over ointments because they have a better corneal penetration*

# Keratitis

## Bacterial Eye Infection

### ? Definition

Infection of the cornea (i.e. transparent covering of the eye)

### 🌐 Most Likely Pathogens

#### High Income Countries:

- Bacteria and viruses are the most common causes

#### Low and Middle Income Countries:

- Fungi predominate (especially in rural settings where eye trauma from plants is a common risk factor)

#### Bacteria:

- *Pseudomonas* spp. (mostly in individuals who wear contact lenses)
- *Staphylococcus epidermidis*
- *Staphylococcus aureus*
- *Streptococcus pneumoniae*

#### Fungi:

- Mostly *Fusarium* spp.
- *Aspergillus* spp.

#### Viruses:

- Reactivation of herpes simplex virus (especially in patients who are immunosuppressed)

### 🔬 Diagnosis

#### 🔍 Clinical Presentation

- Usually painful eye, decreased vision, more tears and corneal oedema with a feeling of “having something in the eye” and difficulty in keeping the eye open +/- eye discharge
- Keratitis is rare in children

#### 🔬 Microbiology Tests

- Consider microscopy and culture of a corneal sample (e.g. corneal scrapings or corneal biopsy)
- Consider nucleic acid amplification testing for herpes simplex virus in patients who are immunosuppressed

#### 🧪 Other Laboratory Tests

Usually not needed

#### 📷 Imaging

Usually not needed; specialist eye examination may be considered

## 📄 Treatment

### 📋 Clinical Considerations

- Infectious keratitis is an ocular emergency because it is a potentially blinding condition with poor prospects of visual restoration
- Consider giving cycloplegic eye drops (cyclopentolate 1% or atropine 1%) to reduce photophobia and to reduce the formation of pupillary adhesions to the lens

### ⌚ Antibiotic Treatment Duration

#### 2 weeks

Duration is often personalized to the individual based on clinical improvement

## 📄 Bacterial Keratitis



#### Ofloxacin 0.3% EYE DROPS

- 1 drop in the affected eye q1h for 48 hours, then q4h until healed

*Drops are preferred over ointments because they have a better corneal penetration*

# Periorbital Cellulitis

## Bacterial Eye Infection

### Definition

Infection of subcutaneous eyelid tissues anterior to the orbital septum (the globe and the tissues within the bony orbit are not involved)

**Important:** most cases result from adjacent infections (e.g. infection of the eyelid, lacrimal sac, periorbital sinuses) or follow bites or trauma of the eyelid

### Most Likely Pathogens

#### Bacteria:

- *Staphylococcus aureus* (including MRSA strains)
- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- Anaerobes should be suspected if there is a history of animal or human bite or if necrosis is present

#### Viruses:

- Consider a virus (e.g. herpes simplex virus or varicella-zoster virus) if there is a vesicular skin rash

### Diagnosis

#### Clinical Presentation

- Usually unilateral signs of inflammation around the affected eye (e.g. red, swollen, warm and tender eyelid) with no restricted or painful eye movement +/- fever
- Vision is normal

#### Important:

- This is usually a mild condition that is rare adults; complications are rare
- It is important to differentiate with orbital cellulitis (where there is usually restricted eye movements, protrusion of the eye and loss of vision)

#### Microbiology Tests

- Usually not needed
- Cultures are difficult to obtain and blood cultures when performed are usually negative

#### Other Laboratory Tests

Usually not needed

#### Imaging

Consider a CT scan of the orbits and sinuses to assess the presence of orbital involvement and possible complications (e.g. abscess)

### Rx Treatment

#### Clinical Considerations


Most cases can be managed in the outpatient setting with oral antibiotics especially in adults with no signs of severe infection

#### Antibiotic Treatment Duration

10-14 days (depending on the severity)

#### Rx Antibiotic Treatment


All dosages are for normal renal function

 Amoxicillin+clavulanic acid 500 mg+125 mg q8h **ORAL** OR 1 g + 200 mg q8h **IV**

OR

 Cefalexin 500 mg q8h **ORAL**

OR

 Cloxacillin (or flucloxacillin) 500 mg q8h **ORAL** OR 2 g q6h **IV**

# Periorbital Cellulitis

## Bacterial Eye Infection

### Definition

Infection of subcutaneous eyelid tissues anterior to the orbital septum (the globe and the tissues within the bony orbit are not involved)

**Important:** most cases result from adjacent infections (e.g. infection of the eyelid, lacrimal sac, periorbital sinuses) or follow bites or trauma of the eyelid

### Diagnosis

#### Clinical Presentation

- Usually unilateral signs of inflammation around the affected eye (e.g. red, swollen, warm and tender eyelid) with no restricted or painful eye movement +/- fever
- Vision is normal

**Important:**

- This is usually a mild condition, complications are rare
- It is important to differentiate with **orbital cellulitis** (where there is usually restricted eye movements, protrusion of the eye and loss of vision)

#### Microbiology Tests

- Usually not needed
- Cultures are difficult to obtain and blood cultures when performed are usually negative

#### Other Laboratory Tests

Usually not needed

#### Imaging

Consider a CT scan of the orbits and sinuses to assess the presence of orbital involvement and possible complications (e.g. abscess)

### Most Likely Pathogens

**Bacteria:**

- *Staphylococcus aureus* (including MRSA strains)
- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- Anaerobes should be suspected if there is a history of animal or human bite or if necrosis is present

**Viruses:**

- Consider a virus (e.g. herpes simplex virus or varicella-zoster virus) if there is a vesicular skin rash

### Rx Treatment

#### Clinical Considerations


Most cases can be managed in the outpatient setting with oral antibiotics especially in children >1 year with no signs of severe infection

#### Antibiotic Treatment Duration

**10-14 days** (depending on the severity)

### Rx Antibiotic Treatment

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **ORAL/IV**


- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution


OR

 Cefalexin 25 mg/kg/dose q12h **ORAL**

- **Oral weight bands:**

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

OR

 Cloxacillin (or flucloxacillin) **ORAL/IV**

- Neonates: 25-50 mg/kg/dose q12h
- Children: 25 mg/kg/dose q6h
- **Oral weight bands:**

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

# Trachoma

## ? Definition

Eye disease caused by specific serovars (A,B and C) of the bacterium *Chlamydia trachomatis* (other serovars cause urogenital diseases, see “Sexually transmitted infections – Chlamydia urogenital infections”)

## 🦠 Pathogen

- *Chlamydia trachomatis* is a Gram-negative obligate intracellular bacterium
- Strains associated with trachoma are serovars A, B, Ba, and C

## 🔍 Diagnosis

### 🔍 Clinical Presentation

#### Acute:

- Usually signs and symptoms of conjunctivitis with redness of the eye, eye discomfort, mucopurulent discharge and light sensitivity
- Less common in adults

#### Advanced:

- Conjunctival scarring, signs of chronic conjunctival inflammation and eyelashes turned inward
- Mostly seen in adults due to repeated infections over time

WHO has a trachoma grading system used in field assessments to evaluate the extent of disease during examination (Reference: Solomon AW et al. The simplified trachoma grading system, amended. Bull World Health Organ. 2020;98(10):698-705)

### 🔬 Microbiology Tests

- Usually not needed
- Consider testing a conjunctival sample (culture or nucleic acid amplification tests for *Chlamydia trachomatis*) to decide whether to stop or continue antibiotic treatment at the population level

### 🧪 Other Laboratory Tests

Usually not needed

### 📷 Imaging

Usually not needed

## ℞ Treatment

### 📋 Clinical Considerations

- Antibiotic treatment is often given as part of mass drug administration programmes in endemic areas to reduce the reservoir of *Chlamydia trachomatis*
- If corneal damage has already occurred due to the inversion of the eyelashes, surgery is needed to correct the eyelid rotation and prevent blindness
- Repeated infections over the years can lead to permanent corneal damage and blindness

**Important:** Reinforce education on personal and community hygiene measures


- Infection spreads via the hands through direct contact with contaminated people or objects
- Flies can contribute by transporting contaminated eye/nose secretions to non-infected people
- Risk factors include living in overcrowded conditions and poor sanitation; most transmission occurs within families

### ⏰ Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic used, please refer to the corresponding antibiotic section for treatment duration


## ℞ Antibiotic Treatment

All dosages are for normal renal function


 Azithromycin 20 mg/kg (max 1 g) **ORAL**  
**Treatment duration:** Single dose

Administered once a year for 3 years as part of mass drug administration programmes

## 👉 Topical Treatment

 Azithromycin 1.5% **EYE DROPS**  
• 1 drop in both eyes q12h  
**Treatment duration:** 3 days

OR

 Tetracycline 1% **EYE OINTMENT**  
• 1 cm in both eyes q12h  
**Treatment duration:** 6 weeks

Topical treatment is used in areas where oral azithromycin is not readily available. Topical azithromycin may be as effective as oral azithromycin

# Trachoma

## ? Definition

Eye disease caused by specific serovars A, B and C) of the bacterium *Chlamydia trachomatis*

## Pathogen

- *Chlamydia trachomatis* is a Gram-negative obligate intracellular bacterium
- Strains associated with trachoma are serovars A, B, Ba, and C

## Diagnosis

### Clinical Presentation

#### Acute:

- Usually signs and symptoms of conjunctivitis with redness of the eye, eye discomfort, mucopurulent discharge and light sensitivity
- Most common in children living in endemic areas

#### Advanced:

- Conjunctival scarring, signs of chronic conjunctival inflammation and eyelashes turned inward
- Mostly seen in adults due to repeated infections over time

WHO has a trachoma grading system used in field assessments to evaluate the extent of disease during examination (Reference: Solomon AW et al. The simplified trachoma grading system, amended. Bull World Health Organ. 2020;98(10):698-705)

### Microbiology Tests

- Usually not needed
- Consider testing a conjunctival sample (culture or nucleic acid amplification tests for *Chlamydia trachomatis*) to decide whether to stop or continue antibiotic treatment at the population level

### Other Laboratory Tests

Usually not needed

### Imaging

Usually not needed

## Rx Treatment

### Clinical Considerations

- Antibiotic treatment is often given as part of mass administration programmes in endemic areas to reduce the reservoir of *Chlamydia trachomatis*
- If corneal damage has already occurred due to the inversion of the eyelashes, surgery is needed to correct the eyelid rotation and prevent blindness
- Repeated infections over the years can lead to permanent corneal damage and blindness

**Important:** Reinforce education on personal and community hygiene measures


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- Risk factors include living in overcrowded conditions and poor sanitation; most transmission occurs within families

### Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic used, please refer to the corresponding antibiotic section for treatment duration


## Rx Antibiotic Treatment

All dosages are for normal renal function


 Azithromycin 20 mg/kg (max 1g) **ORAL**  
**Treatment duration:** Single dose

Administered once a year for 3 years as part of mass drug administration programmes

## Topical Treatment

 Azithromycin 1.5% **EYE DROPS**  
• 1 drop in both eyes q12h  
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 Tetracycline 1% **EYE OINTMENT**  
• 1 cm in both eyes q12h  
**Treatment duration:** 6 weeks

Topical treatment is used in areas where oral azithromycin is not readily available. Topical azithromycin may be as effective as oral azithromycin



# Community-Acquired Pneumonia

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## Definition

An acute illness affecting the lungs usually presenting with cough, sputum production, and rapid and difficult breathing with a new or worsening pulmonary infiltrate on a chest radiograph

## Most Likely Pathogens

### “Typical” Bacteria:

- *Streptococcus pneumoniae* (most cases)
- *Staphylococcus aureus* (often associated with influenza)
- *Haemophilus influenzae* (chronic lung diseases, smoking)
- *Moraxella catarrhalis* (chronic lung diseases, smoking)
- *Enterobacteriales* (severe comorbidities, e.g. chronic lung diseases, dementia, stroke)

### “Atypical” Bacteria:

- *Mycoplasma pneumoniae* (more frequent in young adults)
- *Chlamydia pneumoniae* and *psittaci* (more frequent in young adults)
- *Legionella* spp. (chronic lung diseases or other underlying illness, travel, exposure to hot tubs)
- *Coxiella burnetii* (rural areas, exposure to livestock)

### Respiratory Viruses:

- Influenza viruses (A and B)
- Parainfluenza virus
- Respiratory syncytial virus (RSV)
- Adenovirus
- Metapneumovirus
- Rhinovirus
- Coronavirus (including SARS-CoV-2)

### Bacteria to consider in Specific Settings:

- *Burkholderia pseudomallei* (SE Asia, Australia)

## Investigating for Tuberculosis (TB)

- Consider specific investigations for TB in endemic settings especially in high-risk patients (e.g. HIV)
- A rapid molecular test performed on a single sputum specimen is the preferred first line diagnostic test for pulmonary TB and to detect rifampicin resistance

## Diagnosis

### Clinical Presentation

- New onset (<2 weeks) or worsening cough with fever ( $\geq 38.0^{\circ}\text{C}$ ), sputum production, dyspnea, tachypnea, reduced oxygen saturation, crepitations on lung auscultation, chest pain/discomfort without alternative explanation
- Extrapulmonary features (i.e. confusion, disorientation) may predominate in elderly, and immunosuppressed patients and fever may be absent

### Microbiology Tests

**Mild cases:** usually not needed

**Severe cases (to guide antimicrobial treatment):** blood cultures, urinary antigens for *L. pneumophila* and *S. pneumoniae*

**Selected cases (depending on epidemiology and risk factors):** sputum rapid molecular test for *M. tuberculosis*, nasopharyngeal swab for influenza viruses and SARS-CoV-2, HIV testing in settings with high HIV prevalence and in case of recurrent and/or severe pneumonia

### Other Laboratory Tests

**Determine disease severity:** blood urea nitrogen (see CURB-65 Scoring System box), blood pH and gases, white blood cell count

**Differentiate bacterial and viral (taking into account pre-test probability):** C-reactive protein and/or procalcitonin

*Note: tests depend on availability and clinical severity (e.g. blood gases will only be done in severe cases)*

### Imaging

- Chest X-ray not necessary in mild cases
- Infiltrate may not always be evident (e.g. dehydration) and non-infectious etiologies may mimic infiltrates (e.g. lung edema, pulmonary embolism)
- Radiologic appearance cannot be used to accurately predict pathogen

# Community-Acquired Pneumonia

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### CURB-65 Severity Scoring System

**Signs & Symptoms (1 point each)**

- Presence of **Confusion** (new onset)
- Urea** > 19 mg/dL (or > 7 mmol/L)\*
- Respiratory rate** > 30/min
- Systolic BP** < 90 mmHg (<12 kPa) or **Diastolic BP** ≤ 60 mmHg (<8 kPa)
- Age** ≥ 65 years

**Score 0-1**

- Consider outpatient treatment

**Score 2**

- Consider inpatient treatment
- **Consider adding clarithromycin to beta-lactam for atypical coverage**
- Perform microbiology tests

**Score ≥3**

- Inpatient treatment (consider ICU)
- **Consider adding clarithromycin**
- Perform microbiology tests

*Other considerations such as severe comorbid illnesses or inability to maintain oral therapy should be taken into account. CURB-65 has not been extensively validated in low-income settings.*

*\*The **CRB-65 score**, which does not require laboratory values for its calculation, can also be used, the score value interpretation is the same as for CURB-65*

### Rx Mild to Moderate Cases

All dosages are for normal renal function

**First Choice**

ACCESS Amoxicillin 1 g q8h **ORAL**

OR

ACCESS Phenoxyethylpenicillin 500 mg (800 000 IU) q6h **ORAL**

**Second Choice**

ACCESS Amoxicillin+clavulanic acid 875 mg+125 mg q8h **ORAL**

OR

ACCESS Doxycycline 100 mg q12h **ORAL**

### Rx Treatment

**Antibiotic Treatment Duration**

Treat for **5 days**

If severe disease, consider longer treatment and look for complications such as empyema, if patient not clinically stable at day 5

**Rx Severe Cases**

All dosages are for normal renal function

**First Choice**

WATCH Ceftriaxone 2 g q24h **IV** (1 g q24h **IM**\*)

*\*A larger volume would be painful to give as intramuscular injection*

OR

WATCH Cefotaxime 2 g q8h **IV/IM**

IF CURB-65 ≥2, CONSIDER ADDING

WATCH Clarithromycin 500 mg q12h **ORAL** (or **IV**)

*Clarithromycin has excellent oral bioavailability and the intravenous route should be reserved for patients with impaired gastrointestinal function*

**Second Choice**

ACCESS Amoxicillin+clavulanic acid 1 g+200 mg q8h **IV**

- A higher dose can be considered: 1 g+200 mg q6h

IF CURB-65 ≥2, CONSIDER ADDING

WATCH Clarithromycin 500 mg q12h **ORAL** (or **IV**)

*Clarithromycin has excellent oral bioavailability and the intravenous route should be reserved for patients with impaired gastrointestinal function*

# Community-Acquired Pneumonia

Page 1 of 2

## Definition

An acute illness affecting the lungs usually presenting with cough, and rapid and difficult breathing with a new or worsening pulmonary infiltrate on a chest radiograph

## Most Likely Pathogens

### “Typical” Bacteria:

- *Streptococcus pneumoniae* (most common cause of CAP beyond the 1st week of life)
- *Haemophilus influenzae*
- *Moraxella catarrhalis*
- *Staphylococcus aureus*
- *Enterobacterales*

“Atypical” Pathogens (more frequent in children >5 years compared to younger children):

- *Mycoplasma pneumoniae*
- *Chlamydia pneumoniae*

### Respiratory Viruses:

- Influenza viruses (A and B)
- Parainfluenza virus
- Respiratory syncytial virus (RSV)
- Adenovirus
- Metapneumovirus
- Rhinovirus
- Coronavirus (including SARS-CoV-2)

## Investigating for Tuberculosis (TB)

- Consider specific investigations for TB in endemic settings especially in high-risk patients (e.g. HIV)
- A rapid molecular test performed on a single sputum specimen is the preferred first line diagnostic test for pulmonary TB and to detect rifampicin resistance

## Diagnosis

### Clinical Presentation

- New onset (<2 weeks) or worsening cough with fever ( $\geq 38.0^{\circ}\text{C}$ ), dyspnea, tachypnea, reduced oxygen saturation, crepitations, cyanosis, grunting, nasal flaring, pallor
- Pneumonia is diagnosed on: fast breathing for age and/or chest indrawing
  - Check for hypoxia with oxygen saturometer if available
- Children with runny nose and cough and no signs of severity usually do not have pneumonia and should not receive an antibiotic, only home care advice

### Microbiology Tests

- Mild cases:** Usually not needed
- Severe cases (to guide antimicrobial treatment):** blood cultures

### Other Laboratory Tests

- No test clearly differentiates viral or bacterial CAP**
- Consider:** full blood count and C-reactive protein
- Note: tests depend on availability and clinical severity (e.g. blood gases will only be done in severe cases)*

### Imaging

- Chest X-ray not necessary in mild cases
- Look for lobar consolidation or pleural effusion
- Radiologic appearance cannot be used to accurately predict pathogen

# Community-Acquired Pneumonia

Page 2 of 2

## Severity Assessment and Considerations

### Children with pneumonia:

- Should be treated with oral amoxicillin at home with home care advice
- Pneumonia is diagnosed on either:
  1. Fast breathing (respiratory rate > 50 breaths/minute in children aged 2-11 months; resp rate > 40 breaths/min in children aged 1-5 years)
  2. Chest indrawing

### Children with severe pneumonia (or a child with pneumonia who cannot tolerate oral antibiotics):

#### • Should be admitted to hospital and treated with intravenous antibiotics

- Severe pneumonia is diagnosed on either:
  1. A cough or difficulty in breathing plus one of:
    - Oxygen saturation below 90%
    - Central cyanosis
    - Severe respiratory distress (e.g. grunting or severe chest indrawing)
  2. Signs of pneumonia with a general danger sign:
    - Inability to drink or breast feed
    - Persistent vomiting
    - Convulsions
    - Lethargy or unconsciousness
    - Severe respiratory distress

## Antibiotic Treatment Duration

Treat for **5 days**

If severe disease, consider longer treatment and look for complications such as empyema, if patient not clinically stable at day 5

## Mild to Moderate Cases

All dosages are for normal renal function

**ACCESS** Amoxicillin 40-50 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	500 mg q12h
15-<20 kg	750 mg q12h
20-<30 kg	1000 mg q12h
≥30 kg	Use adult dose

## Rx Treatment

### Rx Severe Cases

Please see Severity Assessment and Considerations for diagnosis of severe cases

All dosages are for normal renal function

#### First Choice

**ACCESS** Ampicillin 50 mg/kg/dose **IV/IM**  
 • ≤1wk of life: q12h  
 • >1wk of life: q8h

OR

**ACCESS** Amoxicillin 50 mg/kg/dose **IV/IM**  
 • ≤1wk of life: q12h  
 • >1wk of life: q8h

OR

**ACCESS** Benzylpenicillin 30 mg/kg (50 000 IU/kg) q8h **IV**

#### COMBINED WITH

**ACCESS** Gentamicin **IV/IM**  
 • Neonates: 5 mg/kg/dose q24h  
 • Children: 7.5 mg/kg/dose q24h

**IF HIV POSITIVE AND <1 YR OLD**  
 To treat potential *Pneumocystis jirovecii* pneumonia, **ADD**

**WATCH** Sulfamethoxazole+trimethoprim 40 mg/kg SMX+8 mg/kg TMP q8h **IV/ORAL** for 3 weeks

#### Second Choice

If **NO Clinical Response to First Choice after 48-72 hours**

**WATCH** Cefotaxime 50 mg/kg/dose q8h **IV/IM**

OR

**WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV/IM**

# Exacerbation of Chronic Obstructive Pulmonary Disease

## ? Definition

Acute worsening of patient's respiratory symptoms beyond normal day-to-day variations that results in additional therapy in patients with underlying chronic obstructive pulmonary disease (COPD). COPD refers to a group of diseases that block airflow and impair breathing and includes emphysema and chronic bronchitis

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- Recent and sustained worsening of dyspnea and cough with increased sputum production compared to the baseline in a patient with COPD

**Important:** symptoms can overlap with pneumonia (pneumonia more likely if tachycardia, tachypnea at rest and crepitations that persist after coughing are present)

### 🔬 Microbiology Tests

Usually not needed but to be considered in severe cases; the respiratory tract of people with COPD may be colonized with bacteria (e.g. *S. pneumoniae*, *H. influenzae*, *M. catarrhalis*, *P. aeruginosa*, *S. maltophilia*) and a positive culture may indicate colonization rather than acute infection

### 🧪 Other Laboratory Tests

Consider C-reactive protein and/or procalcitonin, complete blood count, and blood pH and gases

### 📷 Imaging

Consider a chest radiograph in patients requiring hospitalization to exclude other diagnoses and in outpatients if pneumonia suspected

## 🦠 Most Likely Pathogens

### Respiratory viruses (most cases):

- Influenza virus (A and B)
- Respiratory syncytial virus
- Parainfluenza virus
- Rhinovirus
- Coronavirus (including SARS-CoV-2)

### Bacteria (more rarely):

- Haemophilus influenzae*
- Moraxella catarrhalis*
- Streptococcus pneumoniae*
- Gram-negative bacteria including *Pseudomonas aeruginosa* (including multidrug-resistant strains)

## 👐 Prevention

Recommend smoking cessation, reduced indoor air pollution, use of long-acting inhaled  $\beta_2$ -agonists ( $\pm$  anticholinergics) and vaccination (e.g. against influenza, *S. pneumoniae* and SARS-CoV-2)

## ℞ Treatment

### 🔒 No Antibiotic Care

- Details of COPD exacerbations management are not discussed here, refer to specific guidelines
- Supplementary oxygen and short-acting inhaled  $\beta_2$ -agonists ( $\pm$  anticholinergics)
- Systemic steroids are usually recommended (improve lung function and favour faster recovery)

### 📋 Clinical Considerations

#### Antibiotics are not needed for most cases

- Their use could be considered in patients with dyspnea and an increased volume of purulent sputum
- In case of frequent exacerbations consider risk of infections caused by multidrug-resistant pathogens and previous colonization of the respiratory tract

### ℞ Mild to Moderate Cases

Antibiotic treatment is not required in the great majority of cases (see "Clinical Considerations" when antibiotics may be indicated)

All dosages are for normal renal function

#### First Choice

ACCESS Amoxicillin 500 mg q8h **ORAL**

#### Second Choice

ACCESS Cefalexin 500 mg q12h **ORAL**

OR

ACCESS Doxycycline 100 mg q12h **ORAL**

### ℞ Severe Cases

ACCESS Amoxicillin+clavulanic acid 500 mg+125 mg q8h **ORAL**

### 🕒 Antibiotic Treatment Duration

5 days

# Acute Infectious Diarrhoea & Gastroenteritis

This guidance excludes *Clostridioides difficile* infection or enteric fever (see separate chapters)

## Definition

New (<14 days) onset of diarrhoea ( $\geq 3$  unformed/liquid stools in 24 hrs or more than normal for individual).  
Diarrhoea can be watery or bloody (dysentery)

**Important:** Non-infectious causes are also possible and must be considered (e.g. adverse effects of medicines including antibiotics, bowel and endocrine diseases)

## Most Likely Pathogens

### Most cases have a viral origin

Always consider these risk factors as they may influence the most likely etiologic agents:

- History of recent travel
- Recent consumption of potentially unsafe food
- Recent antibiotic exposure (risk of *C. difficile*)
- Immunosuppression
- Severe malnutrition

### Watery diarrhoea:

- Most likely cause is viral (mostly norovirus and rotavirus)
- Consider cholera in endemic settings or in the context of outbreaks

### Bloody diarrhoea (dysentery):

- Most likely cause are bacteria, mostly:
  - *Shigella* spp.
  - *Campylobacter* spp.
  - *Salmonella* spp.
  - Enterotoxigenic *Escherichia coli*

### Consider parasites if symptoms do not resolve:

- Usually parasites are responsible for persistent (14-29 days duration) or chronic (>30 days duration) rather than acute diarrhoea
  - *Entamoeba histolytica*
  - *Giardia intestinalis*
  - *Schistosoma* (intestinal species)

## Prevention

- Access to safe drinking-water, use of improved sanitation, hand washing with soap, good food hygiene, health education about how these infections spread
- Vaccination against cholera in endemic areas and during outbreaks

## Diagnosis

### Clinical Presentation

- Diarrhoea, nausea, vomiting, bloating, abdominal pain and cramping; fever may be absent
- Most cases are self-limiting in a few days
- Patients may present with varying degree of dehydration and can present with severe malnutrition (both a risk factor and a consequence of diarrhoea)

### Important:

- Rapidly evaluate the degrees of dehydration (especially in the elderly)
- Signs of severe dehydration (two or more must be present):
  - Lethargy and/or unconsciousness
  - Sunken eyes
  - Inability to drink
  - Skin pinch goes back very slowly ( $\geq 2$  seconds)

### Microbiology Tests

Usually not needed

### Consider testing if:

- Bloody diarrhoea
- Immunosuppressed patients (to exclude parasitic infections)
- Recent antibiotic use (to exclude *C. difficile*)
- Suspected cholera outbreak

### Tests to consider:

- Stool culture
- Stool microscopy (for parasites)
- *Vibrio cholerae* antigen (e.g. in outbreaks)
- Test for *C. difficile* (if recent antibiotic exposure)

### Other Laboratory Tests

Usually not needed but consider in severe cases (e.g. check electrolytes)

### Imaging

Usually not needed

# Acute Infectious Diarrhoea & Gastroenteritis

## Rx Treatment

### No Antibiotic Care

- Important:** Rehydration is the main treatment for acute infectious diarrhoea
- An oral rehydration solution (ORS) is composed of clean water, sugar and salt ('make-at-home' ORS: 1L water, 6 tspn sugar, 1/2 tspn salt)
  - In addition to ORS, zinc tablets (10-20 mg/day) for 10-14 days can shorten duration and severity of symptoms
- Antidiarrhoeal and antiemetic drugs are not routinely needed (they do not prevent dehydration or improve nutritional status)

### Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic used, please refer to the corresponding antibiotic section for treatment duration

### Rx Cholera Antibiotic Treatment

*Treat with antibiotics only in the context of an outbreak and not based on the degree of dehydration*

*All dosages are for normal renal function*

#### First Choice

**WATCH** Azithromycin 1 g **ORAL**  
Treatment duration: single dose

*Azithromycin preferred because of the decreasing susceptibility of cholera to tetracyclines and fluoroquinolones*

OR

**ACCESS** Doxycycline 300 mg single dose **ORAL**  
• If single dose is not tolerated: 100 mg q12h  
Treatment duration: 3 days

#### Second Choice

**WATCH** Ciprofloxacin 1 g **ORAL**  
Treatment duration: single dose

### Clinical Considerations

- **Antibiotics usually not needed**, including in cases with severe dehydration
- Consider antibiotic treatment **ONLY** if:
  - Significant bloody diarrhoea
  - Severely immunosuppressed patients
  - Cholera outbreak (to limit transmission see Cholera Antibiotic Treatment)
- If symptoms do not resolve within 24-48 hours of treatment, consider giving metronidazole for treatment of *Entamoeba histolytica* and *Giardia intestinalis*

### Rx Antibiotic Treatment

*All dosages are for normal renal function*

#### First Choice

**WATCH** Ciprofloxacin 500 mg q12h **ORAL**  
Treatment duration: 3 days

#### Second Choice

**WATCH** Azithromycin **ORAL**  
• Day 1: 500 mg q24h  
• Day 2-4: 250 mg q24h  
Treatment duration: 4 days

*Azithromycin is preferred in case of high prevalence of ciprofloxacin resistance among bacteria frequently associated with acute infectious diarrhoea (e.g. Salmonella spp., Shigella spp.)*

OR

**WATCH** Cefixime 400 mg q24h **ORAL**  
Treatment duration: 3 days

OR

**ACCESS** Sulfamethoxazole+trimethoprim 800 mg + 160 mg q12h **ORAL**  
Treatment duration: 5 days

*Use only if local data suggest susceptibility*

OR

**WATCH** Ceftriaxone 1 g q24h **IV/IM**  
Treatment duration: 3 days

# Acute Infectious Diarrhoea & Gastroenteritis

## Definition

New (<14 days) onset of diarrhoea ( $\geq 3$  unformed/liquid stools in 24 hrs or more than normal for individual).  
Diarrhoea can be watery or bloody (dysentery)

**Important:** Non-infectious causes are also possible and must be considered (e.g. adverse effects of medicines including antibiotics, bowel and endocrine diseases)

## Most Likely Pathogens

### Most cases have a viral origin

Always consider these risk factors as they may influence the most likely etiologic agents:

- History of recent travel
- Recent consumption of potentially unsafe food
- Immunosuppression
- Severe malnutrition

### Watery diarrhoea:

- Most likely cause is viral, mostly:
  - Rotavirus
  - Norovirus
  - Adenovirus
- Consider cholera in endemic settings or in the context of outbreaks

### Bloody diarrhoea (dysentery):

- Most likely cause are bacteria, mostly:
  - *Shigella* spp.
  - *Campylobacter* spp.
  - *Salmonella* spp.
  - Enterotoxigenic *Escherichia coli*

### Consider parasites if symptoms do not resolve:

- Usually parasites are responsible for persistent (14-29 days duration) or chronic (>30 days duration) rather than acute diarrhoea
  - *Entamoeba histolytica*
  - *Giardia intestinalis*
  - *Schistosoma* (intestinal species)

## Prevention

- Access to safe drinking-water, use of improved sanitation, hand washing with soap, good food hygiene, health education about how these infections spread
- Exclusive breastfeeding for the first 6 months of life
- Vaccination against rotavirus and against cholera (in endemic areas and during outbreaks)

This guidance excludes enteric fever (see separate chapter)

## Diagnosis

### Clinical Presentation

- Diarrhoea, nausea, vomiting, bloating, abdominal pain and cramping; fever may be absent
- Most cases are self-limiting in a few days
- Patients may present with varying degree of dehydration and can present with severe malnutrition (both a risk factor and a consequence of diarrhoea)

### Important:

- Rapidly evaluate the degree of dehydration
- Signs of severe dehydration (two or more must be present):
  - Lethargy and/or unconsciousness
  - Sunken eyes
  - Inability to drink
  - Skin pinch goes back very slowly ( $\geq 2$  seconds)

### Microbiology Tests

Usually not needed

### Consider testing if:

- Bloody diarrhoea
- Immunosuppressed patients (to exclude parasitic infections)
- Suspected cholera outbreak

### Tests to consider:

- Stool culture
- Stool microscopy (for parasites)

### Other Laboratory Tests

Usually not needed but consider in severe cases (e.g. check electrolytes)

### Imaging

Usually not needed



# Acute Infectious Diarrhoea & Gastroenteritis

## Rx Treatment

### No Antibiotic Care

**Important:** Rehydration is the main treatment for acute infectious diarrhoea

- An oral rehydration solution (ORS) is composed of clean water, sugar and salt ('make-at-home' ORS: 1L water, 6 tspn sugar, 1/2 tspn salt)
- In addition to ORS, zinc tablets (10-20 mg/day) for 10-14 days can shorten duration and severity of symptoms

• Antidiarrhoeal and antiemetic drugs are not routinely needed (they do not prevent dehydration or improve nutritional status)

### Clinical Considerations

- **Antibiotics usually not needed**, including in cases with fever and/or severe dehydration.
- Consider antibiotic treatment **ONLY** if:
  - Significant bloody diarrhoea
  - Severely immunosuppressed patients
  - Cholera outbreak (to limit transmission see Cholera Antibiotic Treatment)
- If symptoms do not resolve within 48 hours of treatment, consider giving metronidazole for treatment of *Entamoeba histolytica* and *Giardia intestinalis*

### Rx Cholera Antibiotic Treatment


Treat with antibiotics only in the context of an outbreak and not based on the degree of dehydration  
All dosages are for normal renal function

#### First Choice

 **Azithromycin 20 mg/kg ORAL**  
Treatment duration: single dose

*Azithromycin preferred because of the decreasing susceptibility of cholera to tetracyclines and fluoroquinolones*


#### Second Choice

 **Ciprofloxacin 10-20 mg/kg ORAL**  
• **Oral weight bands:**

3-<6 kg	50 mg
6-<10 kg	100 mg
10-<15 kg	150 mg
15-<20 kg	200 mg
20-<30 kg	300 mg
≥30 kg	Use adult dose

Treatment duration: single dose

OR

 **Doxycycline ORAL**  
• <45 kg (<12 yrs): 2-4 mg/kg  
• >45 kg (>12 yrs): 300 mg  
Treatment duration: single dose


### Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic used, please refer to the corresponding antibiotic section for treatment duration

### Rx Antibiotic Treatment

All dosages are for normal renal function

#### First Choice

 **Ciprofloxacin 10-20 mg/kg/dose q12h ORAL**  
• **Oral weight bands:**

3-<6 kg	50 mg q12h
6-<10 kg	100 mg q12h
10-<15 kg	150 mg q12h
15-<20 kg	200 mg q12h
20-<30 kg	300 mg q12h
≥30 kg	Use adult dose

Treatment duration: 3 days

#### Second Choice


 **Azithromycin 10 mg/kg/dose q24h ORAL**  
Treatment duration: 4 days

*For children with bloody diarrhoea/dysentery ONLY azithromycin is preferred if suspected ciprofloxacin resistance*

OR

 **Cefixime 10 mg/kg/dose q24h ORAL**  
Treatment duration: 5 days

OR


 **Sulfamethoxazole+trimethoprim 20 mg/kg + 4 mg/kg q12h ORAL**  
• **Oral weight bands:**

3-<6 kg	100 mg+20 mg q12h
6-<10 kg	200 mg+40 mg q12h
10-<30 kg	400 mg+80 mg q12h
≥30 kg	Use adult dose

Treatment duration: 5 days

*Use only if local data suggest susceptibility*

OR

 **Ceftriaxone 80 mg/kg/dose q24h IV/IM**  
Treatment duration: 3 days

# Enteric Fever

## ? Definition

- A severe systemic illness characterized by fever and abdominal pain caused by infection with *Salmonella enterica*
- Acquired through ingestion of contaminated food/water

### Severity:

- *Mild*: Not critically ill with no signs of intestinal perforation, peritonitis, sepsis or septic shock
- *Severe*: Critically ill with confirmed/suspected intestinal perforation, peritonitis, sepsis or septic shock

## Pathogen

Enteric fever is caused by *Salmonella enterica* serotypes Typhi or Paratyphi A, B or C

## Diagnosis

### 🔍 Clinical Presentation

- **It can be difficult to distinguish enteric fever from other febrile illnesses**
- Symptoms include protracted fever ( $\geq 38.0^{\circ}\text{C}$  for  $>3$  days) +/- headache, loss of appetite and nausea; gastrointestinal symptoms may also be present (diarrhoea more frequent in people living with HIV)
- Consider peritonitis if there is severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal muscular tensing; peritonitis occurs as a result of intestinal bleeding and perforation
- Encephalopathy can also occur in severe cases

### 🔬 Microbiology Tests

- *Mild Cases*: Usually not needed
- *Severe Cases*: Blood cultures (ideally before starting antibiotics)
- Bone marrow culture is the reference standard test but is often not feasible
- *Note: the Widal serology is not a reliable method to diagnose acute illness (a positive result may be due to previous infection)*

### 🧪 Other Laboratory Tests

- *Mild Cases*: Usually not needed
- *Severe Cases*: Complete blood count, creatinine, electrolytes, glucose, C-reactive protein and / or procalcitonin

### 📷 Imaging

Usually not needed

## 👐 Prevention

Access to safe water and adequate sanitation, health education, appropriate hygiene among food handlers, and typhoid vaccination

## Rx Treatment

### 📋 Clinical Considerations

- Antibiotic treatment should be started as soon as the diagnosis is suspected; delays are associated with higher risk of complications and severe disease
- **Empiric treatment should be chosen based on:**
  - Severity of presentation
  - Local prevalence of fluoroquinolone resistance among *Salmonella enterica* serotypes Typhi or Paratyphi
- Fever usually decreases slowly after 3-5 days of treatment
- If initially treated IV, step down from IV to oral antibiotics is suggested when the patient has clinically improved, is afebrile and is able to tolerate oral treatment

### 🕒 Antibiotic Treatment Duration

Mild Cases: **7 days\***

Severe Cases: **10 days\***

\*if clinical improvement and the patient is afebrile for 48 hours

### Rx Low Risk of Fluoroquinolone Resistance

All dosages are for normal renal function


#### Mild and Severe Cases

 Ciprofloxacin 500 mg q12h **ORAL**


### Rx High Risk of Fluoroquinolone Resistance

All dosages are for normal renal function

#### Mild Cases

 Azithromycin 1 g once on day 1, then 500 mg q24h **ORAL**

#### Severe Cases

 Ceftriaxone 2 g q24h **IV**

# Enteric Fever

## ? Definition

- A severe systemic illness characterized by fever and abdominal pain caused by infection with *Salmonella enterica*
- Acquired through ingestion of contaminated food/water

### Severity:

- *Mild*: Not critically ill with no signs of intestinal perforation, peritonitis, sepsis or septic shock
- *Severe*: Critically ill with confirmed/suspected intestinal perforation, peritonitis, sepsis or septic shock

## 🦠 Pathogen

Enteric fever is caused by *Salmonella enterica* serotypes Typhi or Paratyphi A, B or C

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- **It can be difficult to distinguish enteric fever from other febrile illnesses**
- Symptoms include prolonged fever ( $\geq 38.0^{\circ}\text{C}$  for  $>3$  days) +/- headache, loss of appetite and nausea; gastrointestinal symptoms may also be present
- Diarrhoea is common
- Consider peritonitis if there is severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal guarding; peritonitis occurs as a result of intestinal bleeding and perforation
- Encephalopathy can also occur in severe cases

### 🔬 Microbiology Tests

- *Mild Cases*: Usually not needed
- *Severe Cases*: Blood cultures (ideally before starting antibiotics); Stool culture
- Note: the Widal serology is not a reliable method to diagnose acute illness (a positive result may be due to previous infection)

### 🧪 Other Laboratory Tests

- *Mild Cases*: Usually not needed
- *Severe Cases*: Complete blood count, creatinine, electrolytes, glucose, C-reactive protein

### 📷 Imaging

Routine imaging is not needed

## 👐 Prevention

Access to safe water and adequate sanitation, health education, appropriate hygiene among food handlers, and typhoid vaccination

## ℞ Treatment

### 📋 Clinical Considerations

- Antibiotic treatment should be started as soon as the diagnosis is suspected; delays are associated with higher risk of complications and severe disease
- **Empiric treatment should be chosen based on:**
  - Severity of presentation
  - Local prevalence of fluoroquinolone resistance among *Salmonella enterica* serotypes Typhi or Paratyphi
- Fever usually decreases slowly after 3-5 days of treatment
- If initially treated IV, step down from IV to oral antibiotics is suggested when the patient has clinically improved, is afebrile and is able to tolerate oral treatment

### 🕒 Antibiotic Treatment Duration

Mild Cases: **7 days\***

Severe Cases: **10 days\***

\*if clinical improvement and the patient is afebrile for 48 hours

### ℞ Low Risk of Fluoroquinolone Resistance

All dosages are for normal renal function

#### Mild and Severe Cases

WATCH	Ciprofloxacin 10-20 mg/kg/dose q12h <b>ORAL</b>	
	• <b>Oral weight bands:</b>	
	3-<6 kg	50 mg q12h
	6-<10 kg	100 mg q12h
	10-<15 kg	150 mg q12h
	15-<20 kg	200 mg q12h
	20-<30 kg	300 mg q12h
$\geq 30$ kg	Use adult dose	

### ℞ High Risk of Fluoroquinolone Resistance

All dosages are for normal renal function

#### Mild Cases

WATCH Azithromycin 20 mg/kg/dose q12h **ORAL**

#### Severe Cases

WATCH Ceftriaxone 80 mg/kg/dose q24h **IV**

# Impetigo / Erysipelas / Cellulitis

## Skin and Soft Tissue Infection

This guidance excludes skin infections caused by viral, fungal or parasitic pathogens; diabetic foot infections; necrotizing fasciitis; pyomyositis; severe infections with sepsis; and surgical site infections

### ? Definition

Superficial bacterial skin infections, not affecting the deeper tissue layers

### 🔬 Diagnosis

#### 🔍 Clinical Presentation

**Impetigo:** Acute onset of superficial skin lesions usually without systemic symptoms

- Most cases: papules progressing to vesicles and pustules that break to form crusts (**non-bullous form**)
- Minority of cases: vesicles evolve to form larger bullae (**bullous form**)

**Erysipelas:** Acute onset of a painful red skin lesion with well-defined indurated margins usually on face or legs

- Bullae may be present or develop in first days
- Fever (> 38.0°C) and other signs of systemic infection may be present

**Cellulitis:** Acute onset of a skin lesion presenting with redness, swelling and induration, warmth and pain or tenderness of the affected area

- Most commonly affected areas: legs and face
- Fever (> 38.0°C) and other signs of systemic infection may be present
- Redness alone may not indicate an infection
- **A clear clinical distinction between cellulitis and erysipelas is often difficult to make**

#### 🔬 Microbiology Tests

Not needed in most mild cases

- Tissue swab cultures are to be avoided, especially in case of intact skin

#### 🧪 Other Laboratory Tests

Not needed in most mild cases

#### 📷 Imaging

Routine imaging of mild cases not necessary

- Ultrasound may be considered if abscess or subdermal involvement suspected

### 🦠 Most Likely Pathogens

#### Bacteria (most cases):

- *Streptococcus pyogenes* (group A *Streptococcus*) - especially in case of erysipelas
- *Staphylococcus aureus* (including MRSA)

#### Additional bacteria (more rarely e.g immunosuppressed and/or diabetic patients, traumatic skin lesions):

- *Enterobacterales*
- *Pseudomonas* spp.
- Anaerobes

### ℞ Treatment

#### 📋 Clinical Considerations

- **Empiric antibiotic options** need to have good activity against both *Streptococcus pyogenes* (group A *Streptococcus*) and MSSA
- **Empiric treatment against community-acquired MRSA:** Consider in selected cases based on individual risk factors, known colonization and local prevalence
- **Mild infections:** Oral treatment is adequate
- **Intravenous antibiotics:** May be required if infection rapidly spreading and not responding to oral antibiotics

#### 🕒 Antibiotic Treatment Duration

Treat for **5 days**


Longer durations may be required in case of no clinical improvement or if an underlying medical condition is present

#### 👉 Topical Treatment


**Localized non-bullous impetigo:** Topical treatment is preferred over an oral antibiotic, whenever possible. For example, a 5 day course with mupirocin 2% ointment

### ℞ Antibiotic Treatment


All dosages are for normal renal function

 Amoxicillin+clavulanic acid 500 mg+125 mg q8h **ORAL**

OR

 Cefalexin 500 mg q8h **ORAL**

OR

 Cloxacillin (or flucloxacillin) 500 mg q8h **ORAL**

# Impetigo / Erysipelas / Cellulitis

Skin and Soft Tissue Infection

Page 1 of 2

*This guidance excludes skin infections caused by viral, fungal or parasitic pathogens; diabetic foot infections; necrotizing fasciitis; pyomyositis; severe infections with sepsis; and surgical site infections*

## ? Definition

Superficial bacterial skin infections, not affecting the deeper tissue layers

## Most Likely Pathogens

### Bacteria (most cases):

- *Streptococcus pyogenes* (group A *Streptococcus*) - especially in case of erysipelas
- *Staphylococcus aureus* (including MRSA)

## Diagnosis

### Clinical Presentation

**Impetigo:** Acute onset of superficial skin lesions usually without systemic symptoms

- Most cases: papules progressing to vesicles and pustules that break to form crusts (**non-bullous form**)
- Minority of cases: vesicles evolve to form larger bullae (**bullous form**)

**Erysipelas:** Acute onset of a painful red skin lesion with well-defined indurated margins usually on face or legs

- Bullae may be present or develop in first days
- Fever (> 38.0°C) and other signs of systemic infection may be present

**Cellulitis:** Acute onset of a skin lesion presenting with redness, swelling and induration, warmth and pain or tenderness of the affected area

- Most commonly affected area: legs and face
- Fever (> 38.0°C) and other signs of systemic infection may be present
- Redness alone may not indicate an infection
- **A clear clinical distinction between cellulitis and erysipelas is often difficult to make**

### Microbiology Tests

Not needed in most mild cases

- Tissue swab cultures are to be avoided, especially in case of intact skin

### Other Laboratory Tests

Not needed in most mild cases

### Imaging

Routine imaging of mild cases not necessary

- Ultrasound may be considered if deep abscess or subdermal involvement suspected

# Impetigo / Erysipelas / Cellulitis

## Rx Treatment

### Clinical Considerations

- **Empiric antibiotic options** need to have good activity against both Group A *Streptococcus* and MSSA
- **Empiric treatment against community-acquired MRSA:** Consider in selected cases based on individual risk factors, known colonization and local prevalence
- **Mild infections:** Oral treatment is adequate
- **Intravenous antibiotics:** May be required if infection rapidly spreading and not responding to oral antibiotics

### Antibiotic Treatment Duration

Treat for **5 days**


Longer durations may be required in case of no clinical improvement or if an underlying medical condition is present

### Topical Treatment

**Localized non-bullous impetigo:** Topical treatment is preferred over an oral antibiotic, whenever possible. For example, a 5 day course with mupirocin 2% ointment

## Rx Antibiotic Treatment

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **ORAL**


- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution


OR

 Cefalexin 25 mg/kg/dose q12h **ORAL**

- **Oral weight bands:**

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

OR

 Cloxacillin (or flucloxacillin) **ORAL**

- Neonates: 25-50 mg/kg/dose q12h
- Children: 25 mg/kg/dose q6h
- **Oral weight bands:**

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

# Burn Wound-Related Infections

## ? Definition

An injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals. Burns can be classified based on cause and depth of the burn.

*This guidance excludes severe infections*

## 🔍 Diagnosis

### 🔍 Clinical Presentation

- Diagnosis of a wound infection relies on the clinical examination
- Burn wounds should be monitored for signs of infection such as increased pain, redness or swelling of the area surrounding the wound
  - Redness alone may not indicate infection
  - Signs of invasive infection (e.g. change in wound colour, signs of sepsis) should be carefully monitored

### 🔬 Microbiology Tests

- Routine testing (including wound cultures) is not needed in mild cases with no signs of systemic infection
- Identifying the pathogen in mild cases will not benefit the patient as it will rarely change management
- In severe cases, refer to the Sepsis infographic if this is suspected

### 🧪 Other Laboratory Tests

- Routine testing is not needed in mild cases with no signs of systemic infection
- Because of the inflammatory response associated with the burn, biomarkers of infection are of limited use to diagnose bacterial infections

### 📷 Imaging

Routine imaging not necessary

## 🦠 Most Likely Pathogens

Mostly polymicrobial. Hospital-acquired multidrug-resistant organisms are a major concern in burn patients often because of prolonged hospitalization and frequent antibiotic exposure.

### Early after the injury:

- *Streptococcus* spp.
- *Staphylococcus aureus* (including MRSA strains)
- *Staphylococcus* spp. other than *S. aureus*
- *Enterobacteriales* (including multidrug-resistant strains)

### During hospitalization:

- *Pseudomonas aeruginosa* (including multidrug-resistant strains)
- *Acinetobacter baumannii* (including multidrug-resistant strains)
- Fungi (e.g. *Candida* spp.)

## ℞ Treatment

### 📋 Clinical Considerations

- Meticulous observation of infection control procedures to prevent transmission of multidrug-resistant organisms
- Irrigation and debridement of necrotic tissue to prevent infection of the wound
- Appropriate daily cleaning and dressing of the wound
- Only infected wounds should be treated
- Coverage against MRSA may be considered based on local prevalence and on individual risk factors

### 🕒 Antibiotic Treatment Duration

- Treat for **5 days (mild cases)** (Potentially longer if severe systemic infections)

### 👤 Prophylactic Antibiotics

- Avoid the routine use of antibiotics to prevent infections (no clear evidence of a benefit and increased risk of colonization with resistant bacteria)
- Consider in selected cases (e.g. immunosuppressed individual, puncture wounds) and/or high-risk “locations” (face, hands, near joints)
- Duration: 3 days


### 👉 Topical Treatment

Local antiseptics could be considered based on local protocols

## ℞ Antibiotic Treatment

**Only infected wounds should be treated**

*All dosages are for normal renal function*

 Amoxicillin+clavulanic acid 500 mg+125 mg q8h **ORAL**

OR

 Cefalexin 500 mg q8h **ORAL**

OR

 Cloxacillin (or flucloxacillin) 500 mg q8h **ORAL**

# Burn Wound-Related Infections

Page 1 of 2

This guidance excludes severe infections

## ? Definition

- An injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals
- Burns can be classified based on cause and depth of the burn

## 🦠 Most Likely Pathogens

Mostly polymicrobial. Hospital-acquired multidrug-resistant organisms are a major concern in burn patients often because of prolonged hospitalization and frequent antibiotic exposure.

### Early after the injury:

- *Streptococcus* spp.
- *Staphylococcus aureus* (including MRSA strains)
- *Staphylococcus* spp. other than *S. aureus*
- *Enterobacterales* (including multidrug-resistant strains)

### During hospitalization:

- *Pseudomonas aeruginosa* (including multidrug-resistant strains)
- *Acinetobacter baumannii* (including multidrug-resistant strains)
- Fungi (e.g. *Candida* spp.)

## 🔬 Diagnosis

### 🔍 Clinical Presentation

Diagnosis of a wound infection relies on the clinical examination

- Burn wounds should be monitored for signs of infection such as increased pain, redness or swelling of the area surrounding the wound
- Redness alone may not indicate infection
- Signs of invasive infection (e.g. change in wound colour, signs of sepsis) should be carefully monitored

### 🔬 Microbiology Tests

- Routine testing (including wound cultures) is not needed in mild cases with no signs of systemic infection
- Identifying the pathogen in mild cases will not benefit the patient as it will rarely change management
- In severe cases, refer to the Sepsis infographic if this is suspected

### 🧪 Other Laboratory Tests

- Routine testing is not needed in mild cases with no signs of systemic infection
- Because of the inflammatory response associated with the burn, biomarkers of infection are of limited use

### 📷 Imaging

Routine imaging not necessary



# Burn Wound-Related Infections

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## Rx Treatment

### Clinical Considerations

- Meticulous observation of infection control procedures to prevent transmission of multidrug-resistant organisms
- Irrigation and debridement of necrotic tissue to prevent infection of the wound
- Appropriate daily cleaning and dressing of the wound
- Only infected wounds should be treated
- Coverage against MRSA may be considered based on local prevalence and on individual risk factors

### Antibiotic Treatment Duration

- Treat for **5 days (mild cases)**  
(Potentially longer if severe systemic infections)

### Prophylactic Antibiotics

- Avoid the routine use of antibiotics to prevent infections (no clear evidence of a benefit and increased risk of colonization with resistant bacteria)
- Consider in selected cases (e.g. immunosuppressed individual, puncture wounds) and/or high-risk “locations” (face, hands, near joints)
- Duration: 3 days


### Topical Treatment

Local antiseptics could be considered based on local protocols

## Rx Antibiotic Treatment

**Only infected wounds should be treated**

*All dosages are for normal renal function*

 **Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h ORAL**

• **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

*Amox = amoxicillin*

*Oral liquid must be refrigerated after reconstitution*

OR

 **Cefalexin 25 mg/kg/dose q12h ORAL**

• **Oral weight bands:**

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

OR

 **Cloxacillin (or flucloxacillin) ORAL**

• Neonates: 25-50 mg/kg/dose q12h

• Children: 25 mg/kg/dose q6h

• **Oral weight bands:**

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

# Wound and Bite-Related Infections

This guidance excludes severe infections, surgical wounds and management of bites from poisonous animals or arthropods

## Definition

Any traumatic skin injury characterized by damage and exposure of deeper skin tissue

## Diagnosis

### Clinical Presentation

Infection may or may not be present at time of clinical evaluation

- *Superficial Infections*: Symptoms of cellulitis (redness, swelling, warmth, lymphangitis, pain around wound)
- *Invasive Wound Infection*: Change in wound colour, signs of sepsis (should be carefully monitored)

### Laboratory Tests

Routine testing not needed in mild cases with no signs of systemic infection

### Imaging

Routine imaging not necessary  
 • May be considered in selected cases based on extent and depth of lesion

## Most Likely Pathogens

Infection commonly polymicrobial (mix of human skin and animal oral microbiota, and environmental organisms)

### Wounds

Most cases:

- *Streptococcus* spp.
- *Staphylococcus aureus* (including MRSA strains)

More rarely:

- Anaerobes
- Enterobacterales
- *Enterococcus* spp.
- *Clostridium tetani* (soil contaminant)

### Bites

Human:

- Anaerobes
- *Streptococcus* spp.
- *Staphylococcus aureus*

Cat:

- Anaerobes
- *Pasteurella multocida*
- *Staphylococcus aureus*

Dog:

- Anaerobes
- *Capnocytophaga canimorsus*
- *Pasteurella multocida*
- *Staphylococcus aureus*

Monkey:

- Anaerobes
- *Streptococcus* spp.
- *Staphylococcus aureus*

Reptile:

- Anaerobes
- Enterobacterales
- *Pseudomonas aeruginosa*

Rodent:

- *Pasteurella multocida*

# Wound and Bite-Related Infections

## Rx Treatment

### Clinical Considerations

- **Rapidly After Injury:** Thorough washing and flushing of the wound (~15 minutes), with soap or detergent and copious amounts of water followed by debridement and immobilization
- **Risk of Tetanus and Rabies:** Quickly evaluate need to provide adequate post-exposure prophylaxis
- **Signs/Symptoms of Infection:** Empiric treatment should include antibiotics with good activity against most likely pathogens (*Staphylococcus* spp. and *Streptococcus* spp. and anaerobes)
- **Animal/Human Bites:** Empiric treatment against both aerobic and anaerobic bacteria required; empiric treatment against community-acquired MRSA usually not required

#### WHO Guidance

- Rabies: <https://apps.who.int/iris/handle/10665/272372>
- Tetanus: <https://apps.who.int/iris/handle/10665/254583>



### Antibiotic Treatment Duration

Treat for **5 days**



### Prophylactic Antibiotics

- In the absence of systemic signs of infection avoid antibiotics to prevent infections in otherwise healthy patients
- No clear evidence that antibiotics can prevent the infection
- Consider in selected cases (e.g. immunosuppressed individual, puncture wounds) and/or high-risk “locations” (face, hands, near joints)
- Duration: 3 days



### Antibiotic Treatment

All dosages are for normal renal function

ACCESS Amoxicillin+clavulanic acid 500 mg + 125 mg q8h **ORAL**

OR

ACCESS Cefalexin 500 mg q8h **ORAL**

OR

ACCESS Cloxacillin (or flucloxacillin) 500 mg q8h **ORAL**

*Not for bite-related infections because cloxacillin (or flucloxacillin) does not provide good anaerobic coverage*

# Wound and Bite-Related Infections

This guidance excludes severe infections, surgical wounds and management of bites from poisonous animals or arthropods

## Definition

Any traumatic skin injury characterized by damage and exposure of deeper skin tissue

## Diagnosis

### Clinical Presentation

Infection may or may not be present at time of clinical evaluation

- *Superficial Infections*: Symptoms of cellulitis (redness, swelling, warmth, lymphangitis, pain around wound)
- *Invasive Wound Infection*: Change in wound colour, signs of sepsis (should be carefully monitored)

### Laboratory Tests

Routine testing not needed in mild cases with no signs of systemic infection

### Imaging

Routine imaging not necessary  
 • May be considered in selected cases based on extent and depth of lesion

## Most Likely Pathogens

Infection commonly polymicrobial (mix of human skin and animal oral microbiota, and environmental organisms)

### Wounds

Most cases:

- *Streptococcus* spp.
- *Staphylococcus aureus* (including MRSA strains)

More rarely:

- Anaerobes
- Enterobacterales
- *Enterococcus* spp.
- *Clostridium tetani* (soil contaminant)

### Bites

*Human:*

- Anaerobes
- *Streptococcus* spp.
- *Staphylococcus aureus*

*Cat:*

- Anaerobes
- *Pasteurella multocida*
- *Staphylococcus aureus*

*Dog:*

- Anaerobes
- *Capnocytophaga canimorsus*
- *Pasteurella multocida*
- *Staphylococcus aureus*

*Monkey:*

- Anaerobes
- *Streptococcus* spp.
- *Staphylococcus aureus*

*Reptile:*

- Anaerobes
- Enterobacterales
- *Pseudomonas aeruginosa*

*Rodent:*

- *Pasteurella multocida*

# Wound and Bite-Related Infections

## Rx Treatment

### Clinical Considerations

- **Rapidly After Injury:** Thorough washing and flushing of the wound (~15 minutes), with soap or detergent and copious amounts of water followed by debridement and immobilization
- **Risk of Tetanus and Rabies:** Quickly evaluate need to provide adequate post-exposure prophylaxis
- **Signs/Symptoms of Infection:** Empiric treatment should include antibiotics with good activity against most likely pathogens (*Staphylococcus* spp. and *Streptococcus* spp. and anaerobes)
- **Animal/Human Bites:** Empiric treatment against both aerobic and anaerobic bacteria required; empiric treatment against community-acquired MRSA usually not required

#### WHO Guidance

- Rabies: <https://apps.who.int/iris/handle/10665/272372>
- Tetanus: <https://apps.who.int/iris/handle/10665/254583>

### Prophylactic Antibiotics


- In the absence of systemic signs of infection avoid antibiotics to prevent infections in otherwise healthy patients
- No clear evidence that antibiotics can prevent the infection
- Consider in selected cases (e.g. immunosuppressed individual, puncture wounds) and/or high-risk “locations” (face, hands, near joints)
- Duration: 3 days

### Antibiotic Treatment Duration

Treat for 5 days

### Rx Antibiotic Treatment

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **ORAL**

#### • Oral weight bands:

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution


OR

 Cefalexin 25 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

OR

 Cloxacillin (or flucloxacillin) **ORAL**

• Neonates: 25-50 mg/kg/dose q12h

• Children: 25 mg/kg/dose q6h

#### • Oral weight bands:

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

Not for bite-related infections because cloxacillin (or flucloxacillin) does not provide good anaerobic coverage

# Chlamydial Urogenital Infection

Sexually Transmitted Infection

Page 1 of 2

In general this guidance applies to adults and young people aged over 12 years. In children, specialist advice should be sought where possible. Consideration should be given that an STI in a child may be due to child sexual abuse

For Chlamydial Ocular Infections (Trachoma) see separate infographic

## Definition

A sexually transmitted infection (STI) caused by certain strains of the bacterium *Chlamydia trachomatis*

## Pathogen

*Chlamydia trachomatis* is an intracellular Gram-negative bacterium; strains associated with urogenital infection are mostly genital tract biovars (serovars D to K) and rarely lymphogranuloma venereum biovar (serovars L1, L2, L3)

## Prevention

Important elements of prevention include:

- Sexuality education
- Promoting consistent use of condoms
- Pre- and post-test counselling
- Safe sex and risk reduction counselling
- Interventions targeting high-risk groups

### Important:

- Sexual partners should be informed of the disease and treated
- Reporting of this infection to health authorities is encouraged according to local regulations

## Diagnosis

### Clinical Presentation

- Most persons remain asymptomatic though they can still transmit the infection
- If symptoms occur they overlap with those of gonococcal infection (co-infection possible and common)

#### Most common symptoms:

- *In Men:* Acute urethritis with “clear” urethral discharge and dysuria
- *In Women:* Vaginal discharge, dyspareunia (painful intercourse), and dysuria
- *Additionally in both sexes:*
  - Symptoms of acute proctitis with pain, pruritus, anal discharge and bleeding
- Symptoms of lymphogranuloma venereum (men>women):
  - Ulcerative lesion or a papule usually on the genitalia or rectum and inguinal or femoral lymphadenopathy (usually unilateral)
  - Often the lesion remains unnoticed in women or when located in the rectum

### Imaging

Usually not needed

### Other Laboratory Tests

Usually not needed

### Microbiology Tests

- See WHO guidance “Laboratory diagnosis of sexually transmitted infections” <https://apps.who.int/iris/handle/10665/85343>
- **Important:** all patients with suspected chlamydial urogenital infection should also be tested for gonococcal infection (as symptoms overlap) and other STIs (e.g. HIV, syphilis)

#### Reference standard:

- Nucleic acid amplification test (a test for both *Chlamydia* and *Neisseria gonorrhoeae* is available)
- Samples that can be used: urine (lower sensitivity and specificity in women), urethral, vulvovaginal, endocervical or anorectal samples collected with a swab
- Perform *Chlamydia* genovar testing for lymphogranuloma venereum in anorectal samples of men who have sex with men

#### Other tests to consider:

- Microscopy (Gram stain)
  - In a symptomatic patient, it can be used to exclude *Neisseria gonorrhoeae* (therefore suggesting non-gonococcal urethritis)
  - Leukocytes are usually present but not a specific finding for chlamydial infection
- Culture: if symptoms persist despite adequate treatment (but it is rarely performed)
- *Note: urines are not good specimens for microscopy and culture*

# Chlamydial Urogenital Infection

## Rx Treatment

### Clinical Considerations

- Treatment is aligned with the WHO 2016 guidelines for chlamydial urogenital infections (<https://apps.who.int/iris/handle/10665/246165>) but only options listed in the 2021 EML are reported below
- Treatment is always indicated when infection is diagnosed, including in asymptomatic persons because they can transmit the infection to others


### Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic used, please refer to the corresponding antibiotic section for treatment duration

### Rx Lymphogranuloma Venereum

All dosages are for normal renal function

#### First Choice


 Doxycycline 100 mg q12h **ORAL**  
Treatment duration: 21 days

#### Second Choice

 Azithromycin 1 g **ORAL**  
Treatment duration: 21 days

### Rx Anorectal Infection

All dosages are for normal renal function

 Doxycycline 100 mg q12h **ORAL**  
Treatment duration: 7 days

### Rx Infection in Pregnant Women

All dosages are for normal renal function


 Azithromycin 1 g **ORAL**  
Treatment duration: single dose

### Rx Uncomplicated Urogenital Infection

All dosages are for normal renal function

 Doxycycline 100 mg q12h **ORAL**  
Treatment duration: 7 days

OR

 Azithromycin 1 g **ORAL**  
Treatment duration: single dose

Recent data suggest that doxycycline is more effective, therefore it could be given priority if adherence is not a concern (except in pregnant women where it is contraindicated)

# Gonococcal Infection

Sexually Transmitted Infection

Page 1 of 3

In general this guidance applies to adults and young people aged over 12 years. In children, specialist advice should be sought where possible. Consideration should be given that an STI in a child may be due to child sexual abuse

## Definition

A sexually transmitted infection (STI) caused by the bacterium *Neisseria gonorrhoeae*

## Pathogen

- *Neisseria gonorrhoeae* is a Gram-negative bacterium that can easily develop resistance to antibiotics leading to infections that are difficult to treat, which is an increasing public health problem worldwide
- Data on *Neisseria gonorrhoeae* resistance is available through GLASS (The WHO Global Antimicrobial Resistance Surveillance System) and GASP (The WHO Gonococcal AMR surveillance program)  
<https://www.who.int/data/gho/data/themes/topics/who-gonococcal-amr-surveillance-programme-who-gasp>

## Diagnosis

### Clinical Presentation

- Some persons remain asymptomatic (women > men) though they can still transmit the infection
- If symptoms occur they overlap with those of chlamydial infection (co-infection possible and common)

#### Most common symptoms (usually occur a few days after infection):

- *In Men:* Acute urethritis with profuse mucopurulent urethral discharge and dysuria +/- testicular discomfort
- *In Women:* Mucopurulent vaginal discharge and dysuria +/- vaginitis with vaginal pain and inflammation and lower abdominal pain, cervical discharge, cervical ectopy and friability and easy bleeding on contact may also occur
- *Additionally in both sexes:*
  - Symptoms of acute proctitis with pain, pruritus, anal discharge and bleeding
  - Pharyngitis and conjunctivitis are other possible presentations
  - Rarely infection can disseminate, typically leading to localized infection in one or more joints
- *In pregnant women:*
  - Infection can transmit to the child during vaginal delivery
- *In newborns:*
  - Acute ocular infection and pharyngitis can occur a few days after birth
  - Disseminated infection with septic arthritis (usually in multiple joints) may also occur

### Microbiology Tests

- See WHO guidance “Laboratory diagnosis of sexually transmitted infections”  
<https://apps.who.int/iris/handle/10665/85343>
- **Important:** all patients with suspected gonococcal infection should also be tested for chlamydial urogenital infection (as symptoms overlap) and other STIs (e.g. HIV, syphilis)

#### Reference standard:

- Nucleic acid amplification test (a test for both *N. gonorrhoeae* and *Chlamydia* is available)
- Samples that can be used: urine (lower sensitivity and specificity in women), urethral, vulvovaginal, endocervical or anorectal samples collected with a swab

#### Other tests to consider:

- Culture + antimicrobial susceptibility testing: If symptoms persist despite adequate treatment and for surveillance of *Neisseria gonorrhoeae* resistance
- Microscopy (Gram stain)
  - Samples that can be used: urethral, endocervical, conjunctival samples collected with a swab
- Blood cultures: If disseminated infection is suspected

### Other Laboratory Tests

Usually not needed

### Imaging

Usually not needed



# Gonococcal Infection

## Prevention

Important elements of prevention include:

- Sexuality education
- Promoting consistent use of condoms
- Pre- and post-test counselling
- Safe sex and risk reduction counselling
- Interventions targeting high-risk groups

### Important:

- Sexual partners should be informed of the disease and treated
- Reporting of this infection to health authorities is encouraged according to local regulations

## Treatment (Section 1 of 2)

### Clinical Considerations

Treatment is aligned with the WHO 2016 guidelines for the treatment of gonococcal infection (<https://apps.who.int/iris/handle/10665/246114>) but only options listed in the 2021 EML are reported below

- Treatment is always indicated when infection is diagnosed, including in asymptomatic patients because they can transmit the infection to others
- Local resistance data should determine the most appropriate therapy and if data not available, dual therapy is preferred
- If symptoms do not resolve in approximately 5 days, resistant infection or alternative diagnosis should be suspected

### Antibiotic Treatment Duration

Single Dose

### Genital and Anorectal Infections

See the following page for treatment recommendations

### Retreatment After Treatment Failure

See the following page for treatment recommendations

## Oropharyngeal Infections

All dosages are for normal renal function

### First Choice

 Ceftriaxone 250 mg **IM**

COMBINED WITH

 Azithromycin 1 g **ORAL**

OR

 Ceftriaxone 250 mg **IM**

Only use single therapy if local resistance data confirm susceptibility to the antibiotic

### Second Choice

 Cefixime 400 mg **ORAL**

COMBINED WITH

 Azithromycin 1 g **ORAL**

# Gonococcal Infection

## Rx Treatment (Section 2 of 2)

### Antibiotic Treatment Duration

Single Dose

### Rx Retreatment after Treatment Failure

Consider treatment failure if symptoms persist after 5 days of adequate treatment

All dosages are for normal renal function

**WATCH** Ceftriaxone 500 mg **IM**

OR

**WATCH** Cefixime 800 mg **ORAL**

OR

**ACCESS** Gentamicin 240 mg **IM**

OR

**ACCESS** Spectinomycin 2 g **IM**

Do not use for spectinomycin for oropharyngeal infections

COMBINED WITH

**WATCH** Azithromycin 2 g **ORAL**

### Rx Genital and Anorectal Infections

All dosages are for normal renal function

#### First Choice

**WATCH** Ceftriaxone 250 mg **IM**

COMBINED WITH

**WATCH** Azithromycin 1 g **ORAL**

OR

**WATCH** Ceftriaxone 250 mg **IM**

Only use single therapy if local resistance data confirm susceptibility to the antibiotic

#### Second Choice

**WATCH** Cefixime 400 mg **ORAL**

COMBINED WITH

**WATCH** Azithromycin 1 g **ORAL**

OR

**ACCESS** Spectinomycin 2 g **IM**

OR

**ACCESS** Gentamicin 240 mg **IM**

The 2021 EML lists gentamicin however, this option is not recommended in the WHO 2016 guidelines

Only use single therapy if local resistance data confirm susceptibility to the antibiotic

# Syphilis

Sexually Transmitted Infection

Page 1 of 2

In general this guidance applies to adults and young people aged over 12 years. In children, specialist advice should be sought where possible. Consideration should be given that an STI in a child may be due to child sexual abuse

## Pathogen

*Treponema pallidum* subspecies *pallidum* is a bacterium of the phylum Spirochaetes

- Slow growing, difficult to culture *in vitro*, thin

## Definition

- A sexually transmitted infection (STI) caused by the bacterium *Treponema pallidum* subspecies *pallidum*
- The infection can be transmitted from the mother to her fetus because the pathogen can cross the placenta

### Classification based on:

- Timing since acquisition
  - **Early:** ≤2 years (includes primary and secondary infections and the early latent phase)
  - **Late:** >2 years (includes the late latent phase and tertiary infections)
- Clinical presentation (see below)

## Diagnosis

### Clinical Presentation

#### Early syphilis:

- **Primary Infection:** Often asymptomatic, localized non painful ulcerative lesion with indurated margins (usually on genitalia, mouth or rectum) +/- local lymphadenopathy
- **Secondary Infection:**
  - Skin and mucosal manifestations over trunk and extremities including palms of hands and soles of feet
  - Rash is commonly maculopapular and non-irritant
  - Mucous membranes of mouth/perineum can show lesions
  - Fever (≥ 38.0°C), generalized lymphadenopathy and malaise usually present
  - Meningitis, hepatitis and ocular involvement can occur

#### Late syphilis:

- **Tertiary Infection:** Can affect different organ systems
  - Cardiovascular system: usually aortitis
  - Skin/soft tissues/bones: nodular lesions (gummas)
  - Central nervous system: often progressive dementia, psychiatric symptoms, problems with coordination of movements

### Other Laboratory Tests

**Primary syphilis:** Usually not needed

**Secondary or tertiary syphilis:** May be required depending on the clinical presentation

### Microbiology Tests

- See WHO guidance “Laboratory diagnosis of sexually transmitted infections” <https://apps.who.int/iris/handle/10665/85343>
- **Important:** all patients with suspected syphilis should also be tested for other STIs (e.g. HIV, gonococcal infection)

#### Direct detection methods:

- Can detect the pathogen in specimens from skin or tissue lesions

#### Serological tests:

- All tests are negative initially in primary infection
- **Treponemal Tests:** detect antibodies to treponemal antigens; they usually remain positive after infection even with successful treatment
  - Type of tests: **FTA-ABS, TPPA, TPHA**
- **Nontreponemal Tests:** detect antibodies that react to lipids released in response to cellular damage caused by infection; usually become negative with successful treatment
  - Type of tests: **VDRL, RPR**
- **Both treponemal and non-treponemal tests need to be positive to confirm the diagnosis**
  - To increase access and same-day treatment, a rapid treponemal test followed (if positive) by a non-treponemal test is recommended; but starting with a non-treponemal test and confirming positive results with a treponemal test is also appropriate

### Imaging

Usually not needed unless a complication of late syphilis is suspected

# Syphilis

## Prevention

Important elements of prevention include:

- Sexuality education
- Promoting consistent use of condoms
- Pre- and post-test counselling
- Safe sex and risk reduction counselling
- Interventions targeting high risk groups
- Access of pregnant women to early and adequate prenatal care to prevent congenital syphilis

### Important:

- Sexual partners should be informed of the disease and treated
- Reporting of this infection to health authorities is encouraged according to local regulations

## Treatment

### Clinical Considerations

- Treatment is aligned with the WHO 2016 guidelines for the treatment of *Treponema pallidum* (<https://apps.who.int/iris/handle/10665/249572>) but only options listed in the 2021 EML are reported below
- Treatment is always indicated when infection is diagnosed, including in asymptomatic patients because they can transmit the infection to others
- In early syphilis (primary/secondary), partners should also be treated if exposed within 90 days
- Assess serological response by repeating non-treponemal test to detect a reduction in titer; a 4-fold reduction in titers confirms adequate response (repeat 3, 6 and 12 months after the end of treatment)

### Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic used and the stage of the infection, please refer to the corresponding antibiotic section for treatment duration

### Early Syphilis

#### First Choice

ACCESS Benzathine benzylpenicillin 2.4 million IU (1.8 g) **IM**  
**Treatment duration:** single dose

#### Second Choice

ACCESS Procaine benzylpenicillin 1.2 million IU (1.2 g) q24h **IM**  
**Treatment duration:** 10-14 days

### Syphilis in Pregnancy

ACCESS Benzathine benzylpenicillin 2.4 million IU (1.8 g) **IM**  
**Treatment duration:**

- Early Syphilis: Single dose
- Late or Unknown Stage Syphilis: One dose per week for 3 consecutive weeks (total of 3 administrations, the interval between doses should not exceed 14 days)

### Neurosyphilis

ACCESS Benzylpenicillin 2-4 million IU (1.2-2.4 g) q4h **IV**  
**Treatment duration:** 14 days

OR

ACCESS Procaine benzylpenicillin 1.2 million IU (1.2 g) q24h **IM**  
**Treatment duration:** 14 days

COMBINED WITH

Probenecid 500 mg q6h **ORAL**  
**Treatment duration:** 14 days

### Late or Unknown Stage Syphilis

#### First Choice

ACCESS Benzathine benzylpenicillin 2.4 million IU (1.8 g) **IM**  
**Treatment duration:** One dose per week for 3 consecutive weeks (total of 3 administrations, the interval between doses should not exceed 14 days)

#### Second Choice

ACCESS Procaine benzylpenicillin 1.2 million IU (1.2 g) q24h **IM**  
**Treatment duration:** 20 days

# Trichomoniasis

## Sexually Transmitted Infection

*In general this guidance applies to adults and young people aged over 12 years. In children, specialist advice should be sought where possible. Consideration should be given that an STI in a child may be due to child sexual abuse*

### ? Definition

A sexually transmitted infection (STI) caused by *Trichomonas vaginalis*

### 🔬 Diagnosis

#### 🔍 Clinical Presentation

- Most persons have mild symptoms or remain asymptomatic (especially men) though they can still transmit the infection

#### Symptomatic infection:

- *In women:* acute onset of vaginal inflammation and discharge (frothy and with a bad smell), dysuria and pelvic pain
- *In men:* urethral discharge, dysuria and testicular discomfort or pain; rarely epididymitis and prostatitis can be present

#### 🔬 Microbiology Tests

- See WHO guidance “Laboratory diagnosis of sexually transmitted infections” <https://apps.who.int/iris/handle/10665/85343>
- **Important:** all patients with suspected trichomoniasis should also be tested for other STIs (e.g. HIV, syphilis, gonococcal infection)

#### Tests to consider:

- Wet mount microscopy (easy and inexpensive but should be read within 10 minutes of sample collection)
- Nucleic acid amplification tests for *T. vaginalis* (very good sensitivity; preferred if available)
- Culture (good sensitivity but requires long incubation)
- Samples that can be used: Urethral, endocervical, and vaginal swabs

#### 🧪 Other Laboratory Tests

Usually not needed

#### 📷 Imaging

Usually not needed

### 🌐 Pathogen

*Trichomonas vaginalis* is an anaerobe flagellated protozoan

### 👐 Prevention

Important elements of prevention include:

- Sexuality education
- Promoting consistent use of condoms
- Pre- and post-test counselling
- Safe sex and risk reduction counselling
- Interventions targeting high-risk groups

#### Important:

- Sexual partners should be informed of the disease and treated
- Reporting of this infection to health authorities is encouraged according to local regulations

### ℞ Treatment

#### 📋 Clinical Considerations

- Treatment is aligned with the WHO 2021 guidelines for the management of symptomatic STI (<https://apps.who.int/iris/handle/10665/342523>)
- Treatment is always indicated when infection is diagnosed, including in asymptomatic persons because they can transmit the infection to others

#### 🕒 Antibiotic Treatment Duration

- Since treatment duration varies, please refer to the corresponding antibiotic section for treatment duration
- Evidence supports better cure rates with 7-day course (consider if treatment adherence is not an issue)

#### ℞ Antibiotic Treatment

All dosages are for normal renal function

**Metronidazole 2 g ORAL**  
ACCESS **Treatment duration:** single dose

OR

**Metronidazole 400 or 500 mg q12h ORAL**  
ACCESS **Treatment duration:** 7 days

# Lower Urinary Tract Infection

## ? Definition

- Infection of the lower part of the urinary tract (e.g. the bladder-cystitis)
- Urinary tract infections (UTI) in individuals with mechanical anomalies of the urinary tract or who are immunosuppressed and in pregnant women are generally considered at greater risk of complicated evolution (complicated UTI)

## Most Likely Pathogens

### Bacteria:

- **Most common:**
  - Enterobacterales (mostly *Escherichia coli* including multidrug-resistant strains such as those producing ESBL)
- **More rarely:**
  - Coagulase-negative Staphylococci: *S. saprophyticus* (mostly in young women)
  - *Streptococcus agalactiae* (group B *Streptococcus*)
  - *Enterococcus* spp.
  - *Pseudomonas aeruginosa* or *Acinetobacter baumannii* (including multidrug-resistant strains such as those producing ESBL especially in patients with recent antibiotic exposure)

## Diagnosis

### Clinical Presentation

- Acute (< 1 week) dysuria, increased urinary urgency and frequency, lower abdominal pain or discomfort and sometimes gross hematuria
- In women, a vaginal source of the symptoms (vaginal discharge or irritation) should be excluded first
  - In elderly patients with pre-existing urinary symptoms the most reliable symptoms are acute urinary changes compared to the baseline

### Other Laboratory Tests

- In symptomatic patients:
- Urinalysis (dipstick or microscopy) to detect bacteriuria and/or indirect signs of infection (positive leucocyte esterase and nitrites)
  - Blood tests usually not needed

### Microbiology Tests

In symptomatic patients:

- Urine culture if risk of complicated UTI and/or recurrent UTI (to confirm the diagnosis and adapt empiric treatment)

#### Important:

- A positive urine culture in an asymptomatic patient indicates bacterial colonization and does not require treatment except in pregnant women or in patients undergoing urological procedures in which bleeding is anticipated
- The absence of urine leucocytes has a good negative predictive value but the positive predictive value of leucocyturia is suboptimal

### Imaging

Usually not needed unless need to investigate possible underlying abnormalities of the urinary tract

# Lower Urinary Tract Infection

Page 2 of 2

## Rx Treatment

### ✓ Clinical Considerations

**Antibiotic treatment recommended if compatible clinical presentation AND a positive test** (positive urine leucocytes/leucocyte esterase or positive urine culture)

- If tests could not be performed, treat based on clinical presentation
- Clinical improvement should be evident within 48-72h
- Antibiotics shorten duration of symptoms by 1-2 days

### 🕒 Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic, please refer to the corresponding antibiotic section for treatment duration

*Note: in general consider longer treatments for pregnant women (usually 5 days) and men (usually 7 days)*

### Rx Antibiotic Treatment

*All dosages are for normal renal function*

ACCESS Nitrofurantoin **ORAL**  
 • 100 mg q12h (modified release formulation)  
 • 50 mg q6h (immediate release formulation)  
**Treatment duration: 5 days**

*Main medicine recommended for acute lower UTI and active against most ESBL-producing isolates*

\_\_\_\_\_ **OR** \_\_\_\_\_

ACCESS Sulfamethoxazole+trimethoprim  
 800 mg+160 mg q12h **ORAL**  
**Treatment duration: 3 days**

*Resistance is high in many settings and NOT active against ESBL-producing isolates*

\_\_\_\_\_ **OR** \_\_\_\_\_

ACCESS Trimethoprim 200 mg q12h **ORAL**  
**Treatment duration: 3 days**

*Resistance is high in many settings and NOT active against ESBL-producing isolates*

\_\_\_\_\_ **OR** \_\_\_\_\_

ACCESS Amoxicillin+clavulanic acid 500 mg+125 mg  
 q8h **ORAL**  
**Treatment duration: 3-5 days**

*Active against some ESBL-producing isolates*

# Lower Urinary Tract Infection

Urinary Tract Infection

Page 1 of 2

## ? Definition

- Infection of the lower part of the urinary tract (e.g. the bladder-cystitis)
- Urinary tract infections (UTI) in children with mechanical anomalies of the urinary tract (e.g. vesicoureteral reflux or other congenital anomalies) or who are immunosuppressed are generally considered at greater risk of complicated evolution (complicated UTI)

## Most Likely Pathogens

### Bacteria:

- **Most common:**
  - Enterobacterales (mostly *Escherichia coli* including multidrug-resistant strains such as those producing ESBL)
- **More rarely:**
  - *Streptococcus agalactiae* (group B *Streptococcus*)
  - *Enterococcus* spp.
  - *Pseudomonas aeruginosa* or *Acinetobacter baumannii* (including multidrug-resistant strains such as those producing ESBL especially in patients with recent antibiotic exposure)

## Diagnosis

### Clinical Presentation

- Acute (< 1 week) dysuria, increased urinary urgency and frequency, incontinence/wetting, lower abdominal pain or discomfort and sometimes hematuria
- Generally no systemic signs/symptoms (e.g. fever)
- In girls, a vaginal source of the symptoms (vaginal discharge or irritation) should be excluded first

### Other Laboratory Tests

- In symptomatic patients:
- Urinalysis (dipstick or microscopy) to detect bacteriuria and/or indirect signs of infection (positive leucocyte esterase and nitrites)
  - Blood tests usually not needed

### Microbiology Tests

In symptomatic patients:

- Urine culture (always in children) to confirm the diagnosis and adapt empiric treatment

#### Important:

- A positive urine culture in an asymptomatic patient indicates bacterial colonization and does not require treatment except in patients undergoing urological procedures in which bleeding is anticipated
- The absence of urine leucocytes has a good negative predictive value but the positive predictive value of leucocyturia is suboptimal

### Imaging

Usually not needed unless need to investigate possible underlying abnormalities of the urinary tract



# Lower Urinary Tract Infection

## Rx Treatment

### Clinical Considerations

**Antibiotic treatment recommended if compatible clinical presentation AND a positive test** (positive urine leucocytes/leukocyte esterase or positive urine culture)

- If tests could not be performed, treat based on clinical presentation
- Clinical improvement should be evident within 48-72h
- Antibiotics shorten duration of symptoms by ~2 days
- Amoxicillin+clavulanic acid still has activity against some ESBL-producing isolates and can be considered an acceptable option, particularly in young children

### Antibiotic Treatment Duration

Since treatment duration varies according to the antibiotic, please refer to the corresponding antibiotic section for treatment duration

## Rx Antibiotic Treatment

All dosages are for normal renal function

**Nitrofurantoin 2-4 mg/kg/dose q12h ORAL**  
ACCESS **Treatment duration: 5 days**

Main medicine recommended for acute lower UTI and active against most ESBL-producing isolates

OR

**Sulfamethoxazole+trimethoprim 20 mg/kg + 4 mg/kg q12h ORAL**  
ACCESS  
 • **Oral weight bands:**

3-<6 kg	100 mg+20 mg q12h
6-<10 kg	200 mg+40 mg q12h
10-<30 kg	400 mg+80 mg q12h
≥30 kg	Use adult dose

**Treatment duration: 3 days**

Resistance is high in many settings and NOT active against ESBL-producing isolates

OR

**Trimethoprim 4 mg/kg q12h ORAL**  
ACCESS  
 • **Oral weight bands:**

3-<6 kg	20 mg q12h
6-<10 kg	40 mg q12h
10-<30 kg	80 mg q12h
≥30 kg	Use adult dose

**Treatment duration: 3 days**

Resistance is high in many settings and NOT active against ESBL-producing isolates

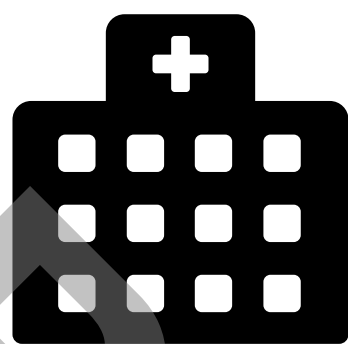
OR

**Amoxicillin+clavulanic acid 40-50 mg/kg/dose (amoxicillin component) q12h OR 30 mg/kg/dose q8h ORAL**  
ACCESS  
 • **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

**Treatment duration: 3-5 days**

Amox = amoxicillin  
 Active against some ESBL-producing isolates  
 Must refrigerate oral liquid after reconstitution



# Hospital Facility

# Sepsis & Septic Shock

Page 1 of 4

## Definition

### Sepsis (Sepsis 3):

- A life-threatening organ dysfunction caused by a dysregulated host response to infection

### Septic Shock:

- A type of sepsis in which underlying circulatory and cellular and/or metabolic abnormalities substantially increase short-term mortality
- Patients have persistent hypotension and require vasopressors to maintain a mean arterial pressure  $\geq 65$  mmHg (8.7 kPa) and present with a level of serum lactate  $> 2$  mmol/L ( $> 18$  mg/dL) in the absence of hypovolemia

**Important:** bacteraemia is not part of the definition of sepsis, while many patients with sepsis have bacteraemia, most patients with bacteraemia do not fulfill sepsis criteria

## Most Likely Pathogens

Sepsis can originate from any type of infection in any organ system. Bacteria, viruses, fungi and protozoa can all cause sepsis (but only sepsis of bacterial origin is addressed here)

### Community Setting:

- *E. coli*, *K. pneumoniae* and other Enterobacterales (including multidrug-resistant strains such as those producing ESBL and carbapenemases)
- *S. aureus* (including MRSA)
- *S. pneumoniae* (including penicillin non-susceptible strains)
- *Salmonella* spp. (including *Salmonella* Typhi and Paratyphi)
- *S. pyogenes* (group A *Streptococcus*)
- *N. meningitidis* (including strains resistant to third-generation cephalosporins)
- *Burkholderia pseudomallei* (agent of melioidosis)

### Hospital Setting:

- *Acinetobacter baumannii* and *Pseudomonas* spp. (including multidrug-resistant strains such as those producing ESBL and carbapenemases)
- *E. coli*, *K. pneumoniae* and other Enterobacterales (including multidrug-resistant strains such as those producing ESBL and carbapenemases)
- *S. aureus* (including MRSA)

### Endemic Setting:

- *Plasmodium* spp. (agent of malaria)
- Viruses causing viral haemorrhagic fevers (e.g. Dengue virus, yellow fever virus, Ebola virus) and respiratory viruses

### Maternal Sepsis:

- Consider *L. monocytogenes* and *S. agalactiae*, however UTIs represent main source of infection

## Diagnosis

### Clinical Presentation

- Early recognition of the source of infection and treatment is fundamental and impacts mortality
- Symptoms are highly variable and mostly non-specific
- Patients often present with fever ( $> 38.0^{\circ}\text{C}$ ) or hypothermia ( $< 36.0^{\circ}\text{C}$ ); tachycardia, respiratory distress, acute altered mental status and hypotension. Reduced urine output may be present

#### Important:

- Accurate identification of patients with sepsis is difficult and no single reference standard test exists
- Adoption and use of the internationally accepted definitions is critical to avoid overdiagnosis and overtreatment
- While it is important to rapidly treat patients with sepsis and septic shock with antibiotics it should be kept in mind that only a very small proportion of patients with an infection have sepsis

### Microbiology Tests

- Guided by the suspected primary site of infection but should always include blood cultures (ideally two sets)
- Tests should ideally be performed before initiating antibiotics

### Other Laboratory Tests

#### To Identify a Bacterial Infection:

- White blood count, CRP and/or procalcitonin
- In initial patient assessment, inflammatory markers in the normal range do not rule out sepsis if high pre-test probability

#### To Identify Organ Dysfunction:

- **Bilirubin, blood pH and gases**, blood urea nitrogen (required for CURB-65 score calculation if suspected pneumonia), complete blood count with **platelets**, **creatinine**, electrolytes, glucose, whole blood lactate
- *Tests in bold are required for SOFA score calculation*

### Imaging

Guided by the suspected primary site of infection

## Prevention

- Preventing infections includes vaccinations, adequate nutrition, and access to safe water and sanitation
- Preventing evolution of infection to sepsis relies on timely diagnosis and adequate treatment of the underlying infection

# Sepsis & Septic Shock

Page 2 of 4

## Organ Dysfunction Assessment Scores

### Sequential Organ Failure Assessment (SOFA)

Parameter	Score				
	0	1	2	3	4
PaO <sub>2</sub> mmHg (kPa) / FiO <sub>2</sub> (%)	≥ 400 (53.3)	< 400 (53.3)	< 300 (40)	< 200 (26.7)	< 100 (13.3)
MAP mmHg (kPa) and catecholamine doses needed (µg/kg/min for ≥ 1h)	MAP ≥ 70 (9.3)	MAP < 70 (9.3)	Dopamine < 5 OR dobutamine any dose	Dopamine 5.1–15 OR epinephrine (adrenaline)/ norepinephrine ≤ 0.1	Dopamine > 15 OR epinephrine/ norepinephrine > 0.1
Platelets (x 10 <sup>3</sup> /µL, x 10 <sup>9</sup> /L)	≥ 150	< 150	< 100	< 50	< 20
Bilirubin mg/dL (mmol/L)	< 1.2 (20)	1.2 - 1.9 (20 - 32)	2.0 - 5.9 (33-101)	6.0 - 11.9 (102 - 204)	> 12.0 (204)
Glasgow coma scale	15	13 - 14	10 - 12	6 - 9	< 6
Creatinine mg/dL (µmol/L)	< 1.2 (110)	1.2 - 1.9 (110 - 170)	2.0 - 3.4 (171 - 299)	3.5 - 4.9 (300-440)	> 5.0 (440)
Urine output (mL/day)				< 500	< 200

Definitions: FiO<sub>2</sub>: fractional inspired oxygen; PaO<sub>2</sub>: arterial oxygen partial pressure; MAP: mean arterial pressure

### Quick SOFA (qSOFA)

Parameter	Value
Respiratory Rate	≥ 22 breaths/min
Altered Mental Status	Glasgow Coma Scale < 15
Systolic Blood Pressure	≤ 100 mmHg

### Interpretation

An acute change of ≥ 2 points from the baseline score suggests organ dysfunction due to infection

# Sepsis & Septic Shock

Page 3 of 4

## Rx Treatment (Section 1 of 2)

### Clinical Considerations

- Treatment includes treatment of the underlying infection and life-saving interventions (not addressed here)
- Many infections require surgical source control; antibiotics are complementary in these cases
- Start IV antibiotics as soon as possible if sepsis is suspected; results of tests should not delay antibiotics
- To choose the best empiric treatment consider most likely infection site and pathogens, local prevalence of antibiotic resistance, comorbidities, and risk of multidrug-resistant organisms
- If pathogen and susceptibilities are known, review antibiotics and adapt treatment

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration

- Clinical Sepsis of Unknown Origin: **7 days** (depends on underlying disease & clinical response)
- Meningitis: **10 days** (may differ in epidemics and with different pathogens)
- Lower Respiratory Tract Infection: **5 days**

### Rx Clinical Sepsis of Unknown Origin

All dosages are for normal renal function

**WATCH** Ceftriaxone 2 g q24h IV

OR

**WATCH** Cefotaxime 2 g q8h IV

COMBINED WITH

**ACCESS** Gentamicin 5 mg/kg q24h IV

OR

**ACCESS** Amikacin 15 mg/kg q24h IV

*Gentamicin and amikacin retain activity against ESBL-producing strains and can be considered as a carbapenem-sparing option*

### Rx Meningitis

Refer also to the bacterial meningitis infographic  
All dosages are for normal renal function

#### First Choice

**WATCH** Ceftriaxone 2 g q12h IV

OR

**WATCH** Cefotaxime 2 g q6h IV

#### Second Choice

**ACCESS** Ampicillin 2 g q4h IV

OR

**ACCESS** Amoxicillin 2 g q4h IV

OR

**ACCESS** Chloramphenicol 1 g q6h IV

*Use chloramphenicol only when no other option is available*

OR

**ACCESS** Benzylpenicillin 4 million IU (2.4 g) q4h IV

### Rx Lower Respiratory Tract Infection

Refer also to the community-acquired pneumonia infographic

All dosages are for normal renal function

**WATCH** Ceftriaxone 2 g q24h IV

OR

**WATCH** Cefotaxime 1 g q8h IV

COMBINED WITH

**WATCH** Clarithromycin 500 mg q12h IV

# Sepsis & Septic Shock

## Rx Treatment (Section 2 of 2)

### Antibiotic Treatment Duration

- Enteric Fever: **10 days**
- Intra-abdominal and Skin & Soft Tissue infections: **generally 7 days** depending on infection type, if adequate surgical source control achieved and on clinical recovery
- Urinary Tract Infection: **7 days**

### Rx Enteric Fever

Refer also to the enteric fever infographic

**WATCH** Ceftriaxone 2 g q24h IV

Some countries may have problems of increasing ceftriaxone resistance

### Rx Intra-abdominal Infection

Refer also to the appendicitis, cholecystitis/cholangitis, diverticulitis and liver abscess infographics

All dosages are for normal renal function

#### First Choice

**WATCH** Ceftriaxone 2 g q24h IV

OR

**WATCH** Cefotaxime 2 g q8h IV

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h IV

OR

**WATCH** Piperacillin+tazobactam 4 g+500 mg q6h IV

Piperacillin+tazobactam does not provide adequate activity against many ESBL-producing isolates; consider meropenem

#### Second Choice

**WATCH** Meropenem 2 g q8h IV

### Rx Skin and Soft Tissues Infection

Refer also to the necrotizing fasciitis infographic

All dosages are for normal renal function

**WATCH** Ceftriaxone 2 g q24h IV

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h IV

In case of suspected necrotizing fasciitis ceftriaxone and metronidazole should **ONLY** be used if *Streptococcus pyogenes* has been excluded

OR

**WATCH** Piperacillin+tazobactam 4 g+500 mg q6h IV

COMBINED WITH

**ACCESS** Clindamycin 900 mg q8h IV

IF MRSA SUSPECTED, ADD

**WATCH** Vancomycin 15-20 mg/kg q12h IV

### Rx Urinary Tract Infection

Refer also to the upper UTI infographic

All dosages are for normal renal function

**WATCH** Ceftriaxone 1 g q24h IV

OR

**WATCH** Cefotaxime 1 g q8h IV

COMBINED WITH

**ACCESS** Amikacin 15 mg/kg q24h IV

Amikacin retains activity against ESBL-producing strains and can be considered as a carbapenem-sparing option

# Sepsis in Children

This guideline is intended for children over the age of 1 month up to 12 years. For children 0-1 month see sepsis in neonates

## Definition

• "A condition characterized by the presence of acute fever ( $> 39.0^{\circ}\text{C}$ ) and severe illness when no other cause is found" (indicating that it is possibly caused by an infection) (WHO Integrated Management of Childhood Illnesses definition)

### Alternative Definitions

- International Pediatric Sepsis Consensus Conference: Suspected or proven infection caused by any pathogen or clinical syndrome associated with a high probability of infection AND systemic inflammatory response syndrome
- Children  $< 5$  years of age can be classified as having "Possible Serious Bacterial Infection" (PSBI) when at least one of the following signs is present:
  - Not able to feed since birth or stopped feeding well (confirmed by observation)
  - Convulsions
  - Fast breathing ( $\geq 60$  breaths per minute)
  - Severe chest indrawing
  - Fever ( $\geq 38.0^{\circ}\text{C}$ )
  - Low body temperature ( $< 35.5^{\circ}\text{C}$ )

**Important:** bacteraemia is not part of the definition of sepsis; while many patients with sepsis have bacteraemia, most patients with bacteraemia do not fulfill sepsis criteria

## Prevention

- Preventing infections includes:
  - Vaccinations
  - Adequate nutrition
  - Healthy living environments (e.g. access to safe water and sanitation)
- Preventing evolution of infection to sepsis relies on:
  - Timely diagnosis
  - Adequate treatment of the underlying infection

## Diagnosis

### Clinical Presentation

- Usually signs and symptoms are non-specific
- Fever ( $> 38.0^{\circ}\text{C}$ ), respiratory symptoms, tachycardia, acute altered mental status, hypotension, vomiting

### Microbiology Tests

- Diagnostic tests will be different depending on the suspected source of infection
- Ideally perform tests before initiating antibiotics; tests should not cause a major delay to the start of antibiotic treatment
- Tests for suspected sepsis would normally include blood, urine and CSF culture

### Other Laboratory Tests

#### To Identify a Bacterial Infection:

- White blood count
- C-reactive protein and/or procalcitonin

#### To Identify Organ Dysfunction:

- Complete blood count with **platelets**
- **Bilirubin**
- **Blood pH and gases**
- Blood urea nitrogen
- **Creatinine**
- Electrolytes
- Glucose
- Whole blood lactate

*Tests in bold are required for pSOFA score calculation*

### Imaging

Guided by the suspected primary site of infection

# Sepsis in Children

## Paediatric Sequential Organ Failure Assessment (pSOFA) Score

Parameter	Age	Score				
		0	1	2	3	4
PaO <sub>2</sub> mmHg (kPa) / FiO <sub>2</sub> (%)	All ages	≥ 400 (53.3)	< 400 (53.3)	< 300 (40)	< 200 (26.7) with respiratory support	< 100 (13.3) with respiratory support
Platelets (x 10 <sup>3</sup> /μL, x 10 <sup>9</sup> /L)	All ages	≥ 150	< 150	< 100	< 50	< 20
Bilirubin mg/dL (mmol/L)	All ages	< 1.2 (20)	1.2 - 1.9 (20 - 32)	2.0 - 5.9 (33 - 101)	6.0 - 11.9 (102 - 204)	> 12.0 (204)
Glasgow coma scale	All ages	15	13 - 14	10 - 12	6 - 9	< 6
MAP mmHg (kPa) and catecholamine doses needed (μg/kg/min for ≥ 1h)	<1 mo	≥ 46 (6.1)	< 46 (6.1)	Dopamine < 5 OR dobutamine any dose	Dopamine 5.1–15 OR epinephrine (adrenaline)/ norepinephrine ≤ 0.1	Dopamine > 15 OR epinephrine/ norepinephrine > 0.1
	1-11 mo	≥ 55 (7.3)	< 55 (7.3)			
	1-2 yrs	≥ 60 (8.0)	< 60 (8.0)			
	2-5 yrs	≥ 62 (8.2)	< 62 (8.2)			
	6-11 yrs	≥ 65 (8.6)	< 65 (8.6)			
	12-18 yrs	≥ 67 (8.9)	< 67 (8.9)			
Creatinine mg/dL (μmol/L)	<1 mo	< 0.8 (71)	0.8 - 0.9 (71 - 80)	1.0 - 1.1 (88 - 97)	1.2 - 1.5 (110 - 133)	≥ 1.6 (141)
	1-11 mo	< 0.3 (26)	0.3 - 0.4 (26 - 35)	0.5 - 0.7 (44 - 62)	0.8 - 1.1 (71 - 97)	≥ 1.2 (110)
	1-2 yrs	< 0.4 (35)	0.4 - 0.5 (35 - 44)	0.6 - 1.0 (53 - 88)	1.1 - 1.4 (97 - 124)	≥ 1.5 (133)
	2-5 yrs	< 0.6 (53)	0.6 - 0.8 (53 - 71)	0.9 - 1.5 (79 - 133)	1.6 - 2.2 (141 - 195)	≥ 2.3 (203)
	6-11 yrs	< 0.7 (62)	0.7 - 1.0 (62 - 88)	1.1 - 1.7 (97 - 150)	1.8 - 2.5 (159 - 221)	≥ 2.6 (230)
	12-18 yrs	< 1.0 (88)	1.0 - 1.6 (88 - 141)	1.7 - 2.8 (150 - 247)	2.9 - 4.1 (256 - 362)	≥ 4.2 (371)

Definitions: FIO<sub>2</sub>: fractional inspired oxygen; PaO<sub>2</sub>: arterial oxygen partial pressure; MAP: mean arterial pressure

## Pathogens Most Frequently Identified in Blood Cultures in Children with Sepsis

- Sepsis can originate from any type of infection in any organ system; it is most commonly caused by bacteria
- Hospital-acquired infections have a higher risk of being caused by multidrug-resistant organisms
- Sepsis related with malaria and viral haemorrhagic fevers should always be considered in endemic settings
- Consider sepsis related with respiratory viruses

	Low and Middle Income Setting	High Income Setting
Community Acquired	<ul style="list-style-type: none"> <li>• Gram-negative bacilli (mostly <i>E. coli</i>, <i>Klebsiella</i> spp.)</li> <li>• <i>Streptococcus pneumoniae</i></li> <li>• Group A <i>Streptococcus</i></li> <li>• <i>Neisseria meningitidis</i></li> <li>• <i>Haemophilus influenzae</i> type b</li> <li>• <i>Salmonella</i> spp.</li> <li>• <i>Staphylococcus aureus</i></li> <li>• <i>Burkholderia pseudomallei</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Streptococcus pneumoniae</i></li> <li>• <i>Staphylococcus aureus</i></li> <li>• Gram-negative bacilli</li> <li>• Group A <i>Streptococcus</i></li> <li>• <i>Neisseria meningitidis</i></li> </ul>
Hospital Acquired	<ul style="list-style-type: none"> <li>• <i>Klebsiella</i> spp.</li> <li>• <i>Staphylococcus aureus</i></li> <li>• <i>Escherichia coli</i></li> <li>• <i>Enterococcus</i> spp.</li> <li>• Other Gram-negative bacteria</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Klebsiella</i> spp.</li> <li>• <i>Staphylococcus aureus</i></li> <li>• <i>Escherichia coli</i></li> <li>• <i>Enterococcus</i> spp.</li> <li>• Other Gram-negative bacteria</li> </ul>



# Sepsis in Children

## Rx Treatment

### Clinical Considerations

- Start IV antibiotics as soon as possible if sepsis is suspected; results of tests should not delay antibiotics
- Choose treatment based on most likely infection site and infecting pathogens, local prevalence of antibiotic resistance, comorbidities, and risk of infection with multidrug-resistant organisms; if susceptibilities & pathogen are known, review and adapt antibiotics

### Antibiotic Treatment Duration

- **7 days**
- **14 days** in case of meningitis

Duration may vary according to underlying condition responsible for sepsis

### Rx Referral to Hospital Not Possible

All dosages are for normal renal function

**ACCESS** Amoxicillin 50 mg/kg/dose q12h **ORAL**

COMBINED WITH

**ACCESS** Gentamicin 7.5 mg/kg/dose q24h **IM**

### Rx Referral to Hospital Possible

All dosages are for normal renal function

#### First Choice

**ACCESS** Ampicillin 50 mg/kg/dose q8h **IV**

OR

**ACCESS** Benzylpenicillin 30 mg/kg/dose (50 000 IU/kg) q8h **IV**

COMBINED WITH

**ACCESS** Gentamicin 7.5 mg/kg/dose q24h **IV**

#### Second Choice

**WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV**

OR

**WATCH** Cefotaxime 50 mg/kg/dose q8h **IV**

OR

**ACCESS** Cloxacillin or flucloxacillin 25 mg/kg/dose q6h **IV**

*Cloxacillin is a useful second-choice option when an infection caused by *S. aureus* is suspected (in community settings with high MRSA prevalence, consider vancomycin instead)*

COMBINED WITH

**ACCESS** Amikacin 15 mg/kg/dose q24h **IV**

*Amikacin would mostly be used as a treatment for infections caused by Gram-negative bacteria and when antibiotic-resistant bacteria are suspected*

*In settings with high prevalence of resistance, particularly for suspected health care-associated infections, a broad-spectrum antibiotic with activity against Gram-negative bacteria should also be considered (e.g. piperacillin+tazobactam)*

# Sepsis in Neonates

This guideline is intended for infants under the age of 1 month

## Definition

• A serious systemic condition of infectious origin (usually bacterial) associated with a combination of clinical and laboratory signs that occurs in the first month of life

### Commonly Used Classifications:

- By timing of clinical onset:
  - *Early onset sepsis*: Occurring  $\leq 3$  days after birth, often acquired vertically or in peripartum period
  - *Late onset sepsis*: Occurring  $> 3$  days after birth, often hospital acquired
- By setting of acquisition:
  - *Community-acquired*
  - *Hospital-acquired*

### Alternative Definition:

- A young infant is classified as having “Possible Serious Bacterial Infection” (PSBI) when at least one of the following signs is present:
  - Not able to feed since birth or stopped feeding well (confirmed by observation)
  - Convulsions
  - Fast breathing ( $\geq 60$  breaths per minute)
  - Severe chest indrawing
  - Fever ( $\geq 38.0^\circ\text{C}$ )
  - Low body temperature ( $< 35.5^\circ\text{C}$ )

**Important:** bacteraemia is not part of the definition of sepsis; while many patients with sepsis have bacteraemia, most patients with bacteraemia do not fulfill sepsis criteria

## Prevention

- Preventing infections includes:
  - Vaccinations
  - Adequate nutrition
  - Healthy living environments (e.g. access to safe water and sanitation)
- Preventing evolution of infection to sepsis relies on:
  - Timely diagnosis
  - Adequate treatment of the underlying infection

## Diagnosis

### Clinical Presentation

- Usually signs and symptoms are non-specific
- Hypothermia ( $< 35.5^\circ\text{C}$ ) or fever ( $> 38.0^\circ\text{C}$ ), severe chest indrawing, tachycardia, poor feeding, reduced spontaneous movements, hypotension, vomiting
- More rarely irritability, diarrhea, abdominal distention, convulsions

### Microbiology Tests

- Diagnostic tests will be different depending on the suspected source of infection
- Ideally perform tests before initiating antibiotics; tests should not cause a major delay to the start of antibiotic treatment
- Tests for suspected sepsis in young infants would normally include blood, urine and culture of the cerebrospinal fluid (CSF)

### Other Laboratory Tests

#### To Identify a Bacterial Infection:

- White blood count
- C-reactive protein and/or procalcitonin

#### To Identify Organ Dysfunction:

- Complete blood count with platelets
- Bilirubin
- Blood pH and gases
- Blood urea nitrogen
- Creatinine
- Electrolytes
- Glucose
- Whole blood lactate

### Imaging

Guided by the suspected primary site of infection

# Sepsis in Neonates



## Pathogens Most Frequently Identified in Blood Cultures in Neonates with Sepsis

- Sepsis can originate from any type of infection in any organ system; it is most commonly caused by bacteria

- Hospital-acquired infections have a higher risk of being caused by multidrug-resistant organisms

- Sepsis related with malaria and viral haemorrhagic fevers should always be considered in endemic settings

- Consider sepsis related with respiratory viruses

	Low and Middle Income Setting	High Income Setting
Community Acquired	<ul style="list-style-type: none"> <li>• <i>Escherichia coli</i>*</li> <li>• <i>Staphylococcus aureus</i> (including MRSA)</li> <li>• <i>Klebsiella</i> spp.*</li> <li>• <i>Acinetobacter</i> spp.*</li> <li>• Group B <i>Streptococcus</i></li> <li>• Group A <i>Streptococcus</i></li> <li>• <i>Streptococcus pneumoniae</i></li> <li>• Non-typhoidal <i>Salmonella</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Escherichia coli</i>*</li> <li>• <i>Staphylococcus aureus</i> (including MRSA)</li> <li>• Group B <i>Streptococcus</i></li> </ul>
Hospital Acquired	<ul style="list-style-type: none"> <li>• <i>Klebsiella</i> spp.*</li> <li>• <i>Escherichia coli</i>*</li> <li>• <i>Acinetobacter</i> spp.*</li> <li>• <i>Staphylococcus aureus</i> (including MRSA)</li> <li>• Other Gram-negative bacteria*</li> <li>• <i>Enterococcus</i> spp.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Escherichia coli</i>*</li> <li>• <i>Klebsiella</i> spp.*</li> <li>• <i>Staphylococcus aureus</i> (including MRSA)</li> <li>• Other Gram-negative bacteria*</li> <li>• <i>Enterococcus</i> spp.</li> </ul>

\*Including multidrug-resistant strains such as those producing ESBL and carbapenemases

# Sepsis in Neonates

## Rx Treatment

### Clinical Considerations

- Start IV antibiotics as soon as possible if sepsis is suspected; results of tests should not delay antibiotics
- Choose treatment based on most likely infection site and infecting pathogens, local prevalence of antibiotic resistance, comorbidities, and risk of infection with multidrug-resistant organisms; if susceptibilities & pathogen are known, review and adapt antibiotics

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration

- **7 days**
  - **14 days** in case of meningitis
- Duration may vary according to underlying condition responsible for sepsis

### Prophylactic Antibiotics


- Consider giving ampicillin AND gentamicin for 2 days if significant risk factors for infection as follows:
  - Membranes ruptured > 18 hours before delivery
  - Mother had fever > 38°C before delivery or during labour
  - Amniotic fluid was foul smelling or purulent

### Rx Referral to Hospital Not Possible

All dosages are for normal renal function

 Amoxicillin 50 mg/kg/dose q12h **ORAL**


COMBINED WITH

 Gentamicin 5 mg/kg/dose q24h **IM**


### Rx Referral to Hospital Possible

All dosages are for normal renal function


#### First Choice

 Ampicillin 50 mg/kg/dose **IV**  
 • ≤1wk of life: q12h  
 • >1wk of life: q8h


OR

 Benzylpenicillin 30 mg/kg (50 000 IU/kg) q8h **IV**

COMBINED WITH

 Gentamicin 5 mg/kg/dose q24h **IV**


#### Second Choice

 Ceftriaxone 80 mg/kg/dose q24h **IV**

OR


 Cefotaxime 50 mg/kg/dose q8h **IV**

OR

 Cloxacillin or flucloxacillin 25-50 mg/kg/dose q12h **IV**

*Cloxacillin is a useful second-choice option when an infection caused by S. aureus is suspected (in community settings with high MRSA prevalence, consider vancomycin instead)*

COMBINED WITH

 Amikacin 15 mg/kg/dose q24h **IV**

*Amikacin would mostly be used as a treatment for infections caused by Gram-negative bacteria and when antibiotic-resistant bacteria are suspected*

*In settings with high prevalence of resistance, particularly for suspected health care-associated infections, a broad-spectrum antibiotic with activity against Gram-negative bacteria should also be considered (e.g. piperacillin+tazobactam)*

# Bacterial Meningitis

Page 1 of 2

## Definition

- Acute inflammation of the meninges, the membranes lining the brain and spinal cord
- The cause can be infectious or non-infectious in origin (e.g. associated with autoimmunity)

## Most Likely Pathogens

### Non-Immunosuppressed patients:

- *Streptococcus pneumoniae*
- *Neisseria meningitidis*

### Immunosuppressed patients or >50 years:

- *Streptococcus pneumoniae*
- *Neisseria meningitidis*
- *Listeria monocytogenes* (consider also in pregnant women)

### Consider in specific situations:

- Viral infections (especially Enteroviruses, Herpesviridae and Arboviruses)
- *Mycobacterium tuberculosis* (mostly in endemic settings and/or in HIV positive patients)
- Cryptococcal meningitis and cerebral toxoplasmosis in severely immunosuppressed patients (HIV)
- Cerebral malaria (in patients living or travelling to endemic settings)
- *Staphylococcus aureus* or Gram-negative bacteria, including multidrug-resistant strains after neurosurgical interventions or (for Gram-negative bacteria) in the context of Strongyloides hyperinfection syndrome

## Prevention

- Vaccination against meningococcal, pneumococcal and *Haemophilus influenzae* type b disease
- Post-exposure antibiotic prophylaxis with ciprofloxacin or ceftriaxone for close contacts (only for meningococcal meningitis)
- [https://www.who.int/health-topics/meningitis#tab=tab\\_3](https://www.who.int/health-topics/meningitis#tab=tab_3)

## Diagnosis

### Clinical Presentation

- Acute onset (<48 h) of:
  - Fever (>38.0°C) and/or
  - Headache and/or confusion and/or
  - Neck stiffness
- All three signs and symptoms are present in only around half of patients but 95% of patients usually have at least two and the absence of all three symptoms significantly reduces the probability of meningitis
- Haemorrhagic rash may be present (especially in case of meningococcal infection)

### Microbiology Tests

#### Ideally before starting antibiotic treatment:

- Microscopy and culture of cerebrospinal fluid (CSF)
- Cryptococcal antigen in CSF and blood (patients with HIV)
- Blood cultures
- *Note: if lumbar puncture not possible immediately start antibiotics after blood cultures. Testing should not delay giving antibiotics*

### Other Laboratory Tests

- Cerebrospinal fluid (CSF) examination (leukocyte count and differential leukocyte count, protein and glucose)
- Complete blood count
- Blood glucose
- CRP and/or procalcitonin
- Blood lactate
- **CSF findings suggestive of bacterial etiology:**
  - High opening pressure (normal range 80-200 mm H<sub>2</sub>O or 8-20 cm H<sub>2</sub>O)
  - Turbid aspect
  - Elevated white blood cell count (often several hundred to several thousand WBC/mm<sup>3</sup> or >0.1 to >1 X 10<sup>9</sup>/L)
  - Elevated % of neutrophils (>80%)
  - Elevated protein (>45 mg/dL or >0.45 g/L)
  - Low glucose (<40 mg/dL or <2.2 mmol/L)
  - CSF/Serum glucose ratio ≤0.4

### Imaging

Consider doing a head CT scan before doing the lumbar puncture in patients with focal neurological signs, decreased level of consciousness/coma or a history of central nervous system disease or recent seizures (<1 week)

# Bacterial Meningitis

Page 2 of 2

## Rx Treatment

### Clinical Considerations

#### Important:

- Due to the severity of this condition all suspected cases of meningitis should be treated as soon as possible as bacterial meningitis until this has been excluded/viral cause has been clearly identified
- *Listeria* is not covered by ceftriaxone or cefotaxime therefore when *Listeria* is suspected, ampicillin should be used
- **Empiric treatment is based on:**
  - Age of the patient
  - Immune status of the patient
  - Local prevalence of *S. pneumoniae* isolates resistant to third-generation cephalosporins (rare but can occur especially in patients with prolonged or multiple exposures to  $\beta$ -lactam antibiotics in the previous three months)
- If a pathogen is isolated and its susceptibilities are known, review and modify antibiotics accordingly

### Use of Corticosteroids

Dexamethasone 0.15 mg/kg q6h

- Recommended **only in high-income settings** (no evidence of benefit in other settings)
- Give with the first dose of antibiotic to attenuate the inflammatory response and reduce the risk of neurological complications and death
- Continue only if *S. pneumoniae* is confirmed

### Antibiotic Treatment Duration

- Pathogen not identified: **10 days**
- Confirmed pneumococcal meningitis: **10-14 days**
- Confirmed meningococcal meningitis: **5-7 days**
- Confirmed *Listeria* meningitis: **21 days**

### Rx Antibiotic Treatment

All dosages are for normal renal function

#### First Choice

WATCH Ceftriaxone 2 g q12h IV

OR

WATCH Cefotaxime 2 g q6h IV

#### Second Choice

ACCESS Ampicillin 2 g q4h IV

OR

ACCESS Amoxicillin 2 g q4h IV

OR

ACCESS Benzylpenicillin 4 million IU (2.4 g) q4h IV

OR

ACCESS Chloramphenicol 1 g q6h IV

Use chloramphenicol only when no other option is available because of toxicity

# Bacterial Meningitis

Page 1 of 2

## Definition

- Acute inflammation of the meninges, the membranes lining the brain and spinal cord
- It can be infectious or non-infectious in origin (e.g. associated with autoimmunity)

## Most Likely Pathogens

### Neonates (0-2 months):

- Group B *Streptococcus*
- *Escherichia coli*
- *Listeria monocytogenes*
- *Streptococcus pneumoniae*

### Children/Adolescents:

- *Streptococcus pneumoniae*
- *Neisseria meningitidis*
- *Haemophilus influenzae* type b

### Consider in specific situations:

- Viral infections (especially Enteroviruses, Herpesviridae and Arboviruses) and non-infectious causes
- *Mycobacterium tuberculosis* (mostly in endemic settings and/or in HIV positive patients)
- Cryptococcal meningitis and cerebral toxoplasmosis in severely immunosuppressed patients
- Cerebral malaria (in patients living or travelling to endemic settings)
- *Staphylococcus aureus* or Gram-negative bacteria, including multidrug-resistant strains after neurosurgical interventions

## Prevention

- Vaccination against meningococcal, pneumococcal and *Haemophilus influenzae* type b disease
- Post-exposure antibiotic prophylaxis with ciprofloxacin or ceftriaxone for close contacts (only for meningococcal meningitis)
- [https://www.who.int/health-topics/meningitis#tab=tab\\_3](https://www.who.int/health-topics/meningitis#tab=tab_3)

## Diagnosis

### Clinical Presentation

#### Neonates:

- Symptoms are usually non-specific; often a combination of fever, poor feeding, lethargy, drowsiness, vomiting, irritability, seizures or a full fontanelle
- Neck stiffness is very uncommon

#### Older children:

- Acute onset (<48 h) of:
  - Fever (>38.0°C) and /or
  - Headache and/or confusion and/or
  - Neck stiffness
- Haemorrhagic rash may be present (especially in case of meningococcal infection)

### Microbiology Tests

#### Ideally before starting antibiotic treatment:

- Microscopy and culture of cerebrospinal fluid (CSF)
- Cryptococcal antigen in CSF and blood (patients with HIV)
- Blood cultures
- *Note: testing should not delay giving antibiotics*

### Other Laboratory Tests

- Cerebrospinal fluid (CSF) examination (leukocyte count and differential leukocyte count, protein and glucose)

#### CSF findings suggestive of bacterial etiology:

- High opening pressure (normal range, 80-200 mm H<sub>2</sub>O or 8-20 cm H<sub>2</sub>O)
- Turbid aspect
- Elevated white blood cell count (often several hundred to several thousand WBC/mm<sup>3</sup>)
- Elevated % of neutrophils (>80%)
- Elevated protein (>45 mg/dL or >0.45 g/L)
- Low glucose (<40 mg/dL or <2.2 mmol/L)
- CSF/Serum glucose ratio ≤0.4

### Imaging

Consider doing a head CT scan before doing the lumbar puncture in patients with focal neurological signs, decreased level of consciousness/coma or a history of central nervous system disease or recent seizures (<1 week)

# Bacterial Meningitis

## Rx Treatment

### Clinical Considerations

**Important:** due to the severity of this condition all suspected cases of meningitis should be treated as soon as possible as bacterial meningitis until this has been excluded/viral cause has been clearly identified

- **Empiric treatment is based on:**
  - Age of the patient
  - Immune status of the patient
  - Local prevalence of *S. pneumoniae* isolates resistant to third-generation cephalosporins (rare but can occur especially in patients with prolonged or multiple exposures to  $\beta$ -lactam antibiotics in the previous three months)
- If a pathogen is isolated and its susceptibilities are known, review and modify antibiotics accordingly

### Use of Corticosteroids

Dexamethasone 0.15 mg/kg q6h

- Recommended **only in high-income settings** (no evidence of benefit in other settings)
- Give with the first dose of antibiotic to attenuate the inflammatory response and reduce the risk of neurological complications and death
- Continue only if *S. pneumoniae* is confirmed
- Steroids are not recommended in neonatal meningitis

### Antibiotic Treatment Duration

Pathogen not identified: **10 days** in older children & **3 weeks** in neonates  
 Confirmed pneumococcal meningitis: **10-14 days**  
 Confirmed meningococcal meningitis: **5-7 days**  
 Confirmed *Listeria* meningitis: **21 days**

## Rx Neonates (< 2 Months)

All dosages are for normal renal function

### First Choice

**Ampicillin IV**  
ACCESS  
 • 1st week of life: 50 mg/kg/dose q12h  
 • >1st week of life: 50 mg/kg/dose q8h

COMBINED WITH

**Gentamicin IV**  
ACCESS  
 • 1st week of life: 5 mg/kg q24h  
 • >1st week of life: 7.5 mg/kg q24h

OR

**Ceftriaxone 100 mg/kg q24h IV**  
WATCH

OR

**Cefotaxime IV**  
WATCH  
 • 1st week of life: 50 mg/kg/dose q12h  
 • >1st week of life: 50 mg/kg/dose q6h

COMBINED WITH

**Gentamicin IV**  
ACCESS  
 • 1st week of life: 5 mg/kg q24h  
 • >1st week of life: 7.5 mg/kg q24h

### Second Choice

**Meropenem 40 mg/kg/dose q8h IV**  
WATCH

## Rx Children

All dosages are for normal renal function

### First Choice

**Ceftriaxone 100 mg/kg q24h IV**  
WATCH

OR

**Cefotaxime 50 mg/kg/dose q8h IV**  
WATCH

### Second Choice

**Ampicillin 50 mg/kg/dose q8h IV**  
ACCESS

OR

**Amoxicillin 40-50 mg/kg/dose q12h IV**  
ACCESS

OR

**Benzylpenicillin 60 mg (100 000 IU)/kg/dose q6h IV**  
ACCESS

OR

**Chloramphenicol 25 mg/kg/dose q6h IV**  
ACCESS

Use chloramphenicol only when no other option is available because of toxicity



# Community-Acquired Pneumonia (Severe)

For community-acquired pneumonia in the hospital setting, please refer to the management of severe cases presented in the infographic on page 31 in the Primary Health Care section

DRAFT

# Hospital-Acquired Pneumonia

Page 1 of 2

## Definition

**Hospital acquired pneumonia (HAP):** Acute illness affecting the lungs caused by pathogens in the hospital setting and presenting 48 hours or more after admission

**Ventilator-associated pneumonia (VAP):** Acute illness affecting the lungs caused by pathogens in the hospital setting and presenting 48 hours or more after admission while the patient is on a ventilator

**Important:** the cut-off of 48 hours is arbitrary and chosen for convenience and surveillance purposes

## Most Likely Pathogens

- HAP may be caused by the same pathogens found in CAP or by multidrug-resistant (MDR) pathogens

- Majority of data on the microbiologic etiology of HAP is derived from ventilated patients in the intensive care setting

### Bacteria most frequently associated with HAP:

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus* (including MRSA)
- Gram-negative bacteria including *Pseudomonas aeruginosa* and *Acinetobacter baumannii* (including multidrug-resistant strains)
- Anaerobes (mostly associated with large aspiration of secretions)
- *Legionella pneumophila*

### Respiratory Viruses:

- Influenza viruses (A and B)
- Other respiratory viruses (including SARS-CoV-2)

### Risk factors for infection with MDR pathogens:

- Previous treatment with antibiotics
- Prolonged hospital stay (particularly in the ICU)
- Prior colonization with MDR pathogens
- High local prevalence of resistant pathogens (e.g. among *S. aureus* and Gram-negative bacteria, including *P. aeruginosa*)

## Diagnosis

### Clinical Presentation

**Non-ventilated patients:** New or worsening cough +/- sputum production, difficult and rapid breathing, reduced oxygen saturation, crepitations on lung auscultation, or chest pain/discomfort with no alternative explanation; fever  $\geq 38.0^{\circ}\text{C}$  usually present (may be absent, especially in the elderly)

**Ventilated patients:** Increased respiratory secretions, reduced oxygen saturation and a new lung infiltrate on a chest-radiograph

*Note: the clinical presentation is non-specific and other diseases (e.g. pulmonary embolism) can mimic HAP. HAP/VAP may progress to sepsis*

### Microbiology Tests

#### All cases:

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of respiratory samples (ideally before starting antibiotics)
- Urinary antigens for *L. pneumophila* and *S. pneumoniae*

**Selected cases (depending on epidemiology and risk factors):** nasopharyngeal swab for influenza viruses and SARS-CoV-2

**Important:** a positive respiratory culture may indicate colonization rather than acute infection

### Other Laboratory Tests

**Determine disease severity:** blood pH and gases, white blood cell count

**Differentiate bacterial and viral (taking into account pre-test probability):** C-reactive protein and/or procalcitonin

*Note: tests depend on availability and clinical severity (e.g. blood gases will only be done in severe cases)*

- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Imaging

- Chest radiograph needed because other conditions have similar clinical features and antibiotics may be avoided if bacterial pneumonia is not suggested

#### Important:

- Chest radiographs can be difficult to interpret and correlate with the clinical presentation; many other conditions mimic infectious infiltrates (especially in the elderly)
- The radiographic pattern cannot be used to accurately predict the microbial cause

# Hospital-Acquired Pneumonia

Page 2 of 2



## Prevention

### Key principles:

- Vaccination against pathogens that can commonly cause pneumonia
- Good hand hygiene
- Maintain mobility
- Maintain good oral and dental care
- Maintain nutrition in hospital
- Elevate the head of the bed to reduce the chances of aspirating respiratory secretions into the lungs
- Avoid intubation or reduce duration as much as possible

### Bundles of care specific to the ICU also usually include:

- Minimizing sedation
- Regularly assessing if the endotracheal tube may be removed; extubate patients as soon as it is safe to do so
- Selective oral decontamination (SOD) and/or selective decontamination of the digestive tract (SDD) to reduce the bacterial burden of the upper (with SOD) and lower (with SDD) digestive tract through the administration of non-absorbable antibiotics
- SOD/SDD can help reduce the incidence of VAP, yet there is concern about the risk of selecting resistant bacteria

## Rx Treatment



### Clinical Considerations

#### Important:

- Consider stopping treatment if HAP is ruled out or an alternative diagnosis can be made
- If not severely ill, consider targeted treatment based on microbiology results

#### Empiric antibiotic treatment should be guided by:

- The severity of symptoms (scoring systems exist but are not addressed here), considering local prevalence of resistant pathogens and individual risk factors for resistant pathogens

#### In patients with VAP specifically consider:

- Need for double anti-pseudomonal coverage (risk of infection caused by isolates resistant to an antibiotic used for monotherapy)

#### Important:

- Simplify empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- Step down to oral treatment is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics



### Antibiotic Treatment Duration

**7 days;** reassess diagnosis and consider longer treatment if the patient is not clinically stable at day 7

## Rx HAP (non-VAP)

All dosages are for normal renal function



Amoxicillin+clavulanic acid 1 g+200 mg q8h **IV**

Consider if low-risk of multidrug-resistant infections (e.g. short hospitalization before symptom onset and no prior antibiotic exposure)

OR



Ceftriaxone 2 g q24h **IV** (1 g q24h **IM\***)

\*A larger volume would be painful to give as intramuscular injection

OR



Cefotaxime 2 g q8h **IV/IM**

OR



Piperacillin+tazobactam 4 g+500 mg q6h **IV**

Piperacillin+tazobactam offers anti-pseudomonal coverage (risk of *P. aeruginosa* higher in patients with recent antibiotic exposure, known previous respiratory colonization and underlying lung diseases)

# Hospital-Acquired Pneumonia

Page 1 of 2

## Definition

**Hospital acquired pneumonia (HAP):** Acute illness affecting the lungs caused by pathogens in the hospital setting and presenting 48 hours or more after admission

**Ventilator-associated pneumonia (VAP):** Acute illness affecting the lungs caused by pathogens in the hospital setting and presenting 48 hours or more after admission while the patient is on a ventilator

**Important:** the cut-off of 48 hours is arbitrary and chosen for convenience and surveillance purposes

## Most Likely Pathogens

- HAP may be caused by the same pathogens found in CAP or by multidrug-resistant (MDR) pathogens
- Majority of data on the microbiologic etiology of HAP is derived from ventilated patients in the intensive care setting

### Bacteria most frequently associated with HAP:

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Staphylococcus aureus* (including MRSA)
- Gram-negative bacteria including *Pseudomonas aeruginosa* and *Acinetobacter baumannii* (including multidrug-resistant strains)
- Anaerobes (mostly associated with large aspiration of secretions)
- *Legionella pneumophila*

### Respiratory viruses:

- Influenza viruses (A and B)
- Other respiratory viruses (including SARS-CoV-2)

### Risk factors for infection with MDR pathogens:

- Previous treatment with antibiotics
- Prolonged hospital stay (particularly in the ICU)
- Prior colonization with MDR pathogens
- High local prevalence of resistant pathogens (e.g. among *S. aureus* and Gram-negative bacteria, including *P. aeruginosa*)

## Diagnosis

### Clinical Presentation

**Non-ventilated patients:** New or worsening cough +/- sputum production, difficult and rapid breathing, reduced oxygen saturation, crepitations on lung auscultation, or chest pain/discomfort with no alternative explanation; fever  $\geq 38.0^{\circ}\text{C}$  usually present (may be absent)

**Ventilated patients:** Increased respiratory secretions, reduced oxygen saturation and a new lung infiltrate on a chest-radiograph

*Note: the clinical presentation is non-specific and other diseases (e.g. pulmonary embolism) can mimic HAP. HAP/VAP may progress to sepsis*

### Microbiology Tests

#### All cases:

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of respiratory samples (ideally before starting antibiotics)

**Selected cases (depending on epidemiology and risk factors):** nasopharyngeal swab for influenza viruses and SARS-CoV-2

**Important:** a positive culture may indicate colonization rather than acute infection

### Other Laboratory Tests

**Determine disease severity:** blood pH and gases, white blood cell count

**Differentiate bacterial and viral (taking into account pre-test probability):** C-reactive protein

*Note: tests depend on availability and clinical severity (e.g. blood gases will only be done in severe cases)*

- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Imaging

- Chest radiograph needed because other conditions have similar clinical features and antibiotics may be avoided if bacterial pneumonia is not suggested

#### Important:

- Chest radiographs can be difficult to interpret and correlate with the clinical presentation; many other conditions mimic infectious infiltrates
- The radiographic pattern cannot be used to accurately predict the microbial cause

# Hospital-Acquired Pneumonia

Page 2 of 2



## Prevention

### Key principles:

- Vaccination against pathogens that can commonly cause pneumonia
- Good hand hygiene
- Maintain mobility
- Maintain good oral and dental care
- Maintain nutrition in hospital
- Elevate the head of the bed to reduce the chances of aspirating respiratory secretions into the lungs
- Avoid intubation or reduce duration as much as possible

### Bundles of care specific to the ICU also usually include:

- Minimizing sedation
- Regularly assessing if the endotracheal tube may be removed; extubate patients as soon as it is safe to do so

## Rx Treatment

### Clinical Considerations

#### Important:

- Consider stopping treatment if HAP is ruled out or an alternative diagnosis can be made
- If not severely ill, consider targeted treatment based on microbiology results

#### Empiric antibiotic treatment should be guided by:

- The severity of symptoms (scoring systems exist but are not addressed here), considering local prevalence of resistant pathogens and individual risk factors for resistant pathogens

#### In patients with VAP specifically consider:

- Need for double anti-pseudomonal coverage (risk of infection caused by isolates resistant to an antibiotic used for monotherapy)

#### Important:

- Simplify empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- Step down to oral treatment is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics



### Antibiotic Treatment Duration

HAP: **7 days**; reassess diagnosis and consider longer treatment if the patient is not clinically stable at day 7

### Rx HAP (non-VAP)

All dosages are for normal renal function



Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **IV/ORAL**

#### • Oral weight bands:

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Consider if low-risk of multidrug-resistant infections (e.g. short hospitalization before symptom onset and no prior antibiotic exposure)

Oral liquid must be refrigerated after reconstitution

OR



Ceftriaxone 80 mg/kg/dose q24h **IV/IM**

OR



Cefotaxime 50 mg/kg/dose q8h **IV/IM**

OR



Piperacillin+tazobactam 100 mg/kg/dose of piperacillin component q8h **IV**

Piperacillin+tazobactam offers anti-pseudomonal coverage (risk of *P. aeruginosa* is higher in patients with recent antibiotic exposure, known previous respiratory colonization and underlying lung diseases)

# Acute Cholecystitis & Cholangitis

Intra-abdominal Infection

Page 1 of 2

## Definition

**Acute Cholecystitis:** Acute inflammation of the gallbladder

- A gallstone obstructing the cystic duct for prolonged periods of time is the most frequent cause

**Acute Cholangitis:** Acute inflammation in the bile duct system

- A gallstone obstructing the common bile duct and malignant obstruction by tumours are the most common causes

### Classification based on complexity:

- *Uncomplicated:* No involvement of the peritoneal cavity and no abscess
- *Complicated:* Involvement of the peritoneal cavity and/or abscess

### Severity:

- *Mild:* Not critically ill with no signs of sepsis or septic shock
- *Severe:* Critically ill with signs of sepsis or septic shock

## Most Likely Pathogens

Infections are often polymicrobial

### Bacteria:

- Enterobacterales (mostly *E. coli*) and other Gram-negative bacilli (including multidrug-resistant strains)
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

### Fungi (consider if recent course of antibiotics):

- Mostly *Candida albicans*

### Parasites (consider in endemic settings):

- *Ascaris lumbricoides*
- *Fasciola hepatica*

## Diagnosis

### Clinical Presentation

#### Acute Cholecystitis:

- Acute abdominal pain especially in the right upper quadrant with nausea and vomiting; fever ( $>38.0^{\circ}\text{C}$ ) may be absent

#### Acute Cholangitis:

- Abdominal pain with fever ( $>38.0^{\circ}\text{C}$ ) and jaundice +/- nausea and vomiting

### Important:

- Consider peritonitis if there is severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal muscular tensing
- Hypotension and signs of organ hypoperfusion (e.g. reduced urine output) are potential signs of sepsis /septic shock that need urgent treatment

### Imaging

- Abdominal ultrasound to confirm the diagnosis
- Consider doing a CT scan of the abdomen if complications suspected or diagnosis uncertain

### Other Laboratory Tests

**Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin

**Assess liver function:** AST, bilirubin and alkaline phosphatase

- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Microbiology Tests

#### Mild Uncomplicated Cases:

- Not usually needed

#### Severe Cases:

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abdominal fluid material and bile (if they can be drained) to adjust empiric antibiotic treatment

# Acute Cholecystitis & Cholangitis

## Rx Treatment

### Antibiotic Treatment Duration

#### Acute Cholecystitis:

- **Uncomplicated Cases:** Antibiotics can be stopped once gallbladder is removed
- **Complicated Cases:** **5 days** is adequate in most cases with good clinical recovery and source control

#### Acute Cholecystitis:

- **All Cases:** Give antibiotics until biliary drainage procedures are performed and continue for a total of **5 days** after successful source control

### Clinical Considerations

- **Cholecystectomy (for acute cholecystitis) and biliary drainage (for acute cholangitis) remain the main approaches to eliminate the source of infection**

**In both conditions empiric antibiotic treatment should be guided by:** The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens

#### Important for both conditions:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested or an alternative extra-abdominal source of infection should be considered

## Rx Mild Cases

### First Choice

ACCESS Amoxicillin+clavulanic acid 875 mg + 125 mg q8h **ORAL**

OR

WATCH Ceftriaxone 2 g q24h **IV**

OR

WATCH Cefotaxime 2 g q8h **IV**

COMBINED WITH

ACCESS Metronidazole 500 mg q8h **IV/ORAL**

### Second Choice

WATCH Ciprofloxacin 500 mg q12h **ORAL**

*Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function*

COMBINED WITH

ACCESS Metronidazole 500 mg q8h **IV/ORAL**

## Rx Severe Cases

### First Choice

WATCH Piperacillin+tazobactam 4 g + 500 mg q6h **IV**

OR

WATCH Ceftriaxone 2 g q24h **IV**

OR

WATCH Cefotaxime 2 g q8h **IV**

COMBINED WITH

ACCESS Metronidazole 500 mg q8h **IV/ORAL**

### Second Choice

WATCH Meropenem 2 g q8h **IV**

*Consider meropenem only in complicated cases if there is a high risk of infection with ESBL-producing Enterobacterales*

# Acute Cholecystitis & Cholangitis

Intra-abdominal Infection

Page 1 of 3

## Definition

**Acute Cholecystitis:** Acute inflammation of the gallbladder

- A gallstone obstructing the cystic duct for prolonged periods of time is the most frequent cause

**Acute Cholangitis:** Acute inflammation in the bile duct system

- Choledocholithiasis and malignant obstruction by tumours are the most common causes

### Classification based on complexity:

- *Uncomplicated:* No involvement of the peritoneal cavity and no abscess
- *Complicated:* Involvement of the peritoneal cavity and/or abscess

### Severity:

- *Mild:* Not critically ill with no signs of sepsis or septic shock
- *Severe:* Critically ill with signs of sepsis or septic shock

## Most Likely Pathogens

Infections are often polymicrobial

### Bacteria:

- Enterobacterales (mostly *E. coli*) and other Gram-negative bacilli (including multidrug-resistant strains)
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

**Fungi** (consider if recent course of antibiotics):

- Mostly *Candida albicans*

**Parasites** (consider in endemic settings):

- *Ascaris lumbricoides*
- *Fasciola hepatica*

## Diagnosis

### Clinical Presentation

#### Acute Cholecystitis:

- Acute abdominal pain especially in the right upper quadrant +/- fever, nausea and vomiting

#### Acute Cholangitis:

- Abdominal pain with fever and jaundice +/- nausea and vomiting

#### Important:

- Both conditions are **rare in children**
- Consider peritonitis if there is severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal muscular tensing
- Hypotension and signs of organ hypoperfusion (e.g. reduced urine output) are potential signs of sepsis /septic shock that need urgent treatment

### Imaging

- Abdominal ultrasound to confirm the diagnosis
- Consider doing a CT scan of the abdomen if complications suspected or diagnosis uncertain

### Other Laboratory Tests

**Determine disease severity and help identify a bacterial infection:** White blood cell count,

C-reactive protein and/or procalcitonin

**Assess liver function:** AST, bilirubin and alkaline phosphatase

- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Microbiology Tests

**Mild Uncomplicated Cases:**

- Not usually needed

**Severe Cases:**

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abdominal fluid material and bile (if they can be drained) to adjust empiric antibiotic treatment



# Acute Cholecystitis & Cholangitis

## Rx Treatment (Section 1 of 2)

### Clinical Considerations

• **Cholecystectomy (for acute cholecystitis) and biliary drainage (for acute cholangitis) remain the main approaches to eliminate the source of infection**

**In both conditions empiric antibiotic treatment should be guided by:**

- The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens

#### Important for both conditions:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested or an alternative extra-abdominal source of infection should be considered

### Antibiotic Treatment Duration

#### Acute Cholecystitis:

- **Uncomplicated Cases:** Antibiotics can be stopped once gallbladder is removed
- **Complicated Cases:** **5 days** is adequate in most cases with good clinical recovery and source control

#### Acute Cholangitis:

- **All Cases:** Give antibiotics until biliary drainage procedures are performed and continue for a total of **5 days** after successful source control

### Rx Mild Cases

See the following page for treatment recommendations

### Rx Severe Cases

All dosages are for normal renal function

#### First Choice

**WATCH** Piperacillin+tazobactam 100 mg/kg/dose of piperacillin component q8h **IV**

OR

**ACCESS** Ampicillin **IV**  
 • First week of life: 50 mg/kg/dose q12h  
 • Beyond first week of life: 50 mg/kg/dose q8h

COMBINED WITH

**ACCESS** Gentamicin **IV**  
 • Neonates: 5 mg/kg q24h  
 • Children: 7.5 mg/kg q24h

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**  
 • Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)  
 • Children: 7.5 mg/kg/dose q8h  
 • **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥ 30 kg	Use adult dose

#### Second Choice

**WATCH** Meropenem 20 mg/kg/dose q8h **IV**

Consider meropenem only in complicated cases if there is a high risk of infection with ESBL-producing Enterobacterales

# Acute Cholecystitis & Cholangitis

## Rx Treatment (Section 2 of 2)

### Rx Mild Cases

All dosages are for normal renal function

#### First Choice

**ACCESS** Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose of amoxicillin component q8h **IV/ORAL**

- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin  
Oral liquid must be refrigerated after reconstitution

OR

**WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV**

OR

**WATCH** Cefotaxime 50 mg/kg/dose q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

OR

**ACCESS** Ampicillin **IV**

- First week of life: 50 mg/kg/dose q12h
- Beyond first week of life: 50 mg/kg/dose q8h

COMBINED WITH

**ACCESS** Gentamicin **IV**

- Neonates: 5 mg/kg q24h
- Children: 7.5 mg/kg q24h

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

#### Second Choice

**WATCH** Ciprofloxacin 10-20 mg/kg/dose q12h **ORAL**

- **Oral weight bands:**

3-<6 kg	50 mg q12h
6-<10 kg	100 mg q12h
10-<15 kg	150 mg q12h
15-<20 kg	200 mg q12h
20-<30 kg	300 mg q12h
≥30 kg	Use adult dose

Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

# Pyogenic Liver Abscess

Intra-abdominal Infection

Page 1 of 2

## ? Definition

A collection of pus within the liver

### Classification based on severity:

- **Mild:** Not critically ill with no signs of sepsis or septic shock
- **Severe:** Critically ill with signs of sepsis or septic shock

## 🔍 Diagnosis

### 🔍 Clinical Presentation

Fever (>38.0°C) and abdominal pain (mostly localized in the right upper abdominal quadrant) +/- vomiting, nausea, anorexia, malaise and jaundice

### 🔬 Microbiology Tests

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (if this can be drained) to adjust empiric antibiotic treatment
- Tests for *Entamoeba histolytica*:
  - Antigen or nucleic acid amplification tests of abscess aspirate material
  - Serology (however in endemic settings, serology can remain positive for months/years after resolution of infection)

### 🧪 Other Laboratory Tests

**Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin

**Assess liver function:** AST, bilirubin and alkaline phosphatase

- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### 📷 Imaging

- Abdominal ultrasound to confirm the diagnosis
- Consider a CT scan of the abdomen especially if complications are suspected or diagnosis is uncertain

## 🦠 Most Likely Pathogens

Infections are often polymicrobial

### Bacteria:

- Enterobacterales (mostly *Escherichia coli*, *K. pneumoniae*, *Enterobacter* spp.) including multidrug-resistant strains
- *Burkholderia pseudomallei* (mostly Southeast Asia and northern Australia)
- *Staphylococcus* spp.
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

### Fungi (consider if recent course of antibiotics):

- Mostly *Candida albicans*

### Parasites (consider in endemic settings):

- *Entamoeba histolytica* (not a cause of “pyogenic” abscess but consider in the differential diagnosis)

## ℞ Treatment (Section 1 of 2)

### 📋 Clinical Considerations

- **Drainage of the abscess remains the main approach to eliminate the source of infection** (especially for large abscesses >5 cm with higher risk of rupture)
- Drainage is also important to identify the causative pathogen and its resistance profile
- **Mild:** Targeted antibiotic treatment preferred (risk of infection due to Enterobacterales producing ESBL or carbapenemases)
- **Severe:** Empiric treatment considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL or carbapenemases) and individual risk factors for resistant pathogens

### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested, or an alternative extra-abdominal source of infection should be considered

# Pyogenic Liver Abscess

## Rx Treatment (Section 2 of 2)

### Antibiotic Treatment Duration

- Usually long (at least 4 weeks) depending on adequate source control with drainage procedures
- Longer treatment in case of *B. pseudomallei* infection (months)
- Follow up imaging can help defining antibiotic treatment duration

### Rx Mild Cases

All dosages are for normal renal function

#### First Choice

**ACCESS** Amoxicillin+clavulanic acid 1 g + 200 mg q8h **IV OR** 875 mg+125 mg q8h **ORAL**

OR

**WATCH** Ceftriaxone 2 g q24h **IV**

OR

**WATCH** Cefotaxime 2 g q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV/ORAL**

#### Second Choice

**WATCH** Ciprofloxacin 500 mg q12h **ORAL**

*Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function*

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV/ORAL**

### Rx Severe Cases

All dosages are for normal renal function

#### First Choice

**WATCH** Piperacillin+tazobactam 4 g+ 500 mg q6h **IV**

OR

**WATCH** Ceftriaxone 2 g q24h **IV**

OR

**WATCH** Cefotaxime 2 g q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV/ORAL**

#### Second Choice

**WATCH** Meropenem 2 g q8h **IV**

*Consider meropenem only if there is a high risk of infection with ESBL-producing Enterobacterales*

### Rx Amoebic Abscess

All dosages are for normal renal function

**ACCESS** Metronidazole 750 mg q8h **ORAL**

FOLLOWED BY

**WATCH** Paromomycin 25-35 mg/kg divided in 3 doses **ORAL**

# Pyogenic Liver Abscess

Intra-abdominal Infection

Page 1 of 3

## ? Definition

A collection of pus within the liver

### Classification based on severity:

- **Mild:** Not critically ill with no signs of sepsis or septic shock
- **Severe:** Critically ill with signs of sepsis or septic shock

## 🔬 Diagnosis

### 🔍 Clinical Presentation

Fever (>38.0°C) and abdominal pain (mostly localized in the right upper abdominal quadrant) +/- vomiting, nausea, anorexia, malaise and jaundice

### 🔬 Microbiology Tests

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (if this can be drained) to adjust empiric antibiotic treatment
- Tests for *Entamoeba histolytica*:
  - Antigen or nucleic acid amplification tests of abscess aspirate material
  - Serology (however in endemic settings, serology can remain positive for months/years after resolution of infection)

### 🧪 Other Laboratory Tests

**Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin

**Assess liver function:** AST, bilirubin and alkaline phosphatase

- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### 📷 Imaging

- Abdominal ultrasound to confirm the diagnosis
- Consider a CT scan of the abdomen especially if complications are suspected or diagnosis is uncertain

## 🌐 Most Likely Pathogens

Infections are often polymicrobial

### Bacteria:

- Enterobacterales (mostly *Escherichia coli*, *K. pneumoniae*, *Enterobacter* spp.) including multidrug-resistant strains
- *Burkholderia pseudomallei* (mostly Southeast Asia and northern Australia)
- *Staphylococcus* spp.
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

### Fungi (consider if recent course of antibiotics):

- Mostly *Candida albicans*

### Parasites (consider in endemic settings):

- *Entamoeba histolytica* (not a cause of “pyogenic” abscess but consider in the differential diagnosis)

## ℞ Treatment (Section 1 of 2)

### 📋 Clinical Considerations

- **Drainage of the abscess remains the main approach to eliminate the source of infection** (especially for large abscesses >5 cm with higher risk of rupture)
- Drainage is also important to identify the causative pathogen and its resistance profile
- **Mild:** Targeted antibiotic treatment preferred (risk of infection due to Enterobacterales producing ESBL or carbapenemases)
- **Severe:** Empiric treatment considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL or carbapenemases) and individual risk factors for resistant pathogens

### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested, or an alternative extra-abdominal source of infection should be considered

# Pyogenic Liver Abscess

## Rx Treatment (Section 2 of 3)

### Antibiotic Treatment Duration

- Usually long (at least 4 weeks) depending on adequate source control with drainage procedures
- Longer treatment in case of *B. pseudomallei* infection (months)
- Follow up imaging can help defining antibiotic treatment duration

### Rx Amoebic Abscess

All dosages are for normal renal function

**ACCESS** Metronidazole 10-15 mg/kg/dose q8h **ORAL**

### Rx Mild Cases

See the following page for treatment recommendations

### Rx Severe Cases

All dosages are for normal renal function

#### First Choice

**WATCH** Piperacillin+tazobactam 100 mg/kg/dose of piperacillin component q8h **IV**

OR

**ACCESS** Ampicillin **IV**  
 • First week of life: 50 mg/kg/dose q12h  
 • Beyond first week of life: 50 mg/kg/dose q8h

COMBINED WITH

**ACCESS** Gentamicin **IV**  
 • Neonates: 5 mg/kg q24h  
 • Children: 7.5 mg/kg q24h

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**  
 • Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)  
 • Children: 7.5 mg/kg/dose q8h  
 • **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

#### Second Choice

**WATCH** Meropenem 20 mg/kg/dose q8h **IV**

Consider meropenem only if there is a high risk of infection with ESBL-producing Enterobacterales

# Pyogenic Liver Abscess

## Rx Treatment (Section 3 of 3)

### Rx Mild Cases

All dosages are for normal renal function

#### First Choice

**ACCESS** Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose of amoxicillin component q8h **IV/ORAL**

- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin  
Must refrigerate oral liquid after reconstitution

OR

**WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV**

OR

**WATCH** Cefotaxime 50 mg/kg/dose q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

OR

**ACCESS** Ampicillin **IV**

- First week of life: 50 mg/kg/dose q12h
- Beyond first week of life: 50 mg/kg/dose q8h

COMBINED WITH

**ACCESS** Gentamicin **IV**

- Neonates: 5 mg/kg q24h
- Children: 7.5 mg/kg q24h

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

#### Second Choice

**WATCH** Ciprofloxacin 10-20 mg/kg/dose q12h **ORAL**

- **Oral weight bands:**

3-<6 kg	50 mg q12h
6-<10 kg	100 mg q12h
10-<15 kg	150 mg q12h
15-<20 kg	200 mg q12h
20-<30 kg	300 mg q12h
≥30 kg	Use adult dose

Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

# Acute Appendicitis

Intra-abdominal Infection

Page 1 of 2

## Definition

Acute inflammation of the appendix sometimes followed by ischemia and perforation

### Classification based on complexity:

- *Uncomplicated* (>70% of cases): No involvement of the peritoneal cavity and no abscess
- *Complicated*: Involvement of the peritoneal cavity and/or presence of an abscess

### Severity:

- *Mild*: Not critically ill with no signs of sepsis or septic shock
- *Severe*: Critically ill with signs of sepsis or septic shock

## Most Likely Pathogens

### Bacteria:

- Enterobacterales (mostly *E. coli* including multidrug-resistant strains)
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

### Fungi (consider if recent course of antibiotics):

- Mostly *Candida albicans*

### Parasites (consider in endemic settings):

- *Enterobius vermicularis* (pinworm) can contribute by causing obstruction of the appendix

## Diagnosis

### Clinical Presentation

- Acute abdominal pain (usually located in the right lower quadrant or migrating from the periumbilical area to the right lower quadrant), with nausea and vomiting; fever (>38.0°C) may be absent

### Important:

- Consider peritonitis if there is severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal muscular tensing
- Hypotension and signs of organ hypoperfusion (e.g. reduced urine output) are potential signs of sepsis /septic shock that need urgent treatment

### Imaging

- Abdominal ultrasound to confirm the diagnosis
- Consider doing a CT scan of the abdomen if complications suspected or diagnosis uncertain

### Microbiology Tests

#### Mild Uncomplicated Cases:

- Not usually needed

#### Severe Cases:

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (taken at the time of surgery) is not routinely recommended, but may be considered in specific cases to adjust empiric antibiotic treatment

### Other Laboratory Tests

#### Identify an alternative cause of abdominal pain:

- Urinalysis (dipstick or microscopy) to exclude an infection of the urinary tract
- Pregnancy test in women: to exclude an ectopic pregnancy

#### Determine disease severity and help identify a bacterial infection: White blood cell count, C-reactive protein and/or procalcitonin

If sepsis is suspected consider additional laboratory tests (see sepsis infographic)



# Acute Appendicitis

## Rx Treatment

### Antibiotic Treatment Duration

#### Antibiotic Treatment Complementary to Surgery

- **Uncomplicated Cases:** Antibiotics can be stopped once appendix is removed
- **Complicated Cases:** Antibiotics can be continued for a total of **5 days** provided that symptoms resolved and the source of infection was eliminated with surgery

#### Treatment with Antibiotics Alone: 7 days

- Consider in selected cases if close clinical monitoring is feasible and considering patient preference (avoiding risks associated with surgery versus higher risk of recurrences and later need for surgery - about 30-40% over 5 years)

### Clinical Considerations

- **Appendectomy remains the main approach to eliminate the source of infection**

#### Empiric antibiotic treatment should be guided by:

- The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens


#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested, or an alternative extra-abdominal source of infection should be considered


## Rx Mild Cases

All dosages are for normal renal function


### First Choice

 Amoxicillin+clavulanic acid 875 mg + 125 mg q8h **ORAL**

OR

 Ceftriaxone 2 g q24h **IV**

OR

 Cefotaxime 2 g q8h **IV**

COMBINED WITH

 Metronidazole 500 mg q8h **IV/ORAL**

### Second Choice

 Ciprofloxacin 500 mg q12h **ORAL**

*Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function*

COMBINED WITH

 Metronidazole 500 mg q8h **IV/ORAL**

## Rx Severe Cases

All dosages are for normal renal function


### First Choice

 Piperacillin+tazobactam 4 g + 500 mg q6h **IV**

OR

 Ceftriaxone 2 g q24h **IV**

OR

 Cefotaxime 2 g q8h **IV**

COMBINED WITH

 Metronidazole 500 mg q8h **IV/ORAL**

### Second Choice

 Meropenem 2 g q8h **IV**

*Consider meropenem only in complicated cases if there is a high risk of infection with ESBL-producing Enterobacterales*

# Acute Appendicitis

Intra-abdominal Infection

Page 1 of 3

## Definition

Acute inflammation of the appendix sometimes followed by ischemia and perforation

### Complexity:

- *Uncomplicated* (>70% of cases): No involvement of the peritoneal cavity and no abscess
- *Complicated*: Involvement of the peritoneal cavity and/or abscess

### Severity:

- *Mild*: Not critically ill with no signs of sepsis or septic shock
- *Severe*: Critically ill with signs of sepsis or septic shock

## Most Likely Pathogens

### Bacteria:

- Enterobacterales (mostly *E. coli* including multidrug-resistant strains)
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

### Fungi (consider if recent course of antibiotics):

- Mostly *Candida albicans*

### Parasites (consider in endemic settings):

- *Enterobius vermicularis* (pinworm) can contribute by causing obstruction of the appendix

## Diagnosis

### Clinical Presentation

- Acute abdominal pain (usually located in the right lower quadrant or migrating from the periumbilical area to the right lower quadrant), with nausea and vomiting; fever (>38.0°C) may be absent

#### Important:

- Consider peritonitis if there is severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal muscular tensing
- Hypotension and signs of organ hypoperfusion (e.g. reduced urine output) are potential signs of sepsis /septic shock that need urgent treatment

### Imaging

- Abdominal ultrasound if available is helpful to confirm the diagnosis
- Consider doing a CT scan of the abdomen if complications suspected or diagnosis uncertain

### Microbiology Tests

#### Mild Uncomplicated Cases:

- Not usually needed

#### Severe Cases:

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (taken at the time of surgery) is not routinely recommended, but may be considered in specific cases to adjust empiric antibiotic treatment

### Other Laboratory Tests

#### Identify an alternative cause of abdominal pain:

- Urinalysis (dipstick or microscopy) to exclude an infection of the urinary tract
- Consider pregnancy test where appropriate to exclude an ectopic pregnancy

#### Determine disease severity and help identify a bacterial infection: White blood cell count, C-reactive protein and/or procalcitonin

If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

# Acute Appendicitis

## Rx Treatment (Section 1 of 2)

### Clinical Considerations

- **Appendectomy remains the main approach to eliminate the source of infection**
- Treatment with antibiotics alone is not recommended in children by WHO

#### Empiric antibiotic treatment should be guided by:

- The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested, or an alternative extra-abdominal source of infection should be considered

### Antibiotic Treatment Duration

- **Uncomplicated Cases:** Antibiotics can be stopped once surgery has been performed and child is well
- **Complicated Cases:** Antibiotics can be continued for a total of **5 days** provided that symptoms resolved and the source of infection was eliminated with surgery


### Rx Mild Cases

See the following page for treatment recommendations


### Rx Severe Cases

All dosages are for normal renal function

#### First Choice


 Piperacillin+tazobactam 100 mg/kg/dose of piperacillin component q8h **IV**

OR

 Ampicillin **IV**


- First week of life: 50 mg/kg/dose q12h
- Beyond first week of life: 50 mg/kg/dose q8h

COMBINED WITH

 Gentamicin **IV**

- Neonates: 5 mg/kg q24h
- Children: 7.5 mg/kg q24h


COMBINED WITH

 Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

#### Second Choice

 Meropenem 20 mg/kg/dose q8h **IV**

Consider meropenem only in complicated cases if there is a high risk of infection with ESBL-producing Enterobacterales

# Acute Appendicitis

## Rx Treatment (Section 2 of 2)

### Rx Mild Cases

All dosages are for normal renal function

#### First Choice

**ACCESS** Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose of amoxicillin component q8h **IV/ORAL**

- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution

OR

**WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV**

OR

**WATCH** Cefotaxime 50 mg/kg/dose q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

OR

**ACCESS** Ampicillin **IV**

- First week of life: 50 mg/kg/dose q12h
- Beyond first week of life: 50 mg/kg/dose q8h

COMBINED WITH

**ACCESS** Gentamicin **IV**

- Neonates: 5 mg/kg q24h
- Children: 7.5 mg/kg q24h

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

#### Second Choice

**WATCH** Ciprofloxacin 10-20 mg/kg/dose q12h **IV/ORAL**

- **Oral weight bands:**

3-<6 kg	50 mg q12h
6-<10 kg	100 mg q12h
10-<15 kg	150 mg q12h
15-<20 kg	200 mg q12h
20-<30 kg	300 mg q12h
≥30 kg	Use adult dose

Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function

COMBINED WITH

**ACCESS** Metronidazole **IV/ORAL**

- Neonates: 7.5 mg/kg/dose q12h (for IV loading dose: 15 mg/kg)
- Children: 7.5 mg/kg/dose q8h
- **Oral weight bands:**

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

# Acute Diverticulitis

Intra-abdominal Infection

Page 1 of 2

## Definition

Acute inflammation of diverticula (sac-like protrusions of the wall of the colon) that can cause severe abdominal pain

### Classification based on complexity:

- **Uncomplicated:** No involvement of peritoneal cavity and no abscess
- **Complicated:** Involvement of the peritoneal cavity and/or abscess

### Severity:

- **Mild:** Not critically ill with no signs of sepsis or septic shock
- **Severe:** Critically ill with signs of sepsis or septic shock

## Most Likely Pathogens

### Bacteria

- Enterobacterales (mostly *E. coli* including multidrug-resistant strains)
- *Streptococcus* spp. (e.g. of the *S. anginosus* group)
- *Enterococcus* spp.
- Anaerobes (mostly *Bacteroides* spp.)

### Fungi (consider if recent course of antibiotics):

- Mostly *Candida albicans*

### Parasites (consider in endemic settings):

- *Enterobius vermicularis* (pinworm)

## Diagnosis

### Clinical Presentation

- Acute pain in the left or right lower abdominal quadrants with chills, nausea and vomiting; fever (>38.0°C) may be absent
- Left diverticulitis is more common in Europe and North America, right diverticulitis in Asia

### Important:

- Consider peritonitis if severe pain, diffuse rebound tenderness upon sudden release of pressure on the abdomen and abdominal muscular tensing
- Hypotension and signs of organ hypoperfusion (e.g. reduced urine output) are potential signs of sepsis /septic shock that need urgent treatment

### Microbiology Tests

**Mild Cases:** Not usually needed

### Severe Cases:

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (if this can be drained) to adjust empiric antibiotic treatment

### Other Laboratory Tests

- **Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin
- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Imaging

Abdominal ultrasound or CT of the abdomen (depending on availability) to confirm the diagnosis

## Rx Treatment (Section 1 of 2)

### Clinical Considerations

- **Uncomplicated cases in immunocompetent patients:** antibiotics **not** needed if there are no systemic signs of infection; if these cases do not resolve spontaneously after 2-3 days, consider antibiotics
- **Uncomplicated cases in severely immunosuppressed patients:** treat with antibiotics alone (if close follow up possible)
- **Complicated cases:** treat with antibiotics and surgical source control (e.g. drainage of large abscesses >5 cm or colonic resection)

### Empiric antibiotic treatment should be guided by:

- The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens

### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- **If signs and symptoms persist**, abdominal imaging is suggested, or an alternative extra-abdominal source of infection should be considered

# Acute Diverticulitis

## Rx Treatment (Section 2 of 2)

### Antibiotic Treatment Duration

- **Most mild cases do not need antibiotic treatment**
- **Treatment with antibiotics alone: 4 days** (if good clinical recovery and symptoms resolved)
- **Treatment with antibiotics & surgical source control:** Stop **4 days** after adequate source control (surgery) is achieved otherwise, continue until clinically stable and afebrile

### Rx Severe Cases

All dosages are for normal renal function

#### First Choice

**WATCH** Piperacillin+tazobactam 4 g + 500 mg q6h **IV**

OR

**WATCH** Ceftriaxone 2 g q24h **IV**

OR

**WATCH** Cefotaxime 2 g q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV/ORAL**

#### Second Choice

**WATCH** Meropenem 2 g q8h **IV**

Consider meropenem only in complicated cases if there is a high risk of infection with ESBL-producing Enterobacterales

### Rx Mild Cases

Most mild cases do not need antibiotic treatment

All dosages are for normal renal function

#### First Choice

**ACCESS** Amoxicillin+clavulanic acid 875 mg + 125 mg q8h **ORAL**

OR

**WATCH** Ceftriaxone 2 g q24h **IV**

OR

**WATCH** Cefotaxime 2 g q8h **IV**

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV/ORAL**

#### Second Choice

**WATCH** Ciprofloxacin 500 mg q12h **ORAL**

Ciprofloxacin has excellent oral bioavailability and the IV route should be reserved for patients with impaired gastrointestinal function

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV/ORAL**

# Clostridioides difficile Infection

Intra-abdominal Infection

## Definition

Infection of the colon caused by the bacterium *C. difficile* that occurs mostly in patients with current/recent antibiotic use and with regular exposure to healthcare settings

## Diagnosis

### Clinical Presentation

Usually diarrhea ( $\geq 3$  unformed/liquid stools in 24 hrs or more than normal for individual) with no other plausible cause +/- abdominal pain, cramping and fever

**Severe cases** (e.g. pseudomembranous colitis):

- Severe abdominal pain, high fever, organ dysfunction
- Toxic megacolon presents with signs of acute surgical abdomen and/or sepsis (diarrhea is often absent)

### Microbiology Tests

- Consider testing symptomatic patients with no other plausible reason for diarrhea especially if recent or current exposure to antibiotics
- Currently no single test to diagnose CDI is completely reliable and the best approach remains controversial

**Two commonly used approaches:**

1. Start with highly sensitive test to detect *C. difficile*, if positive follow with a test to confirm toxin production
  - If toxin test negative: Consider *C. difficile* colonization
2. Perform two tests simultaneously, one to detect the presence of *C. difficile* and one to detect toxin production
  - Concordant results can reliably confirm (both tests positive) or exclude (both tests negative) infection
  - If results conflict and patient is symptomatic, treatment should be based on the pre-test probability of *C. difficile* infection

**Important:** Do not repeat testing during the same episode and do not test to confirm the resolution of the infection at the end of treatment

### Other Laboratory Tests

**Mild Cases:** Not usually needed

**Severe Cases:**

- White blood cell count
- Creatinine and electrolytes

### Imaging

Usually not needed unless a complication is suspected; in these cases, consider abdominal CT

## Pathogen

### *C. difficile*

- Gram-positive spore-forming bacterium widely present in the environment that can be acquired through ingestion of spores
- Infection can be caused by strains producing toxins when the intestinal mucosa of the colon is inflamed and disrupted

### NAP1/027

- *C. difficile* toxigenic strain with a particular virulence that caused outbreaks in recent years especially in North America

## Treatment

### Clinical Considerations

- **Discontinue any other antibiotics except those treating *C. difficile* infection as soon as possible and adopt infection control measures to prevent transmission**
- Always recommend rehydration in patients with diarrhea; anti-diarrheal drugs not routinely necessary
- Diarrhea may resolve slowly over days, but clinical deterioration of a patient on appropriate treatment should precipitate escalation of treatment and a surgical referral

### Antibiotic Treatment Duration

10 days

### Antibiotic Treatment


Refers to a first episode, not recurrences (within 8 weeks of previous episode)

All dosages are for normal renal function

#### First Choice

 Metronidazole 500 mg q8h **ORAL**

#### Second Choice

 Vancomycin 125 mg q6h **ORAL**

**In severe cases:** Oral vancomycin is preferred; vancomycin dose can be increased to 500 mg q6h and can be given in combination with IV metronidazole

# Clostridioides difficile Infection

Intra-abdominal Infection

Page 1 of 2

## Definition

Infection of the colon caused by the bacterium *C. difficile* that occurs mostly in patients with current/recent antibiotic use and with regular exposure to healthcare settings

## Pathogen

### *C. difficile*

- Gram-positive spore-forming bacterium widely present in the environment that can be acquired through ingestion of spores
- Infection can be caused by toxigenic strains when the intestinal mucosa of the colon is inflamed and disrupted

### NAP1/027

- *C. difficile* toxigenic strain with a particular virulence that caused outbreaks in recent years especially in North America

## Diagnosis

### Clinical Presentation

Usually diarrhea ( $\geq 3$  unformed/liquid stools in 24 hrs or more than normal for individual) with no other plausible cause +/- abdominal pain, cramping and fever

#### Severe cases (e.g. pseudomembranous colitis):

- Severe abdominal pain, high fever, organ dysfunction
- Toxic megacolon presents with signs of acute surgical abdomen and/or sepsis (diarrhea is often absent)

**Clinical disease is rare in young children (esp. <2 years); they are often asymptomatic carriers**

### Other Laboratory Tests

#### Mild Cases:

- Not usually needed

#### Severe Cases:

- White blood cell count
- Creatinine and electrolytes

### Imaging

Usually not needed unless a complication is suspected; in these cases, consider abdominal CT

### Microbiology Tests

- Consider testing symptomatic patients with no other plausible reason for diarrhea especially if recent or current exposure to antibiotics
- **Testing <1 year of age is not recommended due to high prevalence of colonization in this age group**
- Currently no single test to diagnose CDI is completely reliable and the best approach remains controversial

#### Two commonly used approaches:

1. Start with highly sensitive test to detect *C. difficile*, if positive follow with a test to confirm toxin production
  - If toxin test negative: Consider *C. difficile* colonization
2. Perform two tests simultaneously, one to detect the presence of *C. difficile* and one to detect toxin production
  - Concordant results can reliably confirm (both tests positive) or exclude (both tests negative) infection
  - If results conflict and patient is symptomatic, treatment should be based on the pre-test probability of *C. difficile* infection

**Important:** Do not repeat testing during the same episode and do not test to confirm the resolution of the infection at the end of treatment



# Clostridioides difficile Infection

## Rx Treatment

### Clinical Considerations

- **Discontinue any other antibiotics except those treating *C. difficile* infection as soon as possible and adopt infection control measures to prevent transmission**
- Always recommend rehydration in patients with diarrhea; anti-diarrheal drugs not routinely necessary
- Diarrhea may resolve slowly over days, but clinical deterioration of a patient on appropriate treatment should precipitate escalation of treatment and a surgical referral



### Antibiotic Treatment Duration

10 days

### Rx Antibiotic Treatment

*First episode, not recurrences (within 8 weeks of previous episode)*

*All dosages are for normal renal function*

#### First Choice



#### Metronidazole **ORAL**

- Neonates: 7.5 mg/kg/dose q12h
- Children: 7.5 mg/kg/dose q8h

#### • Oral weight bands:

3-<6 kg	30 mg q8h
6-<10 kg	50 mg q8h
10-<15 kg	100 mg q8h
15-<20 kg	150 mg q8h
20-<30 kg	200 mg q8h
≥30 kg	Use adult dose

#### Second Choice



Vancomycin 5-10 mg/kg/dose q6h **ORAL**

*In severe cases: Oral vancomycin is preferable to metronidazole*

# Upper Urinary Tract Infection

Urinary Tract Infection

Page 1 of 2

Focus on community-acquired pyelonephritis in patients with no catheter

## ? Definition

Infection of the kidneys (pyelonephritis) in which microorganisms ascend the urinary tract via the urethra, bladder, ureters or reach the kidneys through the bloodstream

### Classification based on complexity:

- **Uncomplicated:** Urinary tract infections (UTI) in individuals with no risk factors for complicated UTI
- **Complicated:** UTI in individuals with mechanical anomalies of the urinary tract (e.g. kidney stones, anatomical anomalies) or who are immunosuppressed and in pregnant women are generally considered complicated (or at risk of complications). UTI in patients with urinary catheters or stents are also considered complicated (not discussed here)

## Most Likely Pathogens

### Bacteria:

#### • Most common:

- Enterobacterales (mostly *E. coli* including multidrug resistant strains such as those producing ESBL and carbapenemases)

#### • More rarely:

- *Enterococcus* spp.
- *Streptococcus agalactiae* (group B *Streptococcus*)
- *Staphylococcus aureus* (rare in uncomplicated UTI, usually in patients with urinary catheters)
- *Pseudomonas aeruginosa*, *Acinetobacter baumannii* (including multidrug-resistant strains especially in patients with recent antibiotic exposure or instrumentation of the urinary tract, rare in uncomplicated UTI)

## Diagnosis

### Clinical Presentation

- Flank pain, costovertebral angle tenderness, nausea and vomiting, fever and signs of systemic illness +/- symptoms of cystitis
- Severity varies from mild disease (most cases) that can be managed with oral treatment (no nausea/vomiting, low-grade fever) to severe cases requiring intravenous treatment and hospital admission

### Other Laboratory Tests

#### All cases:

- Urinalysis (dipstick or microscopy) to detect bacteriuria and/or indirect signs of infection (positive leucocyte esterase and nitrites)

#### Additionally in severe cases:

- White blood cell count, C-reactive protein and/or procalcitonin
- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Microbiology Tests

#### All cases:

- Urine culture: Ideally before starting antibiotic treatment
  - The test is considered positive when bacteria are above a certain minimum cut-off that can vary between laboratories
  - A positive urine culture is not always a sign of urinary tract infection or an indication for antibiotic treatment (and urine can also become contaminated during sampling)

#### Additionally in severe cases:

- Blood cultures: Ideally before starting antibiotic treatment

### Imaging

Routine imaging is not necessary but can be considered if urine flow is blocked or an abscess is suspected

# Upper Urinary Tract Infection

## Rx Treatment

### Clinical Considerations


- Patients with upper urinary tract infection are generally symptomatic
- Patients with a positive urine test but no UTI symptoms usually **do not require treatment** (exceptions exist, e.g. pregnant women or if invasive urologic procedure is scheduled)
- **Empiric antibiotic treatment should be guided by:**
  - The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- Clinical improvement is usually evident within 48-72 hours of starting treatment; **if signs and symptoms persist**, consider and investigate a possible complication (e.g. abscess) and review the results of the urine culture to verify that the pathogen is susceptible to the antibiotic used

### Rx Mild Cases

All dosages are for normal renal function


 Ciprofloxacin 500 mg q12h **ORAL**

### Antibiotic Treatment Duration

7 days

### Rx Severe Cases


All dosages are for normal renal function

 Ceftriaxone 1 g q24h **IV/IM**


OR

 Cefotaxime 1 g q8h **IV/IM**

AND/OR

 Gentamicin 5 mg/kg q24h **IV**

AND/OR

 Amikacin 15 mg/kg q24h **IV**

Consider gentamicin or amikacin where ESBL-producing isolates are highly prevalent

In very sick patients, gentamicin (or amikacin) can be given in combination with ceftriaxone (or cefotaxime)

# Upper Urinary Tract Infection

Urinary Tract Infection

Page 1 of 2

## ? Definition

Infection of the kidneys (pyelonephritis) in which microorganisms ascend the urinary tract via the urethra, bladder, ureters or reach the kidneys through the bloodstream

### Classification based on complexity:

- **Uncomplicated:** Urinary tract infections (UTI) in children with no risk factors for complicated UTI
- **Complicated:** More common in girls, infants and children with structural malformations of the urinary tract (e.g. vesicoureteral reflux or other congenital anomalies)

## 🦠 Most Likely Pathogens

### Bacteria:

- **Most common:**
  - Enterobacterales (mostly *E. coli* including multidrug resistant strains such as those producing ESBL and carbapenemases)
- **More rarely:**
  - *Enterococcus* spp.
  - Other Gram-negative bacilli (e.g. *Klebsiella* spp.)
  - *Staphylococcus aureus* (rare in uncomplicated UTIs, usually in patients with urinary catheters)
  - Group B *Streptococcus* (*Streptococcus agalactiae*)

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- Fever is most common symptom, with irritability, vomiting and diarrhoea
- In older children (e.g. over 2 years of age) abdominal pain, urgency, frequency and dysuria are more common, along with flank pain/tenderness and increased wetting
- Severity varies from mild disease (most cases) that can be managed with oral treatment (no nausea/vomiting, low-grade fever) to severe cases requiring intravenous treatment and hospital admission

### 🧪 Other Laboratory Tests

#### All cases:

- Urinalysis (dipstick or microscopy) to detect bacteriuria and/or indirect signs of infection (positive leucocyte esterase and nitrites)

#### Additionally in severe cases:

- White blood cell count, C-reactive protein and/or procalcitonin
- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### 🔬 Microbiology Tests

#### All cases:

- Urine culture: Ideally before starting antibiotic treatment
- The test is considered positive when bacteria are above a certain minimum cut-off that can vary between laboratories
- A positive urine culture is not always a sign of urinary tract infection or an indication for antibiotic treatment (and urine can also become contaminated during sampling)

#### Additionally in severe cases:

- Blood cultures: Ideally before starting antibiotic treatment

### 📷 Imaging

Ultrasound is helpful if available

# Upper Urinary Tract Infection

## Rx Treatment

### Clinical Considerations

- **In young children with mild cases** it is often difficult to clearly distinguish between lower and upper UTI, therefore oral options recommended for lower UTI can be used initially (if no need for IV treatment) or as step down treatment (see Lower Urinary Tract for antibiotic options)
- **Empiric antibiotic treatment should be guided by:**
  - The severity of symptoms, considering local prevalence of resistance (particularly of isolates of Enterobacterales producing ESBL) and individual risk factors for resistant pathogens

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- Clinical improvement is usually evident within 48-72 hours of starting treatment; **if signs and symptoms persist**, consider and investigate a possible complication (e.g. abscess) and review the results of the urine culture to verify that the pathogen is susceptible to the antibiotic used

### Rx Mild Cases

All dosages are for normal renal function

**WATCH** Ciprofloxacin 10-20 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	50 mg q12h
6-<10 kg	100 mg q12h
10-<15 kg	150 mg q12h
15-<20 kg	200 mg q12h
20-<30 kg	300 mg q12h
≥30 kg	Use adult dose

### Antibiotic Treatment Duration

7 days

### Rx Severe Cases

All dosages are for normal renal function

**WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV/IM**

OR

**WATCH** Cefotaxime 50 mg/kg/dose q8h **IV/IM**

AND/OR

**ACCESS** Gentamicin **IV**  
 • Neonates: 5 mg/kg/dose q24h  
 • Children: 7.5 mg/kg/dose q24h

AND/OR

**ACCESS** Amikacin 15 mg/kg q24h **IV**

Consider gentamicin or amikacin where ESBL-producing isolates are highly prevalent

In very sick patients, gentamicin (or amikacin) can be given in combination with ceftriaxone (or cefotaxime)

# Acute Bacterial Osteomyelitis

Bone and Joint Infection

Page 1 of 2

This guidance does not cover prosthetic-joint infections in detail

## Definition

An infection of the bone characterized by inflammation and bone destruction

### Classification based on:

- **Mechanism of dissemination in the body:** Through the bloodstream (less common in adults), local spread or direct inoculation
- **Duration of symptoms:** Acute (days to weeks), chronic (months to years with presence of dead bone fragments)

### Consequences of classification for management:

- Differences in the causative pathogens:
  - Local spread: more variability in possible causative pathogens
  - Spread through the bloodstream: more common with certain pathogens (e.g. *S. aureus*)
- Necessity for surgery (e.g. dead bone, usually present in chronic infections, needs removal for antibiotic treatment to be successful)

## Most Likely Pathogens

### Bacteria (most cases):

- *Staphylococcus aureus* (including MRSA)
- *Staphylococcus* spp. other than *S. aureus*
- *Streptococcus* spp. (mostly in patients with splenic dysfunction)

### Additionally in immunosuppressed patients:

- *Candida* spp.
- *Cryptococcus* spp.
- *Histoplasma* spp.
- *Mycobacterium tuberculosis*
- *Pseudomonas aeruginosa*

### Consider in specific situations:

- Enterobacterales and anaerobes (pressure ulcers and diabetic foot infections)
- *Brucella* spp. (exposure to infected animals or ingestion of contaminated food, mostly dairy products)
- *Bartonella* spp. (history of cat bite wounds)

## Diagnosis

### Clinical Presentation

- Gradual onset of localized pain with redness, swelling, and warmth of the affected area +/- fever and other signs of systemic infection
- If vertebral spine, hip and pelvis involved, pain is usually the main symptom
- Osteomyelitis can occur with/without septic arthritis
- Tuberculous osteomyelitis: consider when illness is chronic (less ill, less marked local signs), pus drains from the infected bone to the surface of the skin or patient has other signs of tuberculosis

### Other Laboratory Tests

#### To differentiate between bacterial and reactive viral infections:

- White blood cell count

#### To detect inflammation:

- C-reactive protein (CRP) and/or procalcitonin
- Erythrocyte sedimentation rate (ESR could complement CRP especially during follow up)

#### To help exclude other bone diseases:

- Calcium, phosphate and alkaline phosphatase tests
- These tests are usually normal in osteomyelitis but abnormal in other bone diseases

### Microbiology Tests

#### All microbiology tests ideally before starting antibiotics

- Blood cultures
- Microscopy and culture of bone biopsy material
- Microscopy and culture of deep samples of tissue / bone collected during debridement to adjust empiric antibiotic treatment

It is **important** to determine the causative pathogen to adequately target antibiotic treatment because the number of potential pathogens is large and antibiotic resistant pathogens (e.g. MRSA) are not infrequent

- Samples should also be tested for special pathogens (e.g. mycobacteria, fungi, *Brucella* spp.) based on clinical/epidemiological features

### Imaging

- X-ray of the affected bone
- Normal X-ray on admission does not rule out acute osteomyelitis but can help exclude alternative diagnosis
- CT or MRI could also be considered if available
- MRI has a high sensitivity/specificity to detect bone changes (especially in early phase)

# Acute Bacterial Osteomyelitis

## Rx Treatment

### Clinical Considerations

- **Surgical treatment not required in most cases**
- Surgical debridement of the bone can be considered in some selected cases to reduce the risk of complications
- Prosthetic-joint infections: Surgical approach depends on the location of the prosthesis, characteristics of the patient and local practices

#### Antibiotic Treatment:

- The intravenous route is preferred at least in the first week of treatment
- **Targeted antibiotic treatment** based on microbiology results always preferred (many potential causative pathogens and high levels of resistance)
- **If empiric treatment** is required consider most likely pathogens including local prevalence and individual risk factors for MRSA
- Adjust therapy once microbiology results available

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration

#### 4 to 6 weeks


Based on:

- Presence/absence of dead bone or foreign bodies
- Causative organism and its resistance profile
- Ability of the antibiotic to penetrate into bone tissues
- Imaging studies are usually not useful to determine duration

### Rx Antibiotic Treatment

All dosages are for normal renal function

#### First Choice

 Cloxacillin or flucloxacillin 2 g q6h **IV**

#### Second Choice

 Amoxicillin+clavulanic acid 1 g+200 mg q8h **IV**

OR

 Cefazolin 2 g q8h **IV**

OR


 Ceftriaxone 2 g q24h **IV**

*Ceftriaxone or cefotaxime are the preferred options if Salmonella spp. or Enterobacterales infection is suspected*

OR

 Cefotaxime 2 g q8h **IV**

OR

 Clindamycin 600 mg q8h **IV/ORAL**

*Acceptable option for CA-MRSA if MRSA is susceptible or in settings where MRSA maintains high levels of susceptibility to clindamycin, otherwise consider vancomycin*

# Acute Bacterial Osteomyelitis

Bone and Joint Infection

Page 1 of 2

## ? Definition

An infection of the bone characterized by inflammation and bone destruction

### Classification based on:

- *Mechanism of dissemination in the body:* Through the bloodstream (more common when <5 years of age), local spread or direct inoculation
- *Duration of symptoms:* Acute (days to weeks), chronic (months to years with presence of dead bone fragments)

### Consequences of classification for management:

- Differences in the causative pathogens:
  - Local spread: more variability in possible causative pathogens
  - Spread through the bloodstream: more common with certain pathogens (e.g. *S. aureus*)
- Necessity for surgery (e.g. dead bone, usually present in chronic infections, needs removal for antibiotic treatment to be successful)

## Most Likely Pathogens

### Bacteria (most cases):

- *Staphylococcus aureus* (including MRSA)
- *Streptococcus* spp. (mostly Group A *Streptococcus*)
- *Kingella kingae*
- *Haemophilus influenzae* type b
- *Salmonella* spp. (in children with sickle cell disease)

### Additional bacteria in immunosuppressed children:

- Enterobacterales
- *Pseudomonas aeruginosa*

## Diagnosis

### Clinical Presentation

- Gradual onset of localized pain with redness, swelling, and warmth of the affected area +/- fever and other signs of systemic infection
- Often the femur and tibia are affected and the infection presents with difficulty/inability to walk or reluctance to move the limb
- If vertebral spine, hip and pelvis involved, pain is usually the main symptom
- Osteomyelitis can occur with/without septic arthritis
- Tuberculous osteomyelitis: consider when illness is chronic (less ill, less marked local signs), pus drains from the infected bone to the surface of the skin or patient has other signs of tuberculosis

### Microbiology Tests

#### All microbiology tests ideally before starting antibiotics

- Blood cultures
- Microscopy and culture of bone biopsy material
- Microscopy and culture of deep samples of tissue / bone collected during debridement to adjust empiric antibiotic treatment

It is **important** to determine the causative pathogen to adequately target antibiotic treatment because the number of potential pathogens is large and antibiotic resistant pathogens (e.g. MRSA) are not infrequent

- Samples should also be tested for special pathogens (e.g. mycobacteria, fungi, *Brucella* spp.) based on clinical/epidemiological features

### Other Laboratory Tests

#### To differentiate between bacterial and reactive viral infections:

- White blood cell count

#### To detect inflammation:

- C-reactive protein (CRP)
- Erythrocyte sedimentation rate (could complement CRP especially during follow up)

### Imaging

- X-ray of the affected bone
- Normal X-ray on admission does not rule out acute osteomyelitis but can help exclude alternative diagnosis
- CT or MRI could also be considered if available
- MRI has a high sensitivity/specificity to detect bone changes (especially in early phase)



# Acute Bacterial Osteomyelitis

## Rx Treatment

### Clinical Considerations

- **Surgical treatment not required in most cases**

#### Antibiotic Treatment:

- The intravenous route is preferred at least in the first few days of treatment
- **In children empiric treatment is common practice** and *S. aureus* remains the most common pathogen
- In **neonates**, *S. aureus* is also the most common pathogen but empiric treatment should also cover Enterobacterales (very rare in older children)
  - For Enterobacterales use:
    - Cefotaxime or
    - Ceftriaxone (not in infants with hyperbilirubinemia)

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration

Around **3 weeks** in children with uncomplicated infections

Based on:

- Clinical recovery
- Causative organism and its resistance profile

Imaging studies are usually not useful to determine duration

### Rx Antibiotic Treatment

All dosages are for normal renal function

#### First Choice

- ACCESS** Cloxacillin or flucloxacillin **IV/ORAL**
  - Neonates: 25-50 mg/kg/dose q12h
  - Children: 25 mg/kg/dose q6h
  - **Oral weight bands:**

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

#### Second Choice

- ACCESS** Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **IV/ORAL**
  - **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution

OR

- WATCH** Cefazolin 25 mg/kg/dose q12h **IV**

OR

- WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV**

*Ceftriaxone or cefotaxime are the preferred options if Salmonella spp. or Enterobacterales infection is suspected*

OR

- WATCH** Cefotaxime 50 mg/kg/dose q8h **IV**

OR

- ACCESS** Clindamycin **IV**
  - Neonates: 5 mg/kg/dose q8h
  - Children: 10 mg/kg/dose q8h

*Acceptable option for CA-MRSA if MRSA is susceptible or in settings where MRSA maintains high levels of susceptibility to clindamycin, otherwise consider vancomycin*

# Septic Arthritis

## Bone and Joint Infection

### ? Definition

An infection of one or several joints, usually of bacterial origin

#### Gonococcal arthritis:

- Rare complication of gonococcal infection (predominantly affects women)
- Characterized by dissemination of the infection via the bloodstream

#### Classification based on:

- *Causative pathogen*: Gonococcal or non-gonococcal
- *Type of affected joint*: Large or small joint
- *Mechanism of dissemination in the body*:
  - Spread through the bloodstream (more common)
  - Local spread or direct inoculation

### Most Likely Pathogens

#### Bacteria (most cases):

- *Staphylococcus aureus* (including MRSA)
- *Staphylococcus* spp. other than *S. aureus*
- *Streptococcus* spp.

#### Additionally in immunosuppressed patients:

- *Candida* spp.
- *Cryptococcus* spp.
- *Histoplasma* spp.
- *Mycobacterium tuberculosis*
- *Pseudomonas aeruginosa*

#### Consider in specific situations:

- Enterobacterales (pressure ulcers and diabetic foot infections)
- *Brucella* spp. (exposure to infected animals or ingestion of contaminated food, mostly dairy products)
- *Bartonella* spp. (history of cat bite wounds)
- *Neisseria gonorrhoeae* (if gonococcal infection)

## Diagnosis

### Clinical Presentation

- Acute onset (usually a few days, but up to 2 weeks) of joint pain and reduced range of motion with redness, swelling, warmth of the joint (may be less evident in “deep” joints)
- Usually, a single joint is affected (often knee)
- Polyarticular infection is more common in patients with underlying rheumatoid arthritis
- Other signs of systemic infection are usually present
- Septic arthritis can occur with/without osteomyelitis

#### Gonococcal arthritis:

- Typical signs and symptoms of septic arthritis (usually affecting knees and ankles) + skin manifestations (rash, small papules)
- Often no signs/symptoms of cervicitis/urethritis

**Important:** if left untreated, septic arthritis can rapidly lead to destruction of the cartilage; it therefore needs to be rapidly diagnosed and treated

### Imaging

- Ultrasound of the affected joint to detect joint effusion and synovial swelling (due to increased intra-articular fluid)
- Consider MRI if available, especially if concomitant osteomyelitis is suspected (more sensitive/specific to detect bone changes)

### Microbiology Tests

#### All microbiology tests ideally before starting antibiotics

- Blood cultures
- Microscopy and culture of synovial fluid
  - Culture is usually negative in gonococcal arthritis
- Microscopy and culture of deep samples of tissue collected during debridement in prosthetic joint implant to adjust empiric antibiotic treatment

It is **important** to determine the causative pathogen to adequately target antibiotic treatment because the number of potential pathogens is large and antibiotic resistant pathogens (e.g. MRSA) are not infrequent

- Samples should also be tested for special pathogens (e.g. mycobacteria, fungi, *Brucella* spp.) based on clinical/epidemiological features

### Other Laboratory Tests

#### To differentiate between bacterial and reactive viral infections:

- White blood cell count (WBC)

#### To detect inflammation:

- C-reactive protein (CRP)
- Erythrocyte sedimentation rate (ESR could complement CRP especially during follow up)

#### Synovial fluid examination:

- WBC and microscopy for crystals
- WBC usually >20 000 cells/ $\mu$ L (> 20 x 10<sup>9</sup>/L) with >90% neutrophils

# Septic Arthritis

## Rx Treatment

### Clinical Considerations

- **Prompt surgical drainage of purulent material and lavage of the joint is a key part of the management of septic arthritis** (antibiotic treatment alone is usually not sufficient) and can reduce risk of complications
- Immobilization of the joint is not necessary except for pain control
- Prosthetic-joint infections: Surgical approach depends on the location of the prosthesis, characteristics of the patient and local practices

#### Antibiotic Treatment:

- The intravenous route is preferred at least in the first week of treatment
- **Targeted antibiotic treatment** based on microbiology results always preferred (many potential causative pathogens and high levels of resistance)
- **If empiric treatment** is required consider most likely pathogens including local prevalence and individual risk factors for MRSA or *N. gonorrhoeae* based on individual risk factors
- Adjust therapy once microbiology results available

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration

- **4 to 6 weeks**
- **2 weeks** in case of gonococcal infection


Based on:

- Presence/absence/removal of foreign bodies
- Causative organism and its resistance profile
- Presence/absence of osteomyelitis

## Rx Antibiotic Treatment

All dosages are for normal renal function

### First Choice

 Cloxacillin or flucloxacillin 2 g q6h **IV**

### Second Choice

 Amoxicillin+clavulanic acid 1 g+200 mg q8h **IV**

OR


 Cefazolin 2 g q8h **IV**

OR


 Ceftriaxone 2 g q24h **IV**

*Ceftriaxone or cefotaxime are the preferred options if Salmonella spp. or Enterobacterales or gonococcal infection is suspected*

OR

 Cefotaxime 2 g q8h **IV**

OR

 Clindamycin 600 mg q8h **IV/ORAL**

*Acceptable for CA-MRSA if MRSA is susceptible or in settings where MRSA maintains high levels of susceptibility to clindamycin, otherwise consider vancomycin*

# Septic Arthritis

Bone and Joint Infection

Page 1 of 2

## Definition

An infection of one or several joints, usually of bacterial origin

### Classification based on:

- *Type of affected joint:* Large or small joint
- *Mechanism of dissemination in the body:*
  - Spread through the bloodstream (more common)
  - Local spread or direct inoculation

## Most Likely Pathogens

### Bacteria (most cases):

- *Staphylococcus aureus* (including MRSA)
- *Streptococcus* spp. (mostly Group A *Streptococcus*)
- *Kingella kingae*
- *Haemophilus influenzae* type b
- *Salmonella* spp.

## Diagnosis

### Clinical Presentation

- Acute onset (usually a few days, but up to 2 weeks) of joint pain and reduced range of motion with redness, swelling, warmth of the joint (may be less evident in “deep” joints)
- Usually, a single joint is affected (often knee)
- Other signs of systemic infection are usually present
- Septic arthritis can occur alone or with osteomyelitis

**Important:** if left untreated, septic arthritis can rapidly lead to destruction of the cartilage (especially in young children); it therefore needs to be rapidly diagnosed and treated

### Microbiology Tests

#### All microbiology tests ideally before starting antibiotics

- Blood cultures
- Microscopy and culture of synovial fluid
- Microscopy and culture of deep samples of tissue collected during debridement in case of prosthetic joint implant to adjust empiric antibiotic treatment

It is **important** to determine the causative pathogen to adequately target antibiotic treatment because the number of potential pathogens is large and antibiotic resistant pathogens (e.g. MRSA) are not infrequent

- Samples should also be tested for special pathogens (e.g. mycobacteria, fungi, *Brucella* spp.) based on clinical/epidemiological features

### Other Laboratory Tests

#### To differentiate between bacterial and reactive viral infections:

- White blood cell count (WBC)

#### To detect inflammation:

- C-reactive protein (CRP)
- Erythrocyte sedimentation rate (ESR could complement CRP especially during follow up)

#### Synovial fluid examination:

- WBC and microscopy for crystals
- WBC usually  $>20\,000$  cells/ $\mu\text{L}$  ( $> 20 \times 10^9/\text{L}$ ) with  $>90\%$  neutrophils

### Imaging

- Ultrasound of the affected joint to detect joint effusion and synovial swelling (due to increased intra-articular fluid)
- Consider MRI if available, especially if concomitant osteomyelitis is suspected (more sensitive/specific to detect bone changes)

# Septic Arthritis

## Rx Treatment

### Clinical Considerations

- Prompt surgical drainage of purulent material and lavage of the joint can reduce risk of complications
- Immobilization of the joint is not necessary except for pain control
- Prosthetic-joint infections: Surgical approach depends on the location of the prosthesis, characteristics of the patient and local practices

#### Antibiotic Treatment:

- The intravenous route is preferred at least in the first few days of treatment
- **In children empiric treatment is common practice**
- **In neonates**, empiric treatment should also cover Enterobacterales (very rare in older children)
  - For Enterobacterales use:
    - Cefotaxime or
    - Ceftriaxone (not in infants with hyperbilirubinemia)

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics
- Early oral step down in the first week may be used in uncomplicated patients

### Antibiotic Treatment Duration

About **3 weeks**

Based on:

- Presence/absence/removal of foreign bodies
- Causative organism and its resistance profile
- Presence/absence of osteomyelitis

### Rx Antibiotic Treatment

All dosages are for normal renal function

#### First Choice

- ACCESS** Cloxacillin or flucloxacillin **IV/ORAL**
- Neonates: 25-50 mg/kg/dose q12h
  - Children: 25 mg/kg/dose q6h
  - **Oral weight bands:**
- |           |                |
|-----------|----------------|
| 3-<6 kg   | 125 mg q6h     |
| 6-<10 kg  | 250 mg q6h     |
| 10-<15 kg | 250 mg q6h     |
| 15-<20 kg | 500 mg q6h     |
| 20-<30 kg | 750 mg q6h     |
| ≥30 kg    | Use adult dose |

#### Second Choice

- ACCESS** Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **IV/ORAL**
- **Oral weight bands:**
- |           |                           |
|-----------|---------------------------|
| 3-<6 kg   | 250 mg of amox/dose q12h  |
| 6-<10 kg  | 375 mg of amox/dose q12h  |
| 10-<15 kg | 500 mg of amox/dose q12h  |
| 15-<20 kg | 750 mg of amox/dose q12h  |
| 20-<30 kg | 1000 mg of amox/dose q12h |
| ≥30 kg    | Use adult dose            |

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution

OR

- WATCH** Cefazolin 25 mg/kg/dose q12h **IV**

OR

- WATCH** Ceftriaxone 80 mg/kg/dose q24h **IV**

Ceftriaxone or cefotaxime are the preferred options if *Salmonella spp.* or Enterobacterales infection is suspected

OR

- WATCH** Cefotaxime 50 mg/kg/dose q8h **IV**

OR

- ACCESS** Clindamycin **IV/ORAL**
- Neonates: 5 mg/kg/dose q8h
  - Children: 10 mg/kg/dose q8h

Acceptable option for CA-MRSA if MRSA is susceptible or in settings where MRSA maintains high levels of susceptibility to clindamycin, otherwise consider vancomycin

# Necrotizing Fasciitis

Skin and Soft Tissue Infection

Page 1 of 2

## ? Definition

Life-threatening necrotizing infection of the deep soft tissues affecting the muscular fascia; caused mostly by bacteria and characterized by acute/fulminant necrosis with tissue destruction and systemic signs of toxicity

### Classification based on:

- **Causative pathogen:**
  - Type 1/polymicrobial
  - Type 2/monomicrobial
- **Presence or absence of gas in tissues**
  - For example, presence of gas is common in polymicrobial infections
- **Involved site:**
  - Leg
  - Head and neck
  - Perineum (Fournier's gangrene)
- **Risk of poor outcome:**
  - High versus moderate risk

## 🦠 Most Likely Pathogens

### Monomicrobial / Type 2:

- **Most cases:**
  - *Streptococcus pyogenes* (group A *Streptococcus*)
  - *Streptococcus agalactiae*
  - *Streptococcus dysgalactiae* (mostly in elderly and chronically ill patients)
- **Less frequently:**
  - *Staphylococcus aureus* (including MRSA)
- **Specific environmental exposures:**
  - *Aeromonas hydrophila* (freshwater)
  - *Vibrio vulnificus* (seawater)

### Polymicrobial / Type 1:

- Anaerobes (e.g. *Bacteroides* spp., *Clostridium perfringens*, *Peptostreptococcus* spp. or mouth anaerobes when head/neck involved)
- Enterobacterales
- *Pseudomonas* spp.
- *Streptococcus* spp.
- *Staphylococcus aureus* (including MRSA)

## 🔍 Diagnosis

### 🔍 Clinical Presentation

- Acute onset of localized pain out of proportion to physical findings accompanied by rapid onset of systemic signs
- Signs and symptoms of skin and soft tissue infections (redness, warmth, swelling) usually present when portal of entry is the skin but severe pain is the main symptom
- Definitive diagnosis requires direct visualization of necrotic tissue in the muscular fascia through surgical exploration

### Fournier's gangrene:

- Severe pain accompanied by signs of necrosis in the perineal area; rapid progression of the infection to the abdominal wall and gluteal muscles is possible

### 🔬 Microbiology Tests

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of deep samples of tissue collected at debridement to adjust empiric antibiotic treatment

### 🧪 Other Laboratory Tests

- **Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin
- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Initial evaluation for suspected necrotizing fasciitis:

- Complete blood count
- Creatinine
- Electrolytes
- Glucose

### 📷 Imaging

- Ultrasound may be helpful to evaluate the extent of the affected tissue and gas and fluid along the muscular fascia
- Consider CT scan of the affected area

Imaging should not delay surgical exploration/inspection since surgery is the best way to diagnose/treat this infection

# Necrotizing Fasciitis

## Rx Treatment

### Clinical Considerations

- Clinical progression to severe disease is rapid, carefully monitor signs of sepsis/septic shock
- **Early surgical removal of necrotic tissue through drainage/debridement is key; delays associated with increased mortality**
- Antibiotic treatment is a complementary measure to surgical source control
- IVIG sometimes used when shock complicates necrotizing fasciitis (and toxic shock syndrome suspected) however very expensive and unclear effect on mortality

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration

Usually **2-3 weeks**

Based on:

- Clinical response
- Surgical source control, and
- Evolution of laboratory markers of infection

### Rx Antibiotic Treatment

All dosages apply to normal renal function

**WATCH** Piperacillin+tazobactam 4 g+500 mg q6h **IV**

COMBINED WITH

**ACCESS** Clindamycin 900 mg q8h **IV**

OR

*Use this treatment option only if Streptococcus pyogenes infection has been excluded first*

**WATCH** Ceftriaxone 2 g q24h **IV**

COMBINED WITH

**ACCESS** Metronidazole 500 mg q8h **IV**

IF MRSA SUSPECTED,  
CONSIDER ADDING

**WATCH** Vancomycin 15-20 mg/kg q12h **IV**

# Necrotizing Fasciitis

Skin and Soft Tissue Infection

Page 1 of 2

## ? Definition

Life-threatening necrotizing infection of the deep soft tissues, specifically affecting the muscular fascia; caused mostly by bacteria and characterized by acute/fulminant necrosis with tissue destruction and systemic signs of toxicity

### Classification based on:

- **Causative pathogen:**
  - Type 1/polymicrobial
  - Type 2/monomicrobial
- **Presence or absence of gas in tissues**
  - For example, presence of gas is common in polymicrobial infections
- **Involved site:**
  - Leg
  - Head and neck
  - Perineum (Fournier's gangrene)
- **Risk of poor outcome:**
  - High versus moderate risk

## 🦠 Most Likely Pathogens

### Monomicrobial / Type 2:

- **Most cases:**
  - *Streptococcus pyogenes* (group A *Streptococcus*)
  - *Streptococcus agalactiae*
  - *Streptococcus dysgalactiae* (mostly in chronically ill patients)
- **Less frequently:**
  - *Staphylococcus aureus* (including MRSA)
- **Specific environmental exposures:**
  - *Aeromonas hydrophila* (freshwater)
  - *Vibrio vulnificus* (seawater)

### Polymicrobial / Type 1:

- Anaerobes (e.g. *Bacteroides* spp., *Clostridium perfringens*, *Peptostreptococcus* spp. or mouth anaerobes when head/neck involved)
- Enterobacterales
- *Pseudomonas* spp.
- *Streptococcus* spp.
- *Staphylococcus aureus* (including MRSA)

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- **Very rare**, may occur as a complication of varicella/chicken pox (or associated with a compromised immune system)
- Most elements described for adults also apply to children, but certain specificities exist:
  - Areas affected: torso (neonates and infants); extremities and face (older children)
  - Early signs and symptoms: fever  $>38.0^{\circ}\text{C}$ , redness/skin discolouration, localized swelling, marked tenderness and pain of the affected area

### 🔬 Microbiology Tests

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of deep samples of tissue collected at debridement to adjust empiric antibiotic treatment

### 🏢 Other Laboratory Tests

- **Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin
- If sepsis is suspected consider additional laboratory tests (see sepsis infographic)

### Initial evaluation for suspected necrotizing fasciitis:

- Complete blood count
- Creatinine
- Electrolytes
- Glucose

### 📷 Imaging

Imaging should not delay surgical exploration/inspection since surgery is the best way to diagnose/treat this infection

- Ultrasound may be helpful to evaluate the extent of the affected tissue and gas and fluid along the muscular fascia
- Consider CT scan of the affected area



# Necrotizing Fasciitis

## Rx Treatment

### Clinical Considerations

- Clinical progression to severe disease is rapid, carefully monitor signs of sepsis/septic shock
- **Early surgical removal of necrotic tissue through drainage/debridement is key; delays associated with increased mortality**
- Antibiotic treatment is a complementary measure to surgical source control
- IVIG sometimes used when shock complicates necrotizing fasciitis (and toxic shock syndrome suspected) however very expensive and unclear effect on mortality

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics

### Antibiotic Treatment Duration


Usually **2-3 weeks**

Based on:


- Clinical response
- Surgical source control, and
- Evolution of laboratory markers of infection

### Rx Antibiotic Treatment

All dosages apply to normal renal function

 Piperacillin+tazobactam 100 mg/kg/dose of piperacillin component q8h **IV**

COMBINED WITH


 Clindamycin **IV**  
 • Neonates: 5 mg/kg/dose q8h  
 • Children: 10 mg/kg/dose q8h

OR


*Use this treatment option only if Streptococcus pyogenes infection has been excluded first*

 Ceftriaxone 80 mg/kg/dose q24h **IV**

COMBINED WITH

 Metronidazole **IV**  
 • Neonates: 7.5 mg/kg/dose q12h  
 • Children: 7.5 mg/kg/dose q8h

IF MRSA SUSPECTED,  
CONSIDER ADDING

 Vancomycin **IV**  
 • Neonates: 15 mg/kg/dose q12h  
 • Children: 15 mg/kg/dose q8h

# Pyomyositis

Skin and Soft Tissue Infection

## ? Definition

An infection of a skeletal muscle caused by bacteria usually accompanied by abscess formation

## 🔬 Diagnosis

### 🔍 Clinical Presentation

- Acute onset of localized muscle pain with cramping usually in the lower limbs/gluteal muscles with fever  $>38.0^{\circ}\text{C}$  +/- swelling and induration of the affected area
- Other signs of systemic infection are usually present (e.g. tachycardia, leukocytosis)
- Abscess can form within days / weeks
- Signs of severe clinical progression (e.g. signs of sepsis/septic shock) should always be carefully monitored
- Complications due to bacteremia can occur (e.g. septic emboli, septic arthritis, endocarditis)

### 🔬 Microbiology Tests

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (if this can be drained) to adjust empiric antibiotic treatment

### 🧪 Other Laboratory Tests

**Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin

### 📷 Imaging

Initial X-ray is important to localize the site and extent of the infection and/or to exclude alternative diagnosis

- Ultrasound is helpful to detect the presence of abscess (and to guide its drainage)
- If available, also consider MRI or CT-scan because of their higher sensitivity to identify muscle swelling (i.e. inflammation) and the presence of purulent material

## 🦠 Most Likely Pathogens

- *Staphylococcus aureus* (>90%, including MRSA)
- *Streptococcus* spp. (mostly *Streptococcus pyogenes*)
- *Escherichia coli* (sometimes, especially in oncologic patients)

## ℞ Treatment

### 📋 Clinical Considerations

- **Drainage of the abscess remains the main approach to eliminate the source of infection**
- Drainage is also important to obtain material for culture and identify the causative pathogen and its resistance profile
- **Mild:** Targeted antibiotic treatment preferred after having obtained culture results
- **Severe or impossible to obtain a clinical sample for microbiological examination:** Empiric treatment considering most likely pathogens including local prevalence and individual risk factors for MRSA

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics


### 🕒 Antibiotic Treatment Duration

#### Treat for 2-3 weeks:


- 2 weeks in otherwise healthy patients and adequate source control
- 3 weeks if source control is not optimal or underlying diseases

## ℞ Antibiotic Treatment


All dosages are for normal renal function

 Amoxicillin+clavulanic acid 1 g + 200 mg q8h **IV**

OR

 Cefalexin 500 mg q8h **ORAL**

OR

 Cloxacillin (or flucloxacillin) 2 g q6h **IV**

# Pyomyositis

Skin and Soft Tissue Infection

Page 1 of 2

## ? Definition

An infection of a skeletal muscle caused by bacteria usually accompanied by abscess formation

## Most Likely Pathogens

- *Staphylococcus aureus* (> 90%, including MRSA)
- *Streptococcus* spp. (mostly *Streptococcus pyogenes*)
- *Escherichia coli* (sometimes, especially in oncologic patients)

## Diagnosis

### Clinical Presentation

- Acute onset of localized muscle pain with cramping usually in the lower limbs/gluteal muscles with fever >38.0°C +/- swelling and induration of the affected area
- Other signs of systemic infection are usually present (e.g. tachycardia, leukocytosis)
- Abscess can form within days / weeks
- Signs of severe clinical progression (e.g. signs of sepsis/septic shock) should always be carefully monitored
- Complications due to bacteremia can occur (e.g. septic emboli, septic arthritis, endocarditis)

### Other Laboratory Tests

**Determine disease severity and help identify a bacterial infection:** White blood cell count, C-reactive protein and/or procalcitonin

### Microbiology Tests

- Blood cultures (ideally before starting antibiotics)
- Microscopy and culture of abscess fluid material (if this can be drained) to adjust empiric antibiotic treatment

### Imaging

Initial X-ray is important to localize the site and extent of the infection and/or to exclude alternative diagnosis

- Ultrasound is helpful to detect the presence of abscess (and to guide its drainage)
- If available, also consider MRI or CT-scan because of their higher sensitivity to identify muscle swelling (i.e. inflammation) and the presence of purulent material

# Pyomyositis

## Rx Treatment

### Clinical Considerations

- **Drainage of the abscess remains the main approach to eliminate the source of infection**
- Drainage is also important to obtain material for culture and identify the causative pathogen and its resistance profile
- **Mild:** Targeted antibiotic treatment preferred after having obtained culture results
- **Severe or impossible to obtain a clinical sample for microbiological examination:** Empiric treatment considering most likely pathogens including local prevalence and individual risk factors for MRSA

#### Important:

- **Simplify** empiric treatment to a more narrow-spectrum antibiotic based on culture results or rapid clinical improvement if culture results unavailable
- **Step down to oral treatment** is based on improvement of symptoms, signs of infection and the ability to take oral antibiotics


### Antibiotic Treatment Duration

#### Treat for 2-3 weeks:

- 2 weeks in otherwise healthy patients and adequate source control
- 3 weeks if source control is not optimal or underlying diseases

### Rx Antibiotic Treatment

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **IV/ORAL**


- **Oral weight bands:**

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution


OR

 Cefalexin 25 mg/kg/dose q12h **ORAL**

- **Oral weight bands:**

3-<6 kg	125 mg q12h
6-<10 kg	250 mg q12h
10-<15 kg	375 mg q12h
15-<20 kg	500 mg q12h
20-<30 kg	625 mg q12h
≥30 kg	Use adult dose

OR

 Cloxacillin (or flucloxacillin) **IV/ORAL**

- Neonates: 25-50 mg/kg/dose q12h
- Children: 25 mg/kg/dose q6h
- **Oral weight bands:**

3-<6 kg	125 mg q6h
6-<10 kg	250 mg q6h
10-<15 kg	250 mg q6h
15-<20 kg	500 mg q6h
20-<30 kg	750 mg q6h
≥30 kg	Use adult dose

# Febrile Neutropenia

This guidance covers suspected bacterial infections in neutropenic patients (including neutropenic sepsis) but not antiviral or antifungal treatment nor antibiotic prophylaxis for patients with afebrile neutropenia or prophylaxis with granulocyte colony-stimulating factors

## Definition

- A severe syndrome that can occur in patients with neoplastic diseases receiving cytotoxic myelosuppressive chemotherapy
- Two elements need to be considered:
  - **Fever:** Body temperature  $>38.0^{\circ}\text{C}$
  - **Neutropenia:** Temporary reduction of the absolute neutrophil count (ANC)  $<1000$  cells/ $\mu\text{L}$  ( $<1.0 \times 10^9/\text{L}$ )

### Severity:

- **Severe Neutropenia:** ANC  $<500$  cells/ $\mu\text{L}$  ( $<0.5 \times 10^9/\text{L}$ )
- **Profound Neutropenia:** ANC  $<100$  cells/ $\mu\text{L}$  ( $<0.1 \times 10^9/\text{L}$ )

### Categorized by risk of developing severe infections (requiring or prolonging hospitalization):

- **Low Risk:**  $\leq 7$  days of severe neutropenia and no ongoing comorbidities (beside cancer) or renal or hepatic dysfunction
- **High Risk:**  $>7$  days of severe neutropenia and ongoing comorbidities (beside cancer) or renal or hepatic dysfunction

Note: these are ways to classify neutropenia and narrow down the differential diagnosis

### Characterized according to identification of causative pathogen and source of infection:

1. Microbiologically proven infection (causative pathogen identified)
2. Clinical source of infection diagnosed but no pathogen identified (e.g. pharyngitis)
3. Unexplained fever (no pathogen identified and no clear source of infection) (most common scenario)
4. Non-infectious fever (e.g. drug-induced)

## Most Likely Pathogens

Mostly bacteria that colonize patient's own skin and bowel including multidrug-resistant organisms

### Gram-positive bacteria:

- *Staphylococcus* spp. (including MRSA)
- *Streptococcus* spp.
- *Enterococcus* spp. (including vancomycin-resistant Enterococci)

### Gram-negative bacteria:

- Enterobacterales and *Pseudomonas aeruginosa* (including ESBL and carbapenemase-producing strains)

### Other pathogens:

- Anaerobes
- Consider fungi (mostly *Candida albicans* and *Aspergillus* spp.) and viruses (e.g. cytomegalovirus, human herpesvirus 6) if longer duration of neutropenia

## Diagnosis

### Clinical Presentation

- Presentation is highly variable depending on the underlying infection
- Fever is usually present but because patients with neutropenia fail to produce effective inflammatory responses, they can sometimes present with few clinical findings and no fever despite infection
- Clinical progression to severe disease or death can be very rapid (over a few hours); signs of sepsis/septic shock should always be carefully monitored

### Microbiology Tests

**Important:** microbiology tests to consider in the initial assessment depend on the most likely source of infection and should ideally be taken before starting antibiotic treatment

#### Always obtain:

- Blood cultures
- Urine culture

#### In selected cases, consider:

- Sputum microscopy and culture
- Nasopharyngeal swab for nucleic acid test for influenza and other respiratory viruses (including SARS-CoV-2)
- CSF microscopy and bacterial culture
- Stool culture
- *C. difficile* testing
- Tests to diagnose invasive fungal infections and other viral etiologies (especially in high-risk patients)

### Other Laboratory Tests

**Important:** tests to consider in the initial assessment depend on the most likely source of infection

- Complete blood count, bilirubin, creatinine, electrolytes, blood pH and gases, whole blood lactate, C-reactive protein and/or procalcitonin

### Imaging

- Consider imaging in initial assessment to identify the source of infection (depending on clinical presentation)
- Consider additional imaging to expand diagnostic work-up or to exclude a complicated infection if no clinical improvement after a few days of treatment

# Febrile Neutropenia

## Rx Treatment

### Clinical Considerations

- Antibiotic treatment should consider the most likely site of infection, local prevalence of resistance and individual risk factors for resistant pathogens (especially ESBL, carbapenemase-producing isolates and MRSA)
- In addition to antibiotic treatment, it is important that source control is achieved; consider removal of an infected Central Venous Catheter
- If fever persists and there is no clinical improvement after 48-72 hours, consider further tests to identify source or assess whether a local complication has developed (consider a resistant organism or non-bacterial infection)

#### Patients with severe neutropenia (<500 cells/ $\mu$ L or <0.5 x 10<sup>9</sup>/L) who develop fever:

- Should promptly receive antibiotic treatment even when a clear site of infection is not identified

#### Low-risk patients:

- Outpatient setting with monitoring and follow-up, if oral treatment tolerated


#### High-risk patients (or close follow-up unfeasible):

- Hospitalization and initial IV treatment
- Step down from IV to oral antibiotics is suggested when the patient has clinically improved, is afebrile and is able to tolerate oral treatment


## Rx Low Risk

**Important:** treatment escalation in case of persistent fever is beyond the scope of this guidance

All dosages are for normal renal function

 Amoxicillin+clavulanic acid 500 mg + 125 mg q8h **ORAL**

CONSIDER ADDING

 Ciprofloxacin 500 mg q12h **ORAL**

### Antibiotic Treatment Duration

Low Risk Patients: **7 days**

High Risk Patients: Until clinical signs of infection resolved AND no fever for at least 48 hours

- Mostly depends on clinical response and (if identified) infectious site and causative pathogen
- Current evidence suggests discontinuation based on clinical approach and not neutrophil count

**Important:** If using combination therapy, reassess the need to continue combination over time based on microbiology test results and clinical response

## Rx High Risk

**Important:** treatment escalation in case of persistent fever is beyond the scope of this guidance

All dosages are for normal renal function

### First Choice


 Piperacillin+tazobactam 4 g + 500 mg q6h **IV**

### Second Choice

 Meropenem 1 g q8h **IV**


Consider meropenem only in settings with high prevalence of ESBL-producing Enterobacterales or in patients with known prior colonization or infection with resistant pathogens

### CONSIDER ADDING TO EITHER REGIMEN

 Amikacin 15 mg/kg q24h **IV**

If resistant Gram-negative bacteria suspected

AND/OR

 Vancomycin 15-20 mg/kg q12h **IV**

If MRSA suspected

# Febrile Neutropenia

This guidance covers suspected bacterial infections in neutropenic patients (including neutropenic sepsis) but not antiviral or antifungal treatment nor antibiotic prophylaxis for patients with afebrile neutropenia or prophylaxis with granulocyte colony-stimulating factors

## Definition

- A severe infection that can occur in patients with neoplastic diseases receiving cytotoxic myelosuppressive chemotherapy
- Two elements need to be considered:
  - *Fever*: Temperature  $>38.0^{\circ}\text{C}$
  - *Neutropenia*: Temporary reduction of the absolute neutrophil count (ANC)  $<1000$  cells/ $\mu\text{L}$  ( $<1.0 \times 10^9/\text{L}$ )

### Severity:

- *Severe Neutropenia*: ANC  $<500$  cells/ $\mu\text{L}$  ( $<0.5 \times 10^9/\text{L}$ )
- *Profound Neutropenia*: ANC  $<100$  cells/ $\mu\text{L}$  ( $<0.1 \times 10^9/\text{L}$ )

### Categorized by risk of developing severe infections (requiring or prolonging hospitalization):

- *Low Risk*:  $\leq 7$  days of severe neutropenia and no ongoing comorbidities (beside cancer) or renal or hepatic dysfunction
- *High Risk*:  $>7$  days of severe neutropenia and ongoing comorbidities (beside cancer) or renal or hepatic dysfunction

Note: these are ways to classify neutropenia and narrow down the differential diagnosis

### Characterized according to identification of causative pathogen and source of infection:

1. Microbiologically proven infection (causative pathogen identified)
2. Clinical source of infection diagnosed but no pathogen identified (e.g. pharyngitis)
3. Unexplained fever (no pathogen identified and no clear source of infection) (most common scenario)
4. Non-infectious fever (e.g. drug-induced)

## Most Likely Pathogens

Mostly bacteria that colonize patient's own skin and bowel including multidrug-resistant organisms

### Gram-positive bacteria:

- *Staphylococcus* spp. (including MRSA)
- *Streptococcus* spp.
- *Enterococcus* spp. (including vancomycin-resistant Enterococci)

### Gram-negative bacteria:

- Enterobacterales and *Pseudomonas aeruginosa* (including ESBL and carbapenemase-producing strains)

### Other pathogens:

- Anaerobes
- Consider fungi (mostly *Candida albicans* and *Aspergillus* spp.) and viruses (e.g. cytomegalovirus, human herpesvirus 6) if longer duration of neutropenia

## Diagnosis

### Clinical Presentation

- Presentation is highly variable depending on the underlying infection
- Fever is usually present but symptoms and signs are masked and a child can present with no fever and few signs despite infection
- Clinical progression to severe disease or death can be very rapid (over a few hours); signs of sepsis/septic shock should always be carefully monitored

### Microbiology Tests

**Important:** microbiology tests to consider in the initial assessment depend on the most likely source of infection and should ideally be taken before starting antibiotic treatment

#### Always obtain:

- Blood cultures
- Urine culture

#### In selected cases, consider:

- Sputum microscopy and culture
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- CSF microscopy and bacterial culture
- Stool culture
- *C. difficile* testing
- Tests to diagnose invasive fungal infections and other viral etiologies (especially in high-risk patients)

### Other Laboratory Tests

**Important:** tests to consider in the initial assessment depend on the most likely source of infection

- Complete blood count, bilirubin, creatinine, electrolytes, blood pH and gases, whole blood lactate, C-reactive protein and/or procalcitonin

### Imaging

- Consider imaging in initial assessment to identify the source of infection (depending on clinical presentation)
- Consider additional imaging - CT chest and abdominal ultrasound to expand diagnostic work-up or to exclude a complicated infection if no clinical improvement after a few days of treatment

# Febrile Neutropenia

## Rx Treatment

### Clinical Considerations

- Antibiotic treatment should consider the most likely site of infection, local prevalence of resistance and individual risk factors for resistant pathogens (especially ESBL, carbapenemase-producing isolates and MRSA)
- In addition to antibiotic treatment, it is important that source control is achieved; consider removal of an infected Central Venous Catheter
- If fever persists and there is no clinical improvement after 48-72 hours, consider further tests to identify source or assess whether a local complication has developed (consider a resistant organism or non-bacterial infection)

#### Patients with severe neutropenia (<500 cells/ $\mu$ L or <0.5 x 10<sup>9</sup>/L) who develop fever:

- Should promptly receive antibiotic treatment even when a clear site of infection is not identified

#### Low-risk patients:

- Outpatient setting with monitoring and follow-up, if oral treatment tolerated

#### High-risk patients (or close follow-up unfeasible):

- Hospitalization and initial IV treatment
- Step down from IV to oral antibiotics is suggested when the patient has clinically improved, is afebrile and is able to tolerate oral treatment

### Antibiotic Treatment Duration

Low Risk Patients: **7 days**

High Risk Patients: Until clinical signs of infection resolved AND no fever for at least 48 hours

- Mostly depends on clinical response and (if identified) infectious site and causative pathogen
- Current evidence suggests discontinuation based on clinical approach and not neutrophil count

**Important:** If using combination therapy, reassess the need to continue combination over time based on microbiology test results and clinical response

## Rx Low Risk

All dosages are for normal renal function

**ACCESS** Amoxicillin+clavulanic acid 40-50 mg/kg/dose of amoxicillin component q12h OR 30 mg/kg/dose q8h **ORAL**

#### • Oral weight bands:

3-<6 kg	250 mg of amox/dose q12h
6-<10 kg	375 mg of amox/dose q12h
10-<15 kg	500 mg of amox/dose q12h
15-<20 kg	750 mg of amox/dose q12h
20-<30 kg	1000 mg of amox/dose q12h
≥30 kg	Use adult dose

Amox = amoxicillin

Oral liquid must be refrigerated after reconstitution

#### CONSIDER ADDING

**WATCH** Ciprofloxacin 10-20 mg/kg/dose q12h **ORAL**

#### • Oral weight bands:

3-<6 kg	50 mg q12h
6-<10 kg	100 mg q12h
10-<15 kg	150 mg q12h
15-<20 kg	200 mg q12h
20-<30 kg	300 mg q12h
≥30 kg	Use adult dose

## Rx High Risk

All dosages are for normal renal function

### First Choice

**WATCH** Piperacillin+tazobactam 100 mg/kg/dose of piperacillin component q8h **IV**

### Second Choice

**WATCH** Meropenem 20 mg/kg/dose q8h **IV**

Consider meropenem only in settings with high prevalence of ESBL-producing Enterobacterales or in patients with known prior colonization or infection with resistant pathogens

#### CONSIDER ADDING TO EITHER REGIMEN

**ACCESS** Amikacin 15 mg/kg q24h **IV**

If resistant Gram-negative bacteria suspected

AND/OR

**WATCH** Vancomycin **IV**  
 • Neonates: 15 mg/kg/dose q12h  
 • Children: 15 mg/kg/dose q8h

If MRSA suspected



# Surgical Prophylaxis

Page 1 of 2

## ? Definition

Prevention of infectious complications by administering an effective antibiotic before exposure to contamination during surgery

### Types of surgical procedures:

- **Clean:** Respiratory, alimentary, genital or urinary tracts are not entered during surgery
- **Clean-contaminated:** Respiratory, alimentary, genital or urinary tracts are entered under controlled conditions and without unusual contamination
- **Contaminated:** Significant interruptions in sterile technique or gross spillage from the gastrointestinal tract

**WHO guidelines for the prevention of surgical site infections:** <https://apps.who.int/iris/handle/10665/277399>

## 🌐 Most Likely Pathogens

Depends on the anatomical site of the procedure; often bacteria belonging to the human microbiota

## Rx Antibiotic Prophylaxis Before Surgical Procedures (Section 1 of 2)

### ✓ Clinical Considerations

- Choice of antibiotic prophylaxis depends on the type and anatomical site of surgical procedure
- Patients colonized with multidrug-resistant Gram-negative bacteria: Lack of high-quality evidence to support expanding the spectrum of antibiotic prophylaxis; decisions usually made on a case-by-case basis
- Patients colonized with MRSA who will have a skin incision: Consider adding vancomycin to the routine recommended surgical regimen

### 🕒 Timing of Antibiotic Prophylaxis

#### 120 minutes or less before starting surgery

Single dose before surgery. Do not continue the antibiotic after the surgical procedure to prevent infection. Consider an additional dose only for prolonged procedures or if major blood loss.

## Rx Bowel Surgery

*Includes appendectomy, small intestine and colorectal surgical procedures*

*All dosages are for normal renal function*

### First Choice

ACCESS Cefazolin 2 g single dose **IV**

COMBINED WITH

ACCESS Metronidazole 500 mg single dose **IV**

### Second Choice

ACCESS Amoxicillin+clavulanic acid 2 g+200 mg single dose **IV**

# Surgical Prophylaxis


Page 2 of 2

## Rx Antibiotic Prophylaxis Before Surgical Procedures (Section 2 of 2)


### Rx Clean or Clean-Contaminated Procedure

All dosages are for normal renal function

#### First Choice

 Cefazolin 2 g single dose **IV**


#### Second Choice

 Cefuroxime 1.5 g single dose **IV**


### Rx Urologic Procedure

All dosages are for normal renal function

#### First Choice

 Cefazolin 2 g single dose **IV**


#### Second Choice

 Gentamicin 5 mg/kg single dose **IV**

### Rx Contaminated Procedure

All dosages are for normal renal function


#### First Choice

 Cefazolin 2 g single dose **IV**


COMBINED WITH

 Metronidazole 500 mg single dose **IV**

#### Second Choice

 Amoxicillin+clavulanic acid 2 g+200 mg single dose **IV**

OR

 Gentamicin 5 mg/kg single dose **IV**

COMBINED WITH

 Metronidazole 500 mg single dose **IV**

*Gentamicin should be given in combination with metronidazole because, if given alone, it provides insufficient coverage of anaerobic bacteria*

# Surgical Prophylaxis

Page 1 of 2

## ? Definition

Prevention of infectious complications by administering an effective antibiotic before exposure to contamination during surgery

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- **Clean:** Respiratory, alimentary, genital or urinary tracts are not entered
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**WHO guidelines for the prevention of surgical site infections:** <https://apps.who.int/iris/handle/10665/277399>

## 🌐 Most Likely Pathogens

Depends on the anatomical site of the procedure; often bacteria belonging to the human microbiota

## Rx Antibiotic Prophylaxis Before Surgical Procedures (Section 1 of 2)

### ☑️ Clinical Considerations

- Choice of antibiotic prophylaxis depends on the type and anatomical site of surgical procedure
- Patients colonized with multidrug-resistant Gram-negative bacteria: Lack of high-quality evidence to support expanding the spectrum of antibiotic prophylaxis; decisions usually made on a case-by-case basis
- Patients colonized with MRSA who will have a skin incision: Consider adding vancomycin to the routine recommended surgical regimen

### 🕒 Timing of Antibiotic Prophylaxis

#### 120 minutes or less before starting surgery


Single dose before surgery. Do not continue the antibiotic after the surgical procedure to prevent infection. Consider an additional dose only for prolonged procedures or if major blood loss.

## Rx Bowel Surgery


*Includes appendectomy, small intestine and colorectal surgical procedures*

*All dosages are for normal renal function*


### First Choice

 Cefazolin 50 mg/kg single dose **IV**

COMBINED WITH

 Metronidazole 7.5 mg/kg single dose **IV**

### Second Choice

 Amoxicillin+clavulanic acid 40-50 mg/kg of amoxicillin component single dose **IV**

# Surgical Prophylaxis


Page 2 of 2

## R<sub>x</sub> Antibiotic Prophylaxis Before Surgical Procedures (Section 2 of 2)


### R<sub>x</sub> Clean or Clean-Contaminated Procedure

All dosages are for normal renal function

#### First Choice

 Cefazolin 50 mg/kg single dose IV


#### Second Choice

 Cefuroxime 50 mg/kg single dose IV


### R<sub>x</sub> Urologic Procedure

All dosages are for normal renal function

#### First Choice

 Cefazolin 50 mg/kg single dose IV


#### Second Choice

 Gentamicin single dose IV  
 • Neonates: 5 mg/kg  
 • Children: 7.5 mg/kg


### R<sub>x</sub> Contaminated Procedure

All dosages are for normal renal function


#### First Choice

 Cefazolin 50 mg/kg single dose IV


COMBINED WITH

 Metronidazole 7.5 mg/kg single dose IV

#### Second Choice

 Amoxicillin+clavulanic acid 40-50 mg/kg of amoxicillin component single dose IV

OR

 Gentamicin single dose IV  
 • Neonates: 5 mg/kg  
 • Children: 7.5 mg/kg

COMBINED WITH

 Metronidazole 7.5 mg/kg single dose IV

*Gentamicin should be given in combination with metronidazole because, if given alone, it provides insufficient coverage of anaerobic bacteria*



# Reserve Antibiotics

# Cefiderocol

## Rx Pharmacology

- Siderophore cephalosporin
- **Mechanism of Action:** Inhibition of bacterial enzymes responsible for cell-wall synthesis

## 🔒 Indications for Use

### ✓ Targeted Treatment

- Severe infections caused by laboratory-confirmed carbapenem-resistant Enterobacterales and/or *P. aeruginosa* (particularly infections caused by MBL-producing pathogens)
- Caution needed with *A. baumannii* infections because of higher mortality than best available alternative therapy described in a clinical trial (<https://pubmed.ncbi.nlm.nih.gov/33058795/>)

### ⊖ Empiric Use

- Only in very selected cases of seriously ill patients (e.g. sepsis/septic shock):
  - who have not responded to carbapenems if other causes of treatment failure have been excluded first and there is strong suspicion that the infection is caused by a carbapenem-resistant pathogen (especially in settings with a high prevalence of MBL-producing pathogens)
  - who have previously been treated for infections caused by carbapenem-resistant pathogens susceptible to cefiderocol
  - who are known to be colonized with carbapenem-resistant pathogens susceptible to cefiderocol

### ! Important Considerations

- Efficacy demonstrated in clinical trials for empiric use for complicated UTI, VAP/HAP, BSI and sepsis in adults
- Very limited evidence for other infections and use in children

## 📄 Formulations

- Intravenous formulation: 1 g/vial

## 🌐 Spectrum of Activity

- **Active against:**
  - Aerobic Gram-negative bacteria including many carbapenem-resistant Enterobacterales, *Pseudomonas aeruginosa* and *Acinetobacter baumannii*
    - Carbapenemases: KPC, OXA-48 and metallo-β-lactamases (MBL)
    - ESBL and AmpC β-lactamases
- **Not active against:**
  - Gram-positive bacteria and anaerobes
- **New resistance to Cefiderocol in Enterobacterales, *A. baumannii* and *P. aeruginosa*:**
  - The proportion of isolates resistant to cefiderocol is low but data is very limited

## ⚠️ Toxicity

- Well tolerated with side effects similar to other beta-lactams (mostly gastrointestinal)

## 🔑 Dose

### 🕒 Antibiotic Treatment Duration

- Treatment duration varies according to indication and should be as short as possible
- Usually between **7-14 days**

### 👤 Adults

Dosage is for normal renal function

 Cefiderocol 2 g q8h **IV**

### 👶 Children or Neonates

No data for children or neonates

# Ceftazidime+Avibactam

## Rx Pharmacology

- Combination of a third-generation cephalosporin (ceftazidime) and a novel non- $\beta$ -lactam  $\beta$ -lactamase inhibitor (avibactam)
- **Mechanism of Action:**
  - Ceftazidime inhibits bacterial enzymes responsible for cell-wall synthesis
  - Avibactam inactivates certain serine  $\beta$ -lactamases, protecting ceftazidime from degradation

## Indications for Use

### ✓ Targeted Treatment

- Severe infections caused by laboratory-confirmed carbapenem-resistant Enterobacterales or *P. aeruginosa* (not *A. baumannii*) susceptible to ceftazidime+avibactam (CAZ-AVI)

### ⊖ Empiric Use

- Only in very select cases of seriously ill patients (e.g. patients with sepsis/septic shock):
  - who have not responded to carbapenems if other causes of treatment failure have been excluded first and there is strong suspicion that the infection is caused by a carbapenem-resistant pathogen
  - who have previously been treated for infections caused by carbapenem-resistant pathogens susceptible to CAZ-AVI
  - who are known to be colonized with carbapenem-resistant pathogens susceptible to CAZ-AVI

### ! Important Considerations

- When used to treat complicated intra-abdominal infections CAZ-AVI should be given with metronidazole due to its unpredictable activity against anaerobes
- Since it is not active against metallo- $\beta$ -lactamases, it is important to know the local epidemiology of the most prevalent genotypes for aerobic Gram-negative bacteria

## Formulations

- CAZ-AVI is currently available as intravenous/intramuscular formulation
  - Powder for injection: 2 g + 500 mg in vial

## ! Toxicity

- Side effects are similar to those previously reported for ceftazidime alone
- The most frequent are diarrhoea, nausea and vomiting

## Spectrum of Activity

- **Active against:**
  - Aerobic Gram-negative bacteria including ceftazidime-resistant and many carbapenem-resistant isolates Enterobacterales and *Pseudomonas aeruginosa*
    - Carbapenemases: KPC and OXA-48
    - ESBL and AmpC  $\beta$ -lactamases
- **Variable activity against:**
  - *Acinetobacter* spp.
  - *Streptococcus* spp.
  - *Staphylococcus* spp.
  - Anaerobes
- **Not active against:**
  - Metallo- $\beta$ -lactamase-producing Gram-negative bacteria (inactive against NDM, VIM, IMP carbapenemases)
  - *Enterococcus* spp.
- **New resistance to CAZ-AVI in Enterobacterales and *Pseudomonas aeruginosa*:**
  - The proportion of isolates resistant to CAZ-AVI is low (higher for *P. aeruginosa*) with geographical variability


## Dose

### ⌚ Antibiotic Treatment Duration

- Treatment duration varies according to indication and should be as short as possible
- Usually between **7-14 days**


### 👤 Adults

All dosages are for normal renal function; dose adjustment required in case of renal impairment

 Ceftazidime+avibactam 2.5 g (2g ceftazidime + 500 mg avibactam) q8h **IV/IM**


### 👨‍👩‍👧 Children

All dosages are for normal renal function; dose adjustment required in case of renal impairment

 Ceftazidime+avibactam 62.5 mg/kg (Max 2.5 g) q8h **IV/IM**

### 👶 Neonates

All dosages are for normal renal function; dose adjustment required in case of renal impairment

 Ceftazidime+avibactam 62.5 mg/kg q8h **IV/IM**

# Fosfomycin

This infographic only addresses the IV formulation of fosfomycin. Oral formulations are not currently included in the EML/EMLc

## Rx Pharmacology

- Antibiotic belonging to the class of phosphonic acid antibiotics
- **Mechanism of Action:** Inhibition of bacterial enzymes responsible for cell-wall synthesis

## 🔒 Indications for Use

### ✓ Targeted Treatment

- Severe infections caused by laboratory-confirmed carbapenem-resistant Enterobacterales, *P. aeruginosa* or *A. baumannii* susceptible to fosfomycin
- Salvage therapy for otherwise untreatable infections caused by MRSA and vancomycin-resistant *Enterococcus* (VRE) susceptible to fosfomycin

### ⊖ Empiric Use

- Only in very select cases of seriously ill patients (e.g. sepsis/septic shock):
  - who have not responded to carbapenems if other causes of treatment failure have been excluded and there is strong suspicion that the infection is caused by a carbapenem-resistant pathogen
  - who have previously been treated for infections caused by carbapenem-resistant pathogens susceptible to fosfomycin
  - who are known to be colonized with carbapenem-resistant pathogens susceptible to fosfomycin

### ! Important Considerations

- Usually given in combination with other antibiotics due to concerns about the rapid emergence of resistance when used alone
- Very limited data from clinical trials about efficacy and safety (children and adults)

## 💉 Formulations

- Intravenous formulation
- Powder for injection: 2 g/vial or 4 g/vial (as sodium)

## 🌐 Spectrum of Activity

- **Active against:**
  - Aerobic Gram-negative bacteria including many carbapenem-resistant Enterobacterales
    - Carbapenemases: KPC, OXA-48 and metallo-β-lactamases (MBL)
    - ESBL and AmpC β-lactamases
  - Gram-positive bacteria including MRSA, VRE and *S. epidermidis*
- **Variable activity against:**
  - *Acinetobacter baumannii*
  - *Pseudomonas aeruginosa*
- **New resistance to fosfomycin in Enterobacterales:**
  - Rare in clinical practice even though it can rapidly develop *in vitro*

## ⚠️ Toxicity

- Generally well tolerated
- Consider risk of:
  - Sodium overload in patients with heart failure (related to the sodium salt formulation)
  - Hypokalaemia (need to monitor potassium levels regularly)

## 🔑 Dose

### 🕒 Antibiotic Treatment Duration

- Treatment duration varies according to indication and should be as short as possible
- Usually between **7-14 days**

### 👤 Adults

- Fosfomycin 6 g q8h **IV**
- Total daily dose may vary: range 12-24 g depending on indication and renal function

### 👨‍👩‍👧 Children

- Fosfomycin 200-400 mg/kg/day divided q6-8h **IV**

### 👶 Neonates

- Fosfomycin 200 mg/kg/day divided q8h **IV**



# Linezolid

## Rx Pharmacology

- Synthetic antibiotic of the oxazolidinone class
- **Mechanism of Action:** Inhibition of bacterial protein synthesis

## Spectrum of Activity

- **Active against:**
  - Gram-positive bacteria including MRSA, VRE and penicillin non-susceptible pneumococci
  - *Mycobacterium tuberculosis* including extensively drug-resistant strains
- **Not active against:**
  - Gram-negative bacteria
  - Anaerobes
- **New resistance to Linezolid in MRSA, VRSA, VRE:**
  - Reported but remains low

## Indications for Use

### ✓ Targeted Treatment

- MRSA infections in selected situations:
  - Severe renal impairment
  - Hypersensitivity to vancomycin
  - Need to use oral treatment and other cheaper oral options are unavailable or not indicated
- VRSA or VRE infections
- Mycobacterial infections, including extensively drug-resistant *M. tuberculosis* (second-line option)

### ⊖ Empiric Use

Only in very selected cases of seriously ill patients with invasive infections who are known to be colonized with VRE or VRSA

### ! Important Considerations

As Reserve antibiotic, appropriateness of use of linezolid should be monitored by antibiotic stewardship programs

## Formulations

- Intravenous formulation: 2 mg/mL in 300 mL bag
- Oral formulations:
  - Tablet: 400 mg; 600 mg
  - Tablet (dispersible): 150 mg
  - Powder for oral liquid: 100 mg/5 mL

## ! Toxicity

- Generally well tolerated, risks increase with prolonged use (>4 weeks)
- Consider risk of:
  - Myelosuppression (mostly thrombocytopenia)
    - Monitor complete blood cell count every week
  - Severe optic neuropathy and peripheral neuropathy (both rare)

## Dose

### ⌚ Duration

Treatment duration varies according to indication and should be as short as possible (increased risk of side effects if used for >4 weeks)


### 👤 Adults

All dosages are for normal renal function; no need to adjust the dose in case of renal impairment

 Linezolid 400-600 mg q12h **IV/ORAL**


### 👨‍👩‍👧 Children

All dosages are for normal renal function; no need to adjust the dose in case of renal impairment

 Linezolid 10 mg/kg q8h **IV/ORAL**

### 👶 Neonates

All dosages are for normal renal function; no need to adjust the dose in case of renal impairment

 Linezolid **IV/ORAL**

- 1st week of life: 10 mg/kg q12h
- >1st week of life: 10 mg/kg q8h

# Meropenem+Vaborbactam

## Rx Pharmacology

- Combination of a carbapenem (meropenem) and a new  $\beta$ -lactamase inhibitor (vaborbactam)
- **Mechanism of Action:**
  - Meropenem inhibits bacterial enzymes responsible for cell wall synthesis
  - Vaborbactam inactivates certain serine  $\beta$ -lactamases, thus protecting meropenem from degradation

## 🔒 Indications for Use

### ✓ Targeted Treatment

- Severe infections caused by laboratory-confirmed KPC-producing Enterobacterales, including bacteria resistant to ceftazidime+avibactam but susceptible to meropenem+vaborbactam

### ⊖ Empiric Use

- Only in very selected cases of seriously ill patients (e.g. sepsis/septic shock):
  - who have not responded to carbapenems if other causes of treatment failure have been excluded and there is strong suspicion that the infection is caused by a carbapenem-resistant pathogen
  - who have previously been treated for infections caused by carbapenem-resistant pathogens susceptible to meropenem+vaborbactam
  - who are known to be colonized with carbapenem-resistant pathogens susceptible to meropenem+vaborbactam

### ! Important Considerations

- Since it is not active against metallo- $\beta$ -lactamases (Ambler class B) or class D carbapenemases (such as OXA-48), it is important to know the local epidemiology of the most prevalent genotypic variants for aerobic Gram-negative bacteria

## 💉 Formulations

- Intravenous formulation: 1 g+1 g in vial

## 🌐 Spectrum of Activity

- **Active against:**
  - Aerobic Gram-negative bacteria including many carbapenem-resistant Enterobacterales
    - KPC Carbapenemases
    - ESBL and AmpC  $\beta$ -lactamases
  - Aerobic Gram-positive bacteria
  - Anaerobes
- **Variable activity against:**
  - *Acinetobacter baumannii*
  - *Pseudomonas aeruginosa*
- **Not active against:**
  - Gram-negative bacteria producing metallo- $\beta$ -lactamases (NDM, VIM, IMP) or Ambler class D carbapenemases (such as OXA-48)
- **New resistance to Meropenem+vaborbactam in Enterobacterales, *Acinetobacter baumannii* and *Pseudomonas aeruginosa*:**
  - Very rare in clinical practice

## ⚠️ Toxicity

- Generally well tolerated
- Side effects similar to meropenem alone


## 🔑 Dose

### 🕒 Antibiotic Treatment Duration

- Treatment duration varies according to indication and should be as short as possible
- Usually between **7-14 days**

### 👤 Adults

Dosage is for normal renal function; dose adjustment required in case of renal impairment

 Meropenem+vaborbactam 4 g (2 g meropenem + 2 g vaborbactam) q8h **IV**

### 👶 Children or Neonates

Currently not licensed for use in children or neonates

# Plazomicin

## Pharmacology

- New semisynthetic aminoglycoside
- **Mechanism of Action:** Inhibition of bacterial protein synthesis

## Indications for Use

### Targeted Treatment

- Severe infections caused by laboratory-confirmed carbapenem-resistant Enterobacterales susceptible to plazomicin (not *P. aeruginosa* or *A. baumannii*)
- Infections caused by Gram-negative bacteria resistant to other aminoglycosides

### Empiric Use

- Only in very selected cases of seriously ill patients (e.g. sepsis/septic shock caused by urinary tract infections if used as monotherapy - for other infections aminoglycosides are usually used in combination with other antibiotics):
  - who have not responded to carbapenems if other causes of treatment failure have been excluded first and there is strong suspicion that the infection is caused by a carbapenem-resistant pathogen
  - who have previously been treated for infections caused by carbapenem-resistant pathogens susceptible to plazomicin
  - who are known to be colonized with carbapenem-resistant pathogens susceptible to plazomicin

### Important Considerations

- Efficacy demonstrated in clinical trials only for complicated urinary tract infections in adults
- Very limited evidence for other infections and use in children

## Formulations

- Intravenous or intramuscular formulations
- Injection: 500 mg/10 mL

## Spectrum of Activity

- **Active against:**
  - Aerobic Gram-negative bacteria including many carbapenem-resistant Enterobacterales
    - Carbapenemases: KPC and OXA-48
    - ESBL and AmpC  $\beta$ -lactamases
  - Bacteria producing aminoglycoside-modifying enzymes
- **Variable activity against:**
  - Strains producing metallo- $\beta$ -lactamases can be susceptible to plazomicin
  - *Acinetobacter baumannii*
  - *Pseudomonas aeruginosa*
- **New resistance to Plazomicin in Enterobacterales:**
  - Very limited data

## Toxicity

- Side effects similar to other aminoglycosides
- The most frequent are:
  - Kidney damage (monitor creatinine levels regularly)
  - Hearing loss and vestibular toxicity


## Dose

### Antibiotic Treatment Duration

- Treatment duration varies according to indication and should be as short as possible
- Usually between **7-14 days**

### Adults

*Weight-based once-daily dosing is used; dosage is for normal renal function*

 Plazomicin 15 mg/kg q24h **IV/IM**

### Children or Neonates

*No data for children or neonates*

# Polymyxin B and Colistin (Polymyxin E)

This infographic only addresses the IV formulation of fosfomycin. Oral formulations are not currently included in the EML/EMLc

## Rx Pharmacology

- Polymyxin B and colistin are polypeptides belonging to the polymyxin class of antibiotics
- Polymyxin B and colistin have very similar chemical structures, however:
  - Polymyxin B is administered directly as the active antibiotic
  - Colistin is administered as inactive prodrug (colistimethate)
- **Mechanism of Action:** Polymyxin B and colistin act by disrupting the bacterial cell membrane, leading to cell lysis

## Spectrum of Activity

- Polymyxin B and colistin have the same antibacterial spectrum
- **Active against:**
  - Aerobic Gram-negative bacteria (including many multi-drug resistant isolates)
- **Not active against:**
  - Anaerobes
  - Gram-positive bacteria
  - Gram-negative cocci (e.g. *Neisseria* spp.)
- **New resistance to Polymyxins in Enterobacterales, *Acinetobacter baumannii* and *Pseudomonas aeruginosa*:**
  - Resistance can be due to chromosomal mutations leading to changes in the bacterial membrane that impair the ability of polymyxin B and colistin to bind to their target
  - Transmissible resistance due to mobilized colistin resistance (*mcr*) genes is also being increasingly described

## Formulations

- Intravenous formulation
  - *Polymyxin B*: Powder for injection 50 mg (500 000 IU) in vial
  - *Colistin*: Powder for injection 80 mg of colistin base activity (1 million IU of colistimethate) in vial

## ! Toxicity

- Polymyxin B and colistin can cause kidney damage (colistin > polymyxin B) and, more rarely, neurotoxicity (e.g. paresthesia)
- Side effects are reversible in most cases and are associated with the cumulative dose and duration of therapy

## 📋 Indications for Use

### ✓ Targeted Treatment

- Severe infections caused by laboratory-confirmed carbapenem-resistant Gram-negative bacteria susceptible to polymyxins (including infections caused by carbapenemase-producing strains susceptible to polymyxins)

### 🚫 Empiric Use

- Only in very selected cases of seriously ill patients (e.g. patients with sepsis/septic shock):
  - who have not responded to carbapenems if other causes of treatment failure have been excluded first and there is a strong suspicion that the infection is caused by a carbapenem-resistant pathogen
  - who have previously been treated for infections caused by carbapenem-resistant pathogens susceptible to polymyxins
  - who are known to be colonized with carbapenem-resistant pathogens susceptible to polymyxins

### ! Important Considerations

- If both are available, polymyxin B is usually preferred to colistin (**important:** except for urinary tract infections) because it has better pharmacokinetic characteristics and less potential to cause kidney damage
- Usually given as part of combination therapy depending on the type of infection even though currently there is no evidence from randomized clinical trials that combination therapy was superior to colistin monotherapy for short-term clinical success – at least for infections caused by extensively drug-resistant *Acinetobacter* spp.

# Polymyxin B and Colistin (Polymyxin E)

## Dose

### Clinical Considerations

• Great care must be taken to avoid dosing errors with polymyxin B and colistin; errors can arise because doses can be given in different units on labels

• **Polymyxin B doses** can be expressed in:

- mg
- International Units (IU)
- 1 mg of polymyxin B corresponds to 10 000 IU

• **Colistin (polymyxin E) doses** can be expressed in:

- International Units (IU) of colistimethate
- mg of colistimethate
- mg of colistin base activity
- 34 mg of colistin base activity correspond to:
  - 1 million IU of colistimethate
  - 80 mg of colistimethate

• When using polymyxins, it is crucial to start therapy with a loading dose (to achieve more rapidly effective plasma concentrations) followed by maintenance dose after 12-24 hours

• For colistin (but not for polymyxin B), dose adjustments are necessary in cases of renal impairment

### Antibiotic Treatment Duration


• Treatment duration varies according to indication and should be as short as possible

• Usually between **7-14 days**


### Adults

*All dosages are for normal renal function*

#### Polymyxin B

-  **Polymyxin B IV**
- Loading dose: 2.5 mg/kg (25 000 IU/kg)
  - Maintenance dose: 1.5 mg/kg (15 000 IU/kg) q12h

#### Colistin


-  **Colistin IV**
- Loading dose: 300 mg colistin base activity (9 Million IU of colistimethate)
  - Maintenance dose: 150 mg colistin base activity q12h (4.5 Million IU q12h)

### Children


*All dosages are for normal renal function*

*Few data are available for dosing in children; doses approved by regulatory agencies may be suboptimal for many children due to interpatient variability*

#### Polymyxin B

-  **Polymyxin B IV**
- Loading dose: 2.5 mg/kg (25 000 IU/kg)
  - Maintenance dose:
    - Children <2 years: 1.5-4.5 mg/kg/day (15 000-45 000 IU/kg/day) divided q12h
    - Children ≥2 years: 1.5 mg/kg (15 000 IU/kg) q12h


#### Colistin

-  **Colistin 2.5-5 mg (75 000-150 000 IU) /kg/day divided q6 to 12h IV**


### Neonates

*All dosages are for normal renal function*

#### Polymyxin B

-  **Polymyxin B IV**
- Loading dose: 2.5 mg/kg (25 000 IU/kg)
  - Maintenance dose: 1.5-4.5 mg/kg/day (15 000-45 000 IU/kg/day) divided q12h

#### Colistin

-  **Colistin 2.5-5 mg (75 000-150 000 IU)/kg/day divided q6 to 12h IV**