# Table of Contents

1. Pulmonary Embolism 3-5
2. AECOPD 6-9
3. CAP 10-11
4. HAP/VAP 12-13
5. Acute uncomplicated pharyngitis 14
6. Unexplained dyspnea 15-19
7. Acute cough 20
8. Acute exacerbation of asthma 21-23
9. Pneumothorax 24-27
10. Hemoptysis 28-29
11. Oxygenation in Acute respiratory failure 30-32
12. ABG 33-34
13. Acute uncomplicated rhinosinusitis 35-36
PULMONARY EMBOLISM

Diagnostic algorithm:

1. Clinical signs and symptoms of DVT (minimum of leg swelling and pain elicited upon palpation of deep veins)
2. No alternative diagnosis more likely than PE
3. Heart rate >100
4. Immobilization at least 3 days, or surgery in previous 4 weeks
5. Previous DVT or PE
6. Haemoptysis
7. Malignancy (on treatment, treated in last 6 months or palliative)

Simplified Wells Score

- PE likely if ≥500 ng/mL
- PE unlikely if <500 ng/mL

Quantitative Whole Blood D dimer assay

Imaging recommended

NO to ANY

<500 ng/mL

No further investigation to exclude PE

Arrange data for V/Q or CTPA
Start daily SC LMWH

Normal CXR

V/Q Scan

CTPA

Normal
High probability

Low or intermediate probability

PE excluded

Positive

B/L USG leg

Treat as PE

Abnormal CXR, previous PE or haemodynamic instability

Negative
Well’s criteria is a risk stratification and clinical decision rule to estimate the probability of PE in patients with history and examination suggesting acute PE as a diagnostic possibility.

**Investigations**

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Details</th>
</tr>
</thead>
</table>
| CXR           | Normal CXR  
|               | Rate atelectasis  
|               | Hampton hump (pleural-based opacity)  
|               | Small pleural effusion  
|               | Elevated hemidiaphragm  
|               | Heilshier's sign (prominent amputated pulmonary artery)  
|               | Westermann's sign (peripheral oligoemia)  
|               | The more abnormal the CXR, the less likely is PE  
|               | Normal CXR in a breathless hypoxic person in the absence of bronchospasm means that PE is likely |
| ECG           | Sinus tachycardia  
|               | Nonspecific T-wave changes  
|               | P-pulmonale  
|               | RV strain  
|               | Right bundle branch block  
|               | S1, S3, T3 (deep S-wave in lead I, Q-wave in lead II and T-wave inversion in lead III)  
|               | ECG is very useful at revealing alternative diagnoses (e.g. myocardial infarction) |
| ABGs          | Hypoxaemia, hypoponpia and increased P–aO2.  
|               | Can be normal in PE, especially in young people with good pulmonary reserve |
| o-dimer       | o-dimer should always be considered with the clinical probability  
|               | Negative o-dimer is useful in excluding PE in the setting of low clinical probability and obviate the need for further imaging  
|               | o-dimer is not recommended to be used when the clinical probability of PE is high, as it is unlikely to influence the decision for further imaging and would most likely be positive. |
| CUS           | Leg ultrasound study can be helpful as an adjunctive test to nondiagnostic imaging (V/Q or CTPA) in diagnosis of PE.  
|               | A high V/Q scan probably indicates that PE is very likely, especially when combined with a high clinical probability.  
|               | Normal or near-normal V/Q scan virtually excludes PE.  
|               | Nondiagnostic scans occur in most of the patients undergoing V/Q scanning, especially when there is cardiopulmonary disease or abnormal CXR; these patients should be investigated further |
| CTPA          | CTPA is easier to read than V/Q scanning, even in the presence of cardiopulmonary disease or abnormal CXR; CTPA has now replaced V/Q scanning as the screening diagnostic test for PE in many institutions.  
|               | The diagnosis of PE using CTPA can be improved if CUS is used as an adjunctive test and clinical probability is taken into account.  
|               | It is safe to withhold anticoagulant therapy after a negative CTPA and a negative CUS if the clinical probability is low.  
|               | It is also probably safe to withhold anticoagulant therapy after a negative CTPA and a negative CUS with intermediate clinical probability, although this approach should be considered with caution.  
|               | The chance of missing PE with a negative CTPA and a negative CUS in patients with high clinical probability is relatively high and further evaluation is warranted in these patients. |
| Troponin-T and I | Can be raised in severe PE  
|               | Can not be used to rule out PE, but can be used in risk stratification of PE to identify low-risk patients with PE who can be treated as outpatients |
| BNP           | Elevated levels of BNP are associated with RV dysfunction in PE  
|               | It can be used in risk stratification of PE severity |

**Anticoagulation at ER before disposition:**

1. Enoxaparin (Clexane) 1 mg/kg s.c. BD (CrCl >30) or OD (CrCl <30) stat (cont. min. 5 days)
2. Tab. Warfarin 5 mg PO stat and continue 2.5-5 mg PO OD (Target INR: 2-3)

Epomedicine.com
References:


Further Reading:
AECOPD

Empiric Antibiotics for 5-7 days (1):

Antibiotics should only be started or continued in patients with signs and symptoms of a bacterial infection that include the following:

1) Increased dyspnea, increased purulence of sputum, and increased volume of sputum OR
2) Ventilator support (invasive or non-invasive) for AECOPD

Patients with a PCT <0.1 ng/mL are unlikely to benefit from antibiotic administration

- **Mild exacerbation (no respiratory failure*, FEV₁ >50% predicted, < 3 exacerbations/year)**
  - 1<sup>st</sup> line: Doxycycline 100 mg PO BID OR Cefuroxime 500 mg PO BID
  - 2<sup>nd</sup> line: Azithromycin 500 mg PO daily*

- **Moderate exacerbation (non-life-threatening respiratory failure*, FEV₁ 36-50%, ≥ 3 exacerbations/year, ≥ 65 years of age)**
  - 1<sup>st</sup> line: Amoxicillin-clavulanate 875-125 mg PO BID OR Doxycycline 100 mg PO BID
  - 2<sup>nd</sup> line: Azithromycin 500 mg PO daily*

- **Severe exacerbation (life-threatening respiratory failure*, FEV₁ ≤35%, ≥ 3 exacerbations/year, ≥ 65 years of age) OR Requires ventilator support:**
  - No risk factors for *Pseudomonas aeruginosa*:
    - Ceftriaxone 1 gram IV every 24 hours (>80 kg: Ceftriaxone 2 grams IV every 24 hours)
    - Severe beta-lactam allergy: Levofloxacin 750 mg po or IV every 24 hours**
  - Risk factors for *Pseudomonas aeruginosa* (see Table 1):
    - 1<sup>st</sup> line: Cefepime 1 gram IV every 6 hours
    - 2<sup>nd</sup> line: Piperacillin-tazobactam 4.5 grams IV every 8 hours
    - Severe beta-lactam allergy: Aztreonam 2 grams IV every 8 hours + levofloxacin 750 mg po or IV every 24 hours**

+ Respiratory status adapted from the 2017 GOLD guidelines. See Table 1. For patients with re-admission within 30 days or recurrent AECOPD, consider expert consultation with a pulmonologist.

* Consider ECG prior to initiating, especially if other QTc-prolonging medications are present. Alternate therapy may need to be considered in patients at high risk of cardiovascular events.

**Table 1 - Risk factors for Pseudomonas:**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Antibiotics in past 90 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchiectasis</td>
<td></td>
</tr>
<tr>
<td>Prior <em>Pseudomonas</em> respiratory culture</td>
<td>History of intubation</td>
</tr>
<tr>
<td>Systemic steroids</td>
<td>Frequent exacerbations</td>
</tr>
<tr>
<td>Residence in a longterm care facility</td>
<td>Immunocompromised</td>
</tr>
</tbody>
</table>
Classification of Acute Exacerbation of COPD: (2)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>No respiratory failure</th>
<th>Acute respiratory failure – non-life threatening</th>
<th>Acute respiratory failure – life threatening</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR (/min)</td>
<td>20-30</td>
<td>&gt;30</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Accessory muscles of respiration</td>
<td>Unused</td>
<td>Used</td>
<td>Used</td>
</tr>
<tr>
<td>Mental status</td>
<td>Normal</td>
<td>Normal</td>
<td>Altered</td>
</tr>
<tr>
<td>Hypoxemia</td>
<td>Improved with oxygen via nasal cannula</td>
<td>Improved with oxygen via nasal cannula</td>
<td>Requires more than nasal cannula (FiO2 &gt;40%)</td>
</tr>
<tr>
<td>Hypercarbia</td>
<td>Absent</td>
<td>50-60 mmHg</td>
<td>&gt;60 mmHg or pH ≤7.25</td>
</tr>
</tbody>
</table>

Defer sputum cultures unless risk factors for pseudomonas are present or treatment failure of AECOPD.

Patients diagnosed with pneumonia should be treated with the antibiotics appropriate for the diagnosis.

Management (2):

1. Resuscitation
2. Oxygen therapy as per Acute respiratory failure in protocol (Target SpO2 88-92%)
3. Salbutamol 2.5-5 mg +/- Ipratropium 0.5 mg via nebulizer or 2-4 puffs from MDI every hour for 2-3 doses, then every 2-4 hours based on response (Withold long acting bronchodilators).
4. Consider use of long-acting bronchodilators when the patient becomes stable.
5. Tab. Prednisone 40 mg PO or Inj. Methylprednisolone 40 mg IV OD X 5 days.
6. Consider non-invasive or invasive mechanical ventilation (as indicated).
7. Others (3):
   a. Monitor fluid balance
   b. Consider subcutaneous heparin or LMWH for VTE prophylaxis.
c. Identify and treat associated conditions (heart failure, arrhythmias, PE, etc.)

Tables (2):

Table 5.1. Potential indications for hospitalization assessment*
- Severe symptoms such as sudden worsening of resting dyspnea, high respiratory rate, decreased oxygen saturation, confusion, drowsiness.
- Acute respiratory failure.
- Onset of new physical signs (e.g., cyanosis, peripheral edema).
- Failure of an exacerbation to respond to initial medical management.
- Presence of serious comorbidities (e.g., heart failure, newly occurring arrhythmias, etc.).
- Insufficient home support.

Table 5.4. Indications for respiratory or medical intensive care unit admission*
- Severe dyspnea that responds inadequately to initial emergency therapy.
- Changes in mental status (confusion, lethargy, coma).
- Persistent or worsening hypoxemia (PaO₂ < 5.3 kPa or 40 mmHg) and/or severe/worsening respiratory acidosis (pH < 7.25) despite supplemental oxygen and noninvasive ventilation.
- Need for invasive mechanical ventilation.
- Hemodynamic instability—need for vasopressors.

Table 5.5. Indications for noninvasive mechanical ventilation (NIV)
At least one of the following:
- Respiratory acidosis (PaCO₂ ≥ 6.0 kPa or 45 mmHg and arterial pH ≤ 7.35).
- Severe dyspnea with clinical signs suggestive of respiratory muscle fatigue, increased work of breathing, or both, such as use of respiratory accessory muscles, paradoxical motion of the abdomen, or retraction of the intercostal spaces.
- Persistent hypoxemia despite supplemental oxygen therapy.

Table 5.6. Indications for invasive mechanical ventilation
- Unable to tolerate NIV or NIV failure.
- Status post - respiratory or cardiac arrest.
- Diminished consciousness, psychomotor agitation inadequately controlled by sedation.
- Massive aspiration or persistent vomiting.
- Persistent inability to remove respiratory secretions.
- Severe hemodynamic instability without response to fluids and vasoactive drugs.
- Severe ventricular or supraventricular arrhythmias.
- Life-threatening hypoxemia in patients unable to tolerate NIV.

Diagnostic testing and Monitoring (3):
1. Continuous/Close monitoring: vital signs, ECG, respiratory status
2. Monitor blood glucose
3. ABG: Obtain ABG in all patients with severe COPD exacerbation
4. Portable chest radiograph: Look for signs of pneumonia, acute heart failure, pneumothorax
5. CBC, electrolytes (Na+, K+), BUN, and creatinine; also obtain cardiac troponin, BNP, or NT-proBNP, if diagnosis is uncertain
6. ECG: Look for arrhythmia, ischemia, cor pulmonale

**Key elements of discharge (4):**

1. Improved dyspnea: to the point that patient can eat, sleep, walk and correctly use inhaler medications.
2. Clinically stable: for 12-24 hours, with short-acting bronchodilators required no more frequently than q4h.
3. Antibiotics and steroids: complete the course, if initiated in the hospital.
4. Inhaler regimen: a minimum of a long-acting bronchodilator +/- inhaled steroids and a rescue inhaler.
5. Education: on importance of adherence to inhaler regimen, correct inhaler technique and smoking cessation.
6. Domiciliary oxygen: If –
   a. Room air SpO2 <88% (or pO2 <56), or
   b. Room air SpO2 88% (or pO2 56-59) + 1 of the 3: Lower extremity edema suggestive of CHF, pulmonary HTN/cor pulmonale, or erythrocytosis (hematocrit >56%)
   a. High risk of readmission: Follow up in 1 week
   b. Moderate or low risk of readmission: Follow up in 1 month
8. PFT: Schedule full PFTs (including bronchodilators) 4-6 weeks after AECOPD, if not previously performed.

**References:**

3. Rapid overview severe COPD exacerbation [Internet]. Uptodate. [cited 2018Jan4]. Available from:
Community Acquired Pneumonia (CAP)

Symptoms that suggest LRTI:
- Fever
- Cough with sputum
- Dyspnea
- Pleuritic chest pain

Physical Examination Findings (1):
- Fever
- Tachypnea
- Tachycardia
- Dullness to percussion

Order Labs:
- CBC
- BUN and Cr
- Sputum G/S and C/S
- Blood C/S and ABG if needed

CXR if ≥1 of: only 1% risk of pneumonia if 4 absent (1) -
- Fever >37.8 °C or 100°F
- Tachypnea (>20/min)
- Tachycardia (>100/min)
- Decreased breath sounds
- Crackles

Pneumonia develops ≥48 hrs following:
Hospitalization: HAP
ET intubation: VAP

CAP (2): CURB-65 score (1 for each)
- Confusion (AMT ≤8)
- BUN >7 mmol/l or 19 mg/dl
- RR ≥ 30 breaths/min
- SBP ≤ 90 or DBP ≤ 60
- Age 65 or older

CRB-65: 0 OR CURB-65: 0-1 (MILD/LOW)
- Home OR Hospital

CRB-65: 1-2 OR CURB-65: 2 (MODERATE)
- Hospital
- Consider ICU: if CURB-65 4 or 5

CRB-65: 3-4 OR CURB-65: 3-5 (HIGH/SEVERE)

Outpatient Treatment:
Choose #1 or #2:
1. Azithromycin 500 mg PO then 250 mg PO daily day 2-5, PLUS Amoxicillin 1 g PO TID for 7 days
OR
2. Levofloxacin 750 mg PO daily for 5 days

Further reading: [Website Link]
Indications for ward admission: Any 1 -
- Inability to maintain oral intake
- Concern about adherence to therapy
- H/O substance abuse
- Mental illness
- Cognitive or functional impairment
- Concern about living/social situation
- SpO2 <92% in room air (represent a significant change from baseline)

Indications for ICU admission (Severe CAP)
Any 1 of -
- Invasive mechanical ventilation
- Septic shock requiring vasopressor
≥3 of -
- Altered mental status
- Hypotension requiring fluid support
- Temp <36c (96.8 F)
- RR >/= 30/min
- PaO2/FiO2 ratio ≤ 250
- BUN >7 mmol/l or 19 mg/dl
- Leukocyte <4000/cu.mm
- Platelet <100,000/ml
- Multilobar infiltrates

References:


VAP/HAP
**ABX ADJUSTMENTS**
- Direct therapy based on culture results
- DC if no MRSA on sputum/EPA culture, gram stain shows no GPC in clusters, or if MRSA nasal screen negative in last 72h
- If a gram negative is the causal organism, coverage can be narrowed to one agent with in vitro activity against the isolate
- Lincosid is an alternative to vancomycin in proven MRSA pneumonia
- Note: Enterococcus and candida identified in sputum is unlikely to represent true infection
- *Reserve aztreonam for severe Β-lactam allergy. Caution w/monotherapy: may need to supplement MSSA coverage

**DURATION OF TREATMENT**
- 7 days based on clinical improvement and if no widespread infection or local complications (e.g. abscess, empyema)
- Consider stopping ABX prior to 7d if:
  - Procalcitonin (checked 48-72h) drops >80% or is < 0.3
  - In VAP, if PEEP ≤ 5 and FiO2 ≤ 40% on each of the first 3 days of therapy
Reference:


Further reading:

Acute Uncomplicated Pharyngitis

Antibiotics for GABHS acute pharyngitis:

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dose</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st choice:</strong> Penicillin V (Penoxymethyl penicillin)</td>
<td>1.2M IU / oral / 12h</td>
<td>8-10 days</td>
</tr>
<tr>
<td><strong>Alternatives:</strong> Penicillin G</td>
<td>1.2M IU im</td>
<td>1 dose</td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>500mg / 12h</td>
<td>8-10 days</td>
</tr>
<tr>
<td>Cefadroxil</td>
<td>500mg / 12h</td>
<td>8-10 day</td>
</tr>
</tbody>
</table>

Symptomatic treatment:

1. Rest; Ensure adequate intake of fluids, avoid irritants and gargle with warm water and salt.
2. Analgesics and anti-inflammatoryes
   - Ibuprofen and diclofenac > PCM in relieving sore throat
   - Alternative: Lozenges containing flurbiprofen 8.75 mg (Strepsils, Strepfen)

Reference:

Epomedicine.com
Unexplained Dyspnea
Modified Borg Dyspnea Scale
Patient instructions

The Borg scale is used to help us understand the intensity or severity of your breathlessness. We will ask you to use this scale to rate the intensity of your breathlessness before, during, and after your exercise.

Please review the scale to see the various levels from which you can choose.

The top of the scale, “0 or nothing at all,” means no breathlessness at all.

The bottom of the scale, “10 or maximal,” means the most severe breathlessness that you have ever experienced or could imagine experiencing.

When we ask you to rate the intensity of your breathlessness, please place the tip of your finger on the number that best describes the intensity that you are experiencing at that moment. You may also place a finger between 2 numbers if that better describes the intensity of your breathlessness.

Please let us know if you have any questions before we begin.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Nothing at all</td>
</tr>
<tr>
<td>0.5</td>
<td>Very, very slight (just noticeable)</td>
</tr>
<tr>
<td>1</td>
<td>Very slight</td>
</tr>
<tr>
<td>2</td>
<td>Slight</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>Somewhat severe</td>
</tr>
<tr>
<td>5</td>
<td>Severe</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Very severe</td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Very, very severe (almost maximal)</td>
</tr>
<tr>
<td>10</td>
<td>Maximal</td>
</tr>
</tbody>
</table>

Reference:


Acute Cough (<3 weeks)

Algorithm (1):
Control of cough (2):

1. “Home remedy” such as honey and lemon.
2. Simple voluntary suppression of cough may be sufficient to reduce cough frequency.
3. Opiate anti-tussives have a significant adverse side effect profile and are not recommended.
4. Recommended anti-tussives: Dextromethorphan (60 mg BD), 1st generation anti-histaminics (Levodropropizine 60 mg TDS).

Reference:

### Severity of Asthma Exacerbation

<table>
<thead>
<tr>
<th>Signs / Symptoms</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>Respiratory Arrest Imminent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Level:</td>
<td>Walks briskly</td>
<td>Walks slowly</td>
<td>Walks with assistance</td>
<td>Unable to walk</td>
</tr>
<tr>
<td>Feeding (infant):</td>
<td>Normal</td>
<td>Difficulty feeding</td>
<td>Unable to feed</td>
<td>Unable to suck</td>
</tr>
<tr>
<td>Talks in:</td>
<td>Sentences</td>
<td>Phrases</td>
<td>Words</td>
<td>Too dyspneic to speak; perspiring</td>
</tr>
<tr>
<td>Sounds (infant):</td>
<td>Normal cry, cooing</td>
<td>Short, clipped cry</td>
<td>Faint cry, grunting</td>
<td></td>
</tr>
<tr>
<td>Alertness:</td>
<td>May be agitated</td>
<td>Usually agitated</td>
<td>Usually agitated</td>
<td>Drowsy or confused</td>
</tr>
<tr>
<td>Respiratory rate:</td>
<td>Increased</td>
<td>Increased</td>
<td>Often &gt; 30/min</td>
<td></td>
</tr>
</tbody>
</table>

**Normal rates of breathing in awake children:**
- Age: Normal rate
  - < 2 months: < 60/min
  - 2-12 months: < 50/min
  - 1-5 years: < 40/min
  - 6-8 years: < 30/min

**Retractions & accessory muscle use:**
- Usually not
- Usually
- Usually
- Paradoxical thoraco-abdominal movement (see-saw breathing)

**Wheeze:**
- Moderate, often only end expiratory
- Loud expiratory
- Usually loud, may be biphasic (inspiratory and expiratory)
- Absence of wheeze

**Pulse/min. > 8 yrs:**
- < 100
- 100-120
- >120
- Bradycardia

**Pulse/min. < 8 yrs:**
- Guideline limits of normal pulse rate in children:
  - Infants (2-12 months): < 160/min
  - Preschool (1-7 years): < 120/min
  - School age (2-8 years): < 110/min

**Pulsus paradoxus:**
- Absent < 10 mm Hg
- May be present 10-25 mm Hg
- Often present > 25 mm Hg (adult)
- 20-40 mm Hg (child)
- Absence suggests respiratory muscle fatigue

**TESTS**
- **SaO2% (on room air):**
  - > 95%
  - 91-95%
  - < 90%

- **PEF after initial bronchodilator treatment:**
  - Over 80%
  - Approx. 60-80%
  - < 60% predicted

- **PaO2 (on room air):**
  - > 60 mm Hg
  - < 60 mm Hg
  - Possible cyanosis

- **PaCO2:**
  - < 45 mm Hg
  - < 45 mm Hg
  - > 45 mm Hg
  - > 50 mm Hg

**Note:** Hypercapnea (hyperventilation) develops more readily in young children than in adolescents and adults.

**INTERVENTION**
- **Response to inhaled Short-Acting Bronchodilator (SABA):**
  - Prompt relief
  - Complete relief after multiple treatments
  - Partial relief after multiple treatments. Requires continuous inhaled SABA
  - Minimal or no relief from inhaled SABA.
  - Requires systemic bronchodilator (subcutaneous epinephrine, terbutaline)

- **Location of care:**
  - Home Management
  - Office or emergency department
  - Emergency department; possible hospitalization
  - Hospitalization following stabilization in emergency department

*Note: The presence of several parameters, but not necessarily all, indicates the general classification of the exacerbation.*

Epomedicine.com
### Salbutamol

<table>
<thead>
<tr>
<th>Kg</th>
<th>Unit Dose (0.5%)</th>
<th>MDI</th>
<th>Continuous</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-10</td>
<td>2.5 mg (0.5 mL)</td>
<td>4 puffs</td>
<td>7.5 mg/hr</td>
</tr>
<tr>
<td>&gt; 10-20</td>
<td>3.75 mg (0.75 mL)</td>
<td>6 puffs</td>
<td>11.25 mg/hr</td>
</tr>
<tr>
<td>&gt; 20</td>
<td>5 mg (1.0 mL)</td>
<td>8 puffs</td>
<td>15 mg/hr</td>
</tr>
</tbody>
</table>

### Ipratropium

<table>
<thead>
<tr>
<th>Kg</th>
<th>Dose</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-10</td>
<td>500 mcg over 1 hr in nebulizer or 250 mcg q20 min x 3</td>
<td></td>
</tr>
<tr>
<td>&gt; 10</td>
<td>1000 mcg over 1 hr in nebulizer or 500 mcg q20 min x 3</td>
<td></td>
</tr>
</tbody>
</table>

### Prednisone/Methylprednisolone

<table>
<thead>
<tr>
<th>Dose</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 mg/kg p.o./IV, MAX 60 mg or equivalent</td>
<td></td>
</tr>
</tbody>
</table>

### Dexamethasone

<table>
<thead>
<tr>
<th>Dose</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 mg/kg</td>
<td>to maximum dose of 16 mg, for 2 dose</td>
</tr>
</tbody>
</table>

### Magnesium Sulfate

<table>
<thead>
<tr>
<th>Dose</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 mg/kg</td>
<td>MAX 2 g</td>
</tr>
<tr>
<td></td>
<td>Give with Normal saline bolus, 20ml/kg (max 1 liter) over 20 min, observe in ED 60 min prior to transfer to inpatient floor</td>
</tr>
</tbody>
</table>

### Terbutaline

Subcutaneous: 0.01 mg(mL)/kg MAX 0.25 mg (0.25 mL) q20 min X 3 doses

### Epinephrine (1:1000)

Subcutaneous: 0.01 mg(mL)/kg MAX 0.3-0.5 mg (0.3-0.5 mL) q20 min X 3 doses

---

1. **Oxygen**: Target SpO2 – 93 to 95% adults and 94-98% children 6-11 years
2. **Bronchodilators**: Salbutamol + Ipratropium Neb. Or MDI q20 min X 1-3 doses
3. **Corticosteroid**: Oral (if tolerated) or IV and continue for 5 days
4. **Refractory cases (after 1 hour) and Respiratory failure imminent**: Add: Magnesium sulfate X 1 dose
   Consider s.c. terbutaline OR epinephrine
   Consider RSI (slowing of RR, severe hypoxemia, depressed mental status, inability to maintain respiratory effort)
   Consider ICU admission
5. **Fever, purulent sputum or CXR suggestive of pneumonia**: Add antibiotics
6. **Avoid sedatives**
References:

2. [https://online.epocrates.com/diseases/4542/Acute-asthma-exacerbation-in-adults/Treatment-Options](https://online.epocrates.com/diseases/4542/Acute-asthma-exacerbation-in-adults/Treatment-Options)
3. [https://www.thoracic.org/statements/resources/allergy-asthma/asthma.pdf](https://www.thoracic.org/statements/resources/allergy-asthma/asthma.pdf)


[https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2817338/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2817338/)
Spontaneous Pneumothorax (1)
Spontaneous Pneumothorax
If Bilateral/Haemodynamically unstable proceed to chest drain.

Age >50 and significant smoking history. Evidence of underlying lung disease on exam or CXR?

Primay Pneumothorax
Size >2cm and/or breathless

NO

YES

Secondary Pneumothorax
Size 1-2cm

NO

YES

Aspirate. 16-18G cannula Aspirate <2.5l

Success (<2cm and breathing improved)

NO

YES

Consider discharge review in OPD in 2-4 weeks

Aspirate. 16-18G cannula Aspirate <2.5l

Success. Size now <1cm.

YES

NO

Chest drain. Size 8-14Fr. Admit.

Admit. High flow oxygen (unless suspected oxygen sensitive). Observe for 24 hours.

* In some patients with a large pneumothorax but minimal symptoms conservative management may be appropriate.
Occasionally a "skin fold" may be confused with a pneumothorax. To make this distinction, look for whether the "line" in question extends beyond the chest wall - this is suggestive of a skin fold.

Deep sulcus sign – Dark lateral sulcus where the chest wall meets the diaphragm (subtle sign of pneumothorax in supine position).

**Tension Pneumothorax**

**Symptoms and Signs (2):**

1. Universal findings: Chest pain and Respiratory distress
2. Common findings (50-75% cases): Tachycardia, Ipsilateral decreased air entry
3. Inconsistent findings (<25% cases): Low SpO2, Tracheal deviation, Hypotension
4. Rare findings (10% cases): Cyanosis, Hyper-resonance, Decreased level of consciousness, Ipsilateral chest hyper-expansion and hypo-mobility, Acute epigastric pain, Cardiac apical displacement, Sternal resonance

**Indications for immediate chest decompression (2):**

- Chest radiograph not immediately available and:
  - SpO2<92% on 02
  - Systolic BP<90 mm Hg
  - Respiratory rate<10
  - Decreased level of consciousness on 02
  - Cardiac arrest
    - bilateral finger or tube thoracostomy
  - not needle thoracocentesis

**CXR in tension pneumothorax (2):**

- Ipsilateral hyper-expansion:
  - Hemidiaphragmatic depression, Increased rib separation, Increased thoracic volume
- Mediastinal pressure:
  - Ipsilateral flattening of heart border, Contralateral mediastinal deviation

**Emergent needle thoracocentesis (2):**

1. 14-16 G cannula
2. Just above 3rd rib (2nd ICS) in MCL
3. Remove the needle from cannula

**A gush of air (2):** Fix cannula & Prepare for tube thoracostomy

**Reattempt needle thoracocentesis (4):**

1. 14-16 G cannula
2. Just above 5th or 6th rib (4th or 5th ICS) in MAL
3. Remove the needle from cannula
Catheter aspiration of pneumothorax (3):

1. **Landmark:** Identify the 3\textsuperscript{rd} rib in the mid-clavicular line.
2. **Local anesthesia:** Infiltrate 5 to 10 mL of 1\% lignocaine subcutaneously and deeper until reaching the pleural space; this must be confirmed by aspiration of air into the syringe.
3. **Catheter insertion:** Insert venous catheter 16-18 G with 3 way above the 3\textsuperscript{rd} rib in the mid-clavicular line, unless the pneumothorax is elsewhere.
4. **Aspirate:** until no more air is returned.
5. **Repeat CXR:** Leave the catheter in situ and immediately repeat the chest X-ray. Repeat the chest X-ray again in 2 to 4 hours.
6. **Reaccumulation of pneumothorax and removal of catheter:**
   a. If the pneumothorax has not reaccumulated, remove the catheter and discharge with advice to return if symptoms recur, or every 2 weeks until pneumothorax has resolved.
   b. If the pneumothorax has reaccumulated, connect the catheter to a continuous drainage underwater seal or Heimlich valve.

**Indications for tube thoracostomy in Thoracic trauma (5):**

1. Simple pneumothorax associated with any chest trauma
2. Tension pneumothorax
3. Pneumothorax increasing in size
4. Pneumothorax in any unstable patient
5. Bilateral pneumothorax
6. Hemothorax or Hemopneumothorax
7. Pneumothorax in an intubated, ventilated patient (including those about to undergo general anesthesia)
8. Open pneumothorax ("sucking" chest wound) in association with application of sterile occlusive dressing over the chest wall defect

**Indications for thoracotomy in Thoracic trauma (5):**

1. Operating room thoracotomy:
   a. Initial evacuation of 1500 ml of blood or more from thoracostomy tube
   b. Persistent hemorrhage (\geq 200 ml/hr for 4 hours)
   c. Failure of tube thoracostomy with enlarging hemothorax
d. Hemodynamic instability despite adequate resuscitation

2. Emergency department thoracotomy:
   a. Penetrating injury with trauma arrest en route to or in the emergency department.

References:


Further reading:


Hemoptysis

High-flow oxygen and Close monitoring
Decubitus position with affected (gurgling) side down or supine with head down
2 large bore IV access
NS or RL for hypotension
Arrange and cross-match 6U blood
Hemoptysis work-up
Correct coagulopathy/thrombocytopenia
IV antibiotics
8 mm ET intubation and suctioning
Tranexamic acid + Vasopressin/octreotide

Signs and symptoms of pulmonary embolism
Directed appropriate evaluation & therapy
Nonpulmonary source of hemoptysis

Stable patient Nonmassive hemoptysis
Consider ENT or UGI source
Check sputum
Pulmonary source of hemoptysis
Chest radiograph

Abnormal (localizing or nonlocalizing)
Ongoing gross hemoptysis

Yes
Chest CT, consultation for FOB admission +/−
High risk for neoplasm*

No
Chest CT
Low risk for neoplasm*
Expeditious outpatient FOB evaluation and referral if negative

Discharge
Treat bronchitis
Outpatient follow-up

Massive hemoptysis Airway compromised Unstable vital signs
ICU admission
Pulmonologist / radiologist
Thoracic surgeon consultation
Selective intubation
Bronchoscopy
Contrast MDCT
BAE
Massive hemoptysis:

- Volumetric: 600 ml within 24 hours; >8 ml/kg/day (pediatric)
- Magnitude of effect: Respiratory or hemodynamic compromise
- Asphyxiating hemoptysis: >150 ml/hr (volume of anatomical deadspace)

High risk for neoplasm*:

1. Age >40 years old
2. >40 pack-year smoking
3. Recurrent bleed
4. No history consistent with lower respiratory tract infection

Quantifying hemorrhage:

1. 1 teaspoonful (tspf) = 5 ml
2. 1 tablespoon full (tbspf) = 15 ml
3. 1 cup = 250 ml

Tranexamic acid: 15-25 mg/kg IV q6h; for less severe – 1 gm PO TDS X 5 days

Vasopressin: 0.3 U/kg over 20 min followed by 0.3 U/kg/hr; 20 U in 100 ml D5% IV over 15 minutes followed by 0.2 U/min

Octreotide: 50 mcg IV over 15 minutes followed by 2.5 ml/hr (400 mcg in 20 ml D5%)

---

**Hemoptysis work-up**

**Labs**
- Complete blood count
- Electrolytes
- Bleeding dyscrasia work-up
- Liver function tests
- Urine analysis
- Blood gas

**Radiography**
- Chest X-ray
- CT scan with contrast

**Interventional**
- Flexible bronchoscopy with BAL

Oxygenation in Acute Respiratory Failure

Chart 1: pCO2 6kPa = 45 mmHg

Oxygen with reservoir mask at 15l/min.
Once stable, reduce oxygen dose and aim for SpO2 94-98%.
Chart 2:

Yes
Initiate oxygen via nasal cannula 2-6 l/min or face mask 5-10 l/min and check ABG
Choose the most suitable delivery system and flow rate

Titrating oxygen up or down to maintain the target oxygen saturation.

The table below shows available options for stepping dosage up or down. The chart does not imply any equivalence of dose between Venturi masks and nasal cannulae.

Allow at least 5 minutes at each dose before adjusting further upwards or downwards (except with major and sudden fall in saturation). Once your patient has adequate and stable saturation on minimal oxygen dose, consider discontinuation of oxygen therapy.

**Signs of respiratory deterioration**
- Respiratory rate (especially if >30)
- Oxygen saturation needed to keep SpO₂ in target range
- EWS trigger score
- CO₂ retention
- Drowsiness
- Headache
- Flushed face
- Tremor

Seek medical advice

**NIMV Indications**
- Moderate to severe dyspnea
- Tachypnea
  (24 in hypercapnia vs. 30 in hypoxemic)
- Increase breath work
- PaCO₂ > 45mmHg in hypercapnia, and > 50mmHg in hypoxemic
- pH < 7.35
- PaO₂ < 200

**NIMV Contraindication**
- Severe hypoxemia (PaO₂/FiO₂ < 75)
- Severe acidemia
- Multorgan failure
- Upper airway obstruction
- Anatomical abnormalities (facial trauma)
- Respiratory arrest, Apnea
- Cardiac arrest, hemodynamic instability
- Inability to protect airway, with high risk of aspiration (GCS < 8)
- Increased risk of aspiration vomiting or severe gastrointestinal bleeding

**Failure criteria**
- Shock with refractory hemodynamic instability
- GCS < 8
- pH < 7.25
- PaO₂/FiO₂ < 146 in 1 hour
- Vme > 12 lts/m
- Refractory hyperlactatemia

**Please note:** Patients in a peri-arrest situation and critically ill patients should be given maximal oxygen therapy via resuscitation mask or bag-valve mask whilst immediate medical help is arriving (except for patients with COPD with known oxygen sensitivity recorded in patient’s case notes and drug chart or in the EPR keep saturation at 88-92% for this subgroup of patients).
References:


ABG

ABG and VBG correlation (1):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>No. studies</th>
<th>No. patients</th>
<th>Weighted mean difference (bias)</th>
<th>95% limits of agreement*</th>
<th>Clinical interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>13</td>
<td>2009</td>
<td>−0.031</td>
<td>Approximately ±0.1</td>
<td>Clinically interchangeable</td>
</tr>
<tr>
<td>pCO₂</td>
<td>8</td>
<td>965</td>
<td>6.2 mm Hg (0.83 kPa)</td>
<td>−17.4 to 23.9 mm Hg</td>
<td>Poor, unpredictable agreement</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>8</td>
<td>1211</td>
<td>−1.3 mmol/L</td>
<td>Approximately ±5 mmol/L</td>
<td>Probably close enough agreement for classification as high, normal or low</td>
</tr>
<tr>
<td>Base excess</td>
<td>2</td>
<td>429</td>
<td>Divergent results</td>
<td>Up to −4.4 to 3.9 BE units</td>
<td>Agreement unclear May be close enough agreement for classification as high or normal</td>
</tr>
<tr>
<td>Lactate</td>
<td>3</td>
<td>338</td>
<td>0.25 mmol/L</td>
<td>−2 to +2.3 mmol/L</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>cCO₂ ≤45 mm Hg (6 kPa) as a screening test for hypercarbia</th>
<th>No.</th>
<th>No. patients</th>
<th>Sensitivity for hypercarbia</th>
<th>NPV for hypercarbia</th>
<th>Clinical interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>529</td>
<td>100% (95% CI 97% to 100%)</td>
<td>100% (95% CI 97% to 100%)</td>
<td>Reliable screening test; congruence with clinical assessment required</td>
</tr>
</tbody>
</table>

*Interpreted from available data; not reported by all studies.

BE, base excess; NPV, negative pressure ventilation.

Indications (2) | Contraindications
---|---
All critically ill patients. | Negative modified Allen’s test
Unexpected or inappropriate hypoxaemia (SpO₂ <94%) or any patient requiring oxygen to achieve this target range. | Arteriovenous fistula
Deteriorating oxygen saturation or increasing breathlessness in a patient with previously stable chronic hypoxaemia. | Peripheral arterial disease
Any previously stable patient who deteriorates and requires a significantly increased fraction of inspired oxygen to maintain constant oxygen saturation. | Distorted anatomy/trauma/burns to the limb - at or proximal to the attempted arterial puncture site.
Any patient with risk factors for hypercapnic respiratory failure who develops acute breathlessness, deteriorating oxygen saturation or drowsiness or other symptoms of CO₂ retention. | Medium or high dose anticoagulation therapy, or history of clotting disorder.
Breathless patients with risk of metabolic conditions such as diabetic ketoacidosis or metabolic acidosis due to renal failure. | Severe coagulopathy
Any other evidence that would indicate that blood gas results would be useful in the patient’s management.

Abnormal or infectious skin processes at/or near puncture site.

References:


Further reading:


Uncomplicated Acute Rhinosinusitis

Sudden onset of two or more symptoms, one of which should be either nasal blockage/obstruction/congestion or nasal discharge: anterior/post nasal drip; ± facial pain/pressure ± reduction or loss of smell; examination: anterior rhinoscopy X-ray/CT not recommended

Symptoms less than 5 days or improving thereafter
- Common cold
- Symptomatic relief
- No improvement after 14 days of treatment
- Consider referral to specialist

Symptoms persisting or increasing after 5 days
- Moderate cold
- Topical steroids
- Effect in 48 h
- Continued treatment for 7 - 14 days

Severe *
- Antibiotics
- Topical steroids
- No effect in 48 h
- Refer to specialist

At any point immediate referral/hospitalization
- Periorbital oedema
- Displaced globe
- Double vision
- Ophthalmoplegia
- Reduced visual acuity
- Severe unilateral or bilateral frontal headache
- Signs of meningitis or focal neurologic signs

Fever > 38°C severe pain

Patient with uncomplicated ABRS requires antibiotics *

No penicillin allergy

Risk factors for resistance

- No
- Yes

One of the following:
- Amoxicillin-clavulanate (standard dose): either:
  - 300 mg/125 mg three times daily
  - 875 mg/125 mg twice daily
- Amoxicillin-clavulanate (high dose):
  - 2000 mg/125 mg extended-release tablets twice daily

Monitor on antibiotic therapy

Improved symptoms
- Treat for 5 to 7 days total

Symptomatic worsening or no improvement in 7 days
- Confirm the diagnosis of ABRS

Complicated ABRS?

No
- Switch to second-line therapy
- Treat complication accordingly

Yes
- Treat alternative diagnosis

Improved symptoms
- Symptomatic worsening or no improvement in 7 days