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![MDCALC App](image)

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Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

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The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

Table of Contents

Infectious Diseases
26. Sepsis & Septic Shock Diagnostic Criteria
   Sepsis & Septic Shock Algorithm
27. Antimicrobial Guide
   ● URTI/Sinusitis
   ● Pharyngitis/Tonsillitis
   ● Laryngitis
   ● Acute Gastroenteritis
   ● Urinary Tract Infection (UTI)
   ● Sepsis & Septic Shock
   ● Community Acquired Pneumonia
   ● Malaria
   ● Community-Acquired Severe Intra-Abdominal Infection, Biliary, and Extra-Biliary Infections
   ● Cellulitis/ Abscesses/ Folliculitis/ Carbuncle/ Furuncle
   ● Necrotizing skin & soft tissue infections
   ● STI – Urethritis, Epididymitis, Orchitis, Proctitis, Cervicitis
   ● HIV Post Exposure Prophylaxis (PEP)

Gastrointestinal Emergencies
28. Epigastric Pain Algorithm
29. Upper Gastrointestinal Bleeding Algorithm

Psychiatric Emergencies
30. Suicide & Homicidal Evaluation
   Brief Suicide Prevention Interventions
31. Management of the severely agitated or violent patient

Poisoning
32. Poisoning
33. Organophosphate Poisoning Algorithm
34. Alcohol (Methanol) Poisoning Algorithm

Pain and Sedation
35. Pain Management Algorithm
36. Low Back Pain Algorithm
37. Management of Pain in Sickle Cell Disease Algorithm
38. Procedural Sedation and Analgesia (PSA)

Analgesia Chart

References
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**Adult Triage Criteria**

*(Adapted from the Canadian ED Triage and Acuity Scale)*

### **LEVEL I: RESUSCITATION**

Conditions that are life or limb threatening (or with imminent risk of deterioration) needing immediate aggressive intervention.

**Time to doctor: IMMEDIATE**

**Usual presentations:**

1. Cardiac and/or pulmonary arrest
2. Major trauma
3. Shock states
4. Unconscious patients
5. Severe respiratory distress
6. Status epilepticus
7. Acute coronary syndrome/ chest pain
8. CVA / stroke
9. DKA / HHS
10. Shock states (Trauma haemorrhagic / septic shock)
   - BP <90/60
   - Temp>39°C or <36°C
   - RR<60 bpm or >100bpm
   - HR<60 bpm or >100bpm
11. Hypertensive Emergencies
   - BP >180/110 mmHg with brurred vision / vomiting / CVA / confusion
12. GI bleed
13. Severe asthmatic attack
   - Major: SPO2 <90%
   - Single word speech
   - Confusion
   - Silent chest
14. Deranged blood glucose levels
   - <3mmol/l or >18mmol/l with confusion / seizures / diaphoresis
15. Pregnancy related complications
   - Presenting fetal parts
   - Prolapsed cord
   - Vaginal bleeding (esp. 3rd trimester except show)
   - Abnormal fetal movements
   - Eclampsia
16. Severe head injury (GCS: 3-6/15)
17. Drug / substance abuse / intoxication with haemodynamic instability

### **LEVEL II: EMERGENT**

Conditions that are potential threat to life, function or limb, requiring rapid medical intervention.

**Time to doctor < 15min**

**Usual presentations:**

1. Altered mental state
2. Head injury (mild / moderate with GCS of 9-15)
3. Nausea
4. Eye pain / injuries
5. Drug and/or substance overdose / intoxication / withdrawal with stable vitals
6. Asthma (mild)
7. Anaphylaxis
8. Heavy vaginal bleeding (acute pelvic or lower abdominal pain
9. Sepsis/pyrexia
10. Severe vomiting and/or diarrhoea (haemodynamically unstable)
11. Acute psychosis / extreme agitation
12. Severe abdominal / groin pain / acute abdomen
13. Severe hypotension or hypertension (BP > 180/110 mmHg or < 90/60 mmHg)
14. Abuse / neglect / assault (physical / sexual)
15. Patients on chemotherapy
16. Acute pain - severe (pain score 8-10/10)
17. Seizure disorder

### **LEVEL III: URGENT**

Conditions could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or affecting ability to function at work or activities of daily living.

**Time to doctor < 30min**

**Usual presentations:**

1. Asthma, mild
2. Acute pain - moderate (pain score 4-7/10)
3. Vomiting or diarrhoea with dehydration
4. Dialysis (or transplantation patients)
5. Other diabetic - associated conditions e.g. neuropathy, nephropathy, retinopathy.

### **LEVEL IV: LESS URGENT**

Conditions could potentially progress to a serious problem requiring emergency intervention. May be associated with significant discomfort or affecting ability to function at work or activities of daily living.

**Time to doctor < 1 hour**

**Usual presentations:**

1. Minor trauma with soft tissue injuries
2. Headache (pain score 0-3/10)
3. Ear ache
4. Back pain, chronic
5. URTI symptoms with fever
6. Vomiting and/or diarrhoea with no signs of dehydration
7. Acute pain - mild (pain score 0-3/10)

### **LEVEL V: NOT URGENT**

Problem with or without evidence of deterioration.

**Time to doctor < 2 hours**

**Usual Presentations:**

1. Sore Throat/URTI without fever
2. Abdominal pain without vomiting
3. Diarrhoea or vomiting alone without dehydration.
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1. Adult & Paediatric Cardiac Arrest

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

*If a DEFIBRILLATOR is available, follow the appropriate ACLS/EPLS Algorithm

High-Quality CPR
- Compress the centre of the chest with 2 hands at a rate of at least 100-120/min
- Compress to a depth of at least 5-6 cm
- Allow complete chest recoil after each compression
- Minimize interruptions in chest compressions to < 10 seconds
- Avoid excessive ventilation – Give enough volume just to produce visible chest rise. If intubated, give 1 breath every 6 seconds

Unresponsive
No Breathing or No Normal breathing (i.e. only gasping)

Activate Resuscitation Team

CHECK PULSE
DEFINITE pulse palpated within 10 secs?

Definite Pulse
- Open and maintain patent airway
- Give 1 breath every 6 seconds
- Recheck pulse every 2 mins
- Go to 2. Post Cardiac Arrest Care Algorithm

No Pulse

Begin CPR - Cycles of 30 CHEST COMPRESSIONS then 2 BREATHS (30:2)
- Perform continuous chest compressions until BVM is available
- Use BVM when available to give breaths even without O2. Attach O2 at 15L/min when available
- IV/IO access – Check RBS
- Continue CPR at cycles of 30:2

PULSE CHECK AT 2 MINS
DEFINITE pulse palpated within 10 secs?

Definite Pulse
- Continue CPR at cycles of 30:2

No Pulse

High-Quality CPR
- Compress the centre of the chest with 2 hands at a rate of at least 100-120/min
- Compress to a depth of at least 5-6 cm
- Allow complete chest recoil after each compression
- Minimize interruptions in chest compressions to < 10 seconds
- Avoid excessive ventilation – Give enough volume just to produce visible chest rise. If intubated, give 1 breath every 6 seconds

Pulse Check
No pulse

Activate Resuscitation Team

CHECK PULSE
DEFINITE pulse palpated within 10 secs?

Definite Pulse
- Open and maintain patent airway
- Give 1 breath every 6 seconds
- Recheck pulse every 2 mins
- Go to 2. Post Cardiac Arrest Care Algorithm

No Pulse

Change Chest Compressors
- Adrenaline 1mg in 9mL NS IV/IO followed with 20mL NS flush (Repeat dose after 2 Pulse Checks/4mins)
- Identify and Treat these reversible causes
  - Hypoglycaemia
  - Hypovolaemia
  - Hypoxia
  - Hydrogen ion (acidosis)
  - Hypo-/hyperkalaemia
  - Hypothermia
  - Tension Pneumothorax
  - Tamponade, cardiac
  - Toxins
  - Thrombosis, pulmonary
  - Thrombosis, coronary

CONTINUE CPR at cycles of 30:2

No Pulse

PULSE CHECK AT 2 MINS
DEFINITE pulse palpated within 10 secs?

Definite Pulse
- Continue CPR at cycles of 30:2

Paediatric Cardiac Arrest Algorithm

Treat as per the above algorithm EXCEPT:
- Compress the chest with 1 or 2 hands (use the 2 thumbs-encircling hands in the centre of the chest, just below the nipple line in infants) to a depth of at least 2/3 the antero-posterior diameter of chest
- If 2 rescuers present, perform CPR at a rate of 15 chest compressions then 2 breaths (15:2)
- Give Adrenaline at 0.1mL/kg IV/IO of the 1mg Adrenaline in 9mL NS solution (use an insulin syringe for small doses)
2. Post-Cardiac Arrest Care Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Return of Spontaneous Circulation (ROSC)

- Activate Resuscitation Team (if not already present)
- Monitor, support ABCs. Be prepared to provide CPR
- Check vital signs (BP, PR, RR, SPO2, T°C, RBS)

Optimize Ventilation and Oxygenation

- Avoid excessive ventilation.
  - Start at 10 – 12 breaths/min (1 breath every 6 seconds)
  - Titrate FiO2 to minimum necessary to maintain SPO2 ≥ 94%. DO NOT aim for 100%
- Consider an advanced airway

Treat Hypotension (SBP < 90mmHg)

- IV/IO Bolus (if not contraindicated e.g. pulmonary oedema, renal failure): 1-2 L Ringer’s Lactate or Normal Saline
- Vasopressor infusion if NO response to fluid bolus or fluid bolus contraindicated:
  - Adrenaline IV Infusion: Put 1mg of adrenaline in 1L NS. This makes 1µg/ml. Dose: 0.1 – 0.5µg/kg/min (7-35µg/min in 70-kg adult)
- Identify and Treat reversible causes
  - Hypoglycaemia
  - Hypovolemia
  - Hypoxia
  - Hypo/Hyperkalaemia
  - Hypothermia
  - Tension Pneumothorax
  - Tamponade, cardiac
  - Toxins
  - Thrombosis, pulmonary
  - Thrombosis, coronary

If patient is stable, consider immediate transfer to a Critical Care Unit (ICU)

- For patients who are comatose after cardiac arrest (i.e., lacking meaningful response to verbal commands), temperature should be monitored continuously, and fever should be treated aggressively with a target temperature between 32°C and 36°C maintained constantly for at least 24 hours.
3. Maternal Cardiac Arrest Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**FIRST RESPONDER**
- Activate Resuscitation Team (if not already present) AND OB GYN
- Document time of onset of maternal cardiac arrest
- Place the patient supine and perform a left uterine displacement (LUD) as below.

A

B

- Start resuscitation as per the 1. Adult Cardiac Arrest Algorithm; place hands slightly higher on the sternum than usual

**SUBSEQUENT RESPONDERS**

Maternal Interventions
Treat as per 1. Adult & Paediatric Cardiac Arrest Algorithm
- Do not delay defibrillation
- Give typical ACLS drugs and doses
- Ventilate with 100% oxygen
- Monitor wave form capnography and CPR quality
- Provide post-cardiac arrest care as appropriate. See 2. Post-Cardiac Arrest Care Algorithm

Maternal Modifications
- Start IV access above the diaphragm
- Assess for hypovolaemia and give fluid bolus when required
- Anticipate difficult airway; experienced provider preferred for advanced airway placement
- If patient receiving IV/IO magnesium prearrest, stop magnesium and give IV/IO calcium chloride 10mL in 10% solution, or calcium gluconate 30 mL in 10% solution
- Continue all maternal resuscitative interventions (CPR, positioning, defibrillation, drugs, and fluids) during and after caesarean section

Obstetric Interventions for Patient With an Obviously Gravid Uterus*
- Perform manual uterine displacement (LUD) – displace uterus to the patient’s left to relieve aortocaval compression
- Remove both internal and external foetal monitors if present

Obstetric and neonatal teams should immediately prepare for possible emergency caesarean section
- If no ROSC by 4 minutes of resuscitative efforts, consider performing immediate emergency caesarean section
- Aim for delivery within 5 minutes of onset of resuscitative efforts

*An obviously gravid uterus is a uterus that is deemed clinically to be sufficiently large to cause aortocaval compression

Search for and Treat Possible Contributing Factors (BEAU-CHOPS)
- Bleeding/DIC
- Embolism: coronary/pulmonary/amniotic fluid embolism
- Anaesthetic complications
- Uterine atony
- Cardiac disease (MI/ischaemia/aortic dissection cardiomyopathy)
- Hypertension/pre eclampsia/eclampsia
- Other: differential diagnosis of standard ACLS guidelines
- Placenta abruption/previa
- Sepsis
4. Neonatal Resuscitation Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

The most important and effective action in neonatal resuscitation is ventilation of the baby’s lungs.

- **Airway**
  - Put baby’s head in “sniffing” position
  - Suction mouth, then nose
  - Suction trachea if meconium-stained and NOT vigorous

- **Breathing**
  - Bag-valve-mask ventilation for apnea, gasping, or pulse <100 bpm
  - Ventilate at rate of 40 to 60 breaths/minute
  - Listen for rising heart rate, audible breath sounds
  - Look for slight chest movement with each breath
  - Use CO2 detector after intubation
  - Attach a pulse oximeter

- **Circulation**
  - Start compressions if HR is <60 after 30 secs of effective ventilation
  - Give (3 compressions: 1 breath) every 2 seconds
  - Compress one-third of the anterior-posterior diameter of the chest

- **Drugs**
  - Give epinephrine if HR is <60 after 45 to 60 seconds of compressions and ventilation
  - Caution: epinephrine dosage is different for ET and IV routes

### Corrective Steps

- M: Mask adjustment.
- R: Reposition airway.
- S: Suction mouth and nose.
- O: Open mouth.
- P: Pressure increase.
- A: Airway alternative.

### Endotracheal Intubation

<table>
<thead>
<tr>
<th>Gestational Age (weeks)</th>
<th>Weight (kg)</th>
<th>ET Tube Size (ID, mm)</th>
<th>Depth of Insertion* (cm from upper lip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;28</td>
<td>&lt;1.0</td>
<td>2.5</td>
<td>6-7</td>
</tr>
<tr>
<td>28-34</td>
<td>1.0-2.0</td>
<td>3.0</td>
<td>7-8</td>
</tr>
<tr>
<td>34-38</td>
<td>2.0-3.0</td>
<td>3.5</td>
<td>8-9</td>
</tr>
<tr>
<td>&gt;38</td>
<td>&gt;3.0</td>
<td>3.5-4.0</td>
<td>9-10</td>
</tr>
</tbody>
</table>

*Depth of Insertion (cm) = 6 + weight (in kg)

### Medications Used During or Following Resuscitation of the Newborn

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage/Route*</th>
<th>Concentration</th>
<th>Wt (kg)</th>
<th>Total IV Volume (mL)</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine</td>
<td>IV (IVC preferred route) 0.10 to 0.3 mL/kg</td>
<td>1:10,000</td>
<td>1</td>
<td>0.1-0.3</td>
<td>Give rapidly. Repeat every 3 to 5 minutes if HR &lt;60 with chest compressions.</td>
</tr>
<tr>
<td></td>
<td>IV higher dose not recommended Endotracheal 0.5 to 1 mL/kg</td>
<td>2</td>
<td>0.2-0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>3</td>
<td>0.3-0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>4</td>
<td>0.4-1.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Endotracheal dose may not result in effective plasma concentration of drug, so vascular access should be established as soon as possible. Drugs given endotracheally require higher dosing than when given IV.
5. Rapid Sequence Intubation/Airway Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**Preparation**

- **MALE MESS**
  - Mask
  - Airways (oral and nasal)
  - Laryngoscopes, Laryngeal Mask Airway (LMA)
  - Endotracheal tubes – Adult Males 8F, Females 7.5F; Child >1 year (Age/4) + (4(uncuffed) or 3.5(cuffed))
  - Monitoring (pulse oximetry, ECG, capnography), Magill Forceps
  - Emergency drugs/trolley
  - Self-inflating bag valve resuscitator;
  - Suction, Stylet, Bougie
  - Plentiful oxygen supply

**Pre-oxygenation**

- Attach oxygen via nasal prongs. Turn up to MAXIMUM if patient is unconscious or after sedation. Keep this for the entire intubation process.
- **Spontaneously breathing patient** – Position patient as below and allow at least 5 mins of spontaneous breathing with a tight-fitting non-rebreather facemask at MAXIMUM and continue until the patient stops breathing after sedation/paralysis: Avoid positive pressure ventilation if possible
- **Patient not breathing or not breathing adequately**– Use a Bag-Valve-Mask (BVM) with a reservoir and O₂ at 15L/min to provide 1 breath every 6 seconds (synchronized to the patient’s breaths) until you can achieve and sustain the highest possible SpO₂

**Position the patient**

Ensure you have 360° access to the patient

- Belt/Belly Height – Head at or just above belt/belly level
- HoP up – Head of Patient up to Head of Bed
- HoB up – Head of Bed up 30°; Reverse trendelenburg in High BMI, Late Pregnancy, Spinal Immobilisation
- Face Plane parallel to Ceiling (or just 10° tilt back) & Ear level to Sternal Notch
- Assistants ready to help add or maintain external laryngeal manipulation, head elevation, jaw thrust, mouth opening

**Paralysis with Induction**

**Pharmacologic agents and dosages used for rapid sequence intubation**

<table>
<thead>
<tr>
<th>Sedatives</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketamine (Ketamine is preferred for patients with hemodynamic instability or renal insufficiency)</td>
<td>2 mg/kg IV</td>
</tr>
<tr>
<td>Midazolam</td>
<td>0.15 to 0.2 mg/kg IV (decrease dose in elderly)</td>
</tr>
</tbody>
</table>

**Neuromuscular Blocking (NMB) Agents**

<table>
<thead>
<tr>
<th>Dose</th>
<th>Onset</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 mg/kg IV (adults)</td>
<td>½ to 1 min</td>
<td>6-10 min</td>
</tr>
<tr>
<td>2 mg/kg IV (infants)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3mg/kg IV (new-borns)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Succinylcholine (depolarizing NMB)**

**Contraindications:**
- Hyperkalemia e.g. renal failure
- Organophosphate poisoning
- Delayed severe burns
- Prolonged crush injuries

**Pass the tube /Laryngeal Mask Airway (LMA)**

Limit attempt to < 30 seconds. Proceed down the algorithm after 30 seconds

**Successful**

- Self-inflating bag valve resuscitator ventilation – 1 breath every 6s
- Secure tube at a depth of 3 x ET Tube size at the teeth/gums
- Connect patient to the ventilator if available
- Initiate postintubation analgesia and sedation
  - Morphine 0.1 – 0.4mg/kg/hr
  - Ketamine (analgesic and sedative) 0.05 – 0.4mg/kg/hr
  - Midazolam 0.02 – 0.1mg/kg/hr
- Obtain portable CXR to Confirm Depth of ET Tube NOT location

**Proof of Intubation/LMA Insertion**

5 Point Auscultation – Epigastrium, Bilateral Axillae, Bilateral Lung Bases

**Not Successful**

Resume BVM ventilation – 1 breath every 3 seconds

See 6. Failed Intubation Algorithm
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6. Failed Intubation Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Direct Laryngoscopy and Intubation (D.L.)

- Resume BVM ventilation - 1 breath every 3 seconds
- CALL Anaesthetist immediately

Able to ventilate with BVM?

- Yes
  - Resume BVM ventilation - 1 breath every 3 seconds
  - Reposition patient to align the airway (sniffing position)
  - One more D.L. attempt. Limit attempt to < 30 seconds

- No
  - Call Anaesthetist immediately

Proof of Intubation

5 Point Auscultation

Epigastrium, Bilateral Axillae, Bilateral Bases

- Self-inflating bag valve resuscitator ventilation – 1 breath every 6s
- Secure tube at a depth of 3 x ET Tube size at the teeth/gums
- Check vital signs (BP, PR, RR, SPO2, T° C, RBS)
- Connect patient to the ventilator if available
- Initiate postintubation analgesia and sedation
  - Morphine 0.1 – 0.4mg/kg/hr
  - Ketamine (analgesic and sedative) 0.05 – 0.4mg/kg/hr
  - Midazolam 0.02 - 0.1mg/kg/hr
- Obtain portable CXR to Confirm Depth of ET Tube NOT location

Insert Laryngeal Mask Airway

- Able to ventilate with BVM?
  - Yes
    - Surgical Cricothyrotomy
  - No
    - CALL Anaesthetist immediately

Maintain ventilation

Advanced Airway Techniques
Consult an Anaesthetist
7. Anaphylaxis Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard.

A patient meets the definition of anaphylaxis when ANY 1 of the following 3 criteria are fulfilled:

1. Acute onset of mucocutaneous signs AND 1 of the following:
   - respiratory compromise (wheezing-bronchospasm, dyspnoea, stridor, hypoxemia),
   - hypotension (syncope), or
   - hypotonia.

2. Rapid onset of 2 of the following after exposure to likely allergen:
   - mucocutaneous signs,
   - respiratory compromise,
   - hypotension, or
   - persistent gastrointestinal symptoms.

3. Hypotension after exposure to a known allergen.

Patients with simple allergic reactions who DO NOT meet the criteria for anaphylaxis may be managed similarly WITHOUT the use of adrenaline.

Features of Anaphylaxis
CAREFULLY REMOVE ALLERGEN IF STILL PRESENT e.g. Bee sting

Adrenaline
(1mg/ml 1:1000)
0.3 ml IM anterolateral thigh (all age groups)
Repeat every 5-15 minutes if no improvement

- Monitor, support ABCs in Resuscitation room. Be prepared for intubation/cricothyrotomy if necessary
- Check vital signs (BP, PR, RR, SPO2, T°C, RBS)
- Start Oxygen IF SPO2 < 94% or if patient is dyspnoeic. Maintain SPO2 ≥ 94%
- If severe bronchospasms, start nebulization. see 8. Acute Asthma Exacerbation Algorithm
- Establish large bore IV Access
- Perform brief, targeted history, physical exam.

Antihistamines
H1 Receptor Blockers
e.g. Chlorpheniramine 10-20mg IM/IV &
H2 Receptor Blockers
e.g. Ranitidine 50mg IM/Slow IV

IV Fluids
(e.g. Ringer’s Lactate/Hartmann’s Solution)
Rapid infusion of 20ml/kg if no response to Adrenaline
Repeat IV infusions as necessary as large amounts may be required
Adrenaline infusion 0.1-0.5µg/kg/min ONLY if unresponsive to IM Adrenaline and fluids

Steroids
Hydrocortisone 200mg IM/Slow IV

Patients with suspected anaphylaxis should be observed for at least 6 hours. Patients who are NOT HIGH-RISK should be discharged in the care of others. Before discharge from the hospital, all patients with anaphylactic reactions must be;
- Given clear indications for immediate return to the emergency department (ED).
- Considered for treatment with antihistamines and oral steroids for 3 days to decrease the chance of further reaction.

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8. Acute Asthma Exacerbation Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Acute Asthmatic Attack

- Monitor, support ABCs
- Start Oxygen if \( \text{SPO}_2 \) < 92%. Maintain \( \text{SPO}_2 \geq 92\% \); Oxygen should be provided to all patients with severe asthma, even those with normal oxygenation.
- Perform brief, targeted history, physical exam (auscultation, use of accessory muscles, PR, RR)
- Initiate treatment of underlying cause of exacerbation
- Check Peak Expiratory Flow (PEF) as per PEF Chart below and record predicted or best PEF (%) in patient’s clinical notes. DO NOT measure PEF in patients with impending/actual respiratory arrest, drowsiness, confusion or silent chest. Start treatment immediately.

PEF > 50 % predicted or best

- Nebulise* with Salbutamol + Ipratropium bromide (doses below) every 20 mins or 3 doses for 1 hour. A combination of 4 mL volume fill with NS 6 to 8L/min oxygen flow rate is recommended.
- Give Oral (if patient can swallow) or IV systemic corticosteroids (dose below) immediately

PEF ≤ 50 % predicted or best

- Nebulise* with Salbutamol + Ipratropium bromide (doses below) every 20 mins or 3 doses for 1 hour. A combination of 4 mL volume fill with NS 6 to 8L/min oxygen flow rate is recommended.
- Give IV Hydrocortisone 2mg/kg (maximum 200mg) immediately

Reassess Hourly (or after every 3 doses)

Symptoms, physical exam + BP, PR, RR, SpO₂, PEF

PEF > 60-80% of predicted or personal best

- No Distress
- Physical Exam – Normal
- Response sustained 60 minutes after last treatment

Discharge Home

- Continue treatment with inhaled SABA – 2 puffs QID for 3-5 days
- Give oral systemic corticosteroids: Dexamethasone 0.6mg/kg or 12mg for adults as a single dose or Prednisone (see dose in table below)
- Review medication including inhaler technique
- Consider therapy for underlying cause of exacerbation
- Refer to Chest Physician for follow-up

Continuing Clinical Deterioration, Drowsiness, Confusion, or Silent Chest?

- Give high-dose IV Magnesium, 2gm in 5% Dextrose over 20-min
- Consider intubation (RSI with Ketamine if no C/I) and ventilation with 100% oxygen; anticipate cardiovascular collapse post-intubation
- Get CXR
- Nebulise* with Salbutamol + Ipratropium bromide (doses below) every 20 mins or 3 doses for 1 hour. A combination of 4 mL volume fill with NS and 6 to 8L/min oxygen flow rate is recommended.
- Give IV Hydrocortisone 2mg/kg (maximum 200mg) immediately
- Admit to HDU/ICU

Continuing Clinical Deterioration

Discharge Home

emergencymedicinekenya.org
**Introduction**

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for examining cardiac electrical activity. Originally used in emergencies, it has been incorporated into routine monitoring of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

Familiarity with the wide range of patterns seen in the electrocardiograms then as needed

*available in MDCalc

**Comments**

In mild to moderate exacerbations, pMDI plus spacer is as effective as nebulized therapy with appropriate administration technique and coaching by trained personnel.

Systemic Corticosteroids

**Prednisone**

40–80 mg/d in 1 or 2 divided doses until PEF reaches 70% of predicted or personal best

For outpatient "burst," use 40–60 mg in single or 2 divided doses for a total of 5–10 d.

Hydrocortisone

200mg IV then 1mg/kg/dose IV QID

Only if patient cannot tolerate PO corticosteroids

ED = emergency department; ICS = inhaled corticosteroid; MDI = metered-dose inhaler; PEF = peak expiratory flow; SABA = short-acting β2-adrenergic agonist

Notes: There is no known advantage for higher doses of corticosteroids in severe asthma exacerbations, nor is there any advantage for intravenous administration over oral therapy provided gastrointestinal transit time or absorption is not impaired. The total course of systemic corticosteroids for an asthma exacerbation requiring an ED visit or hospitalization may last from 3 to 10 days. For corticosteroid courses of <1 week, there is no need to taper the dose. For slightly longer courses (e.g., up to 10 d), there probably is no need to taper, especially if patients are concurrently taking ICSs. ICSs can be started at any point in the treatment of an asthma exacerbation.

---

**How to Measure Peak Expiratory Flows (PEF)**

**DO NOT** measure PEF in patients with impending/actual respiratory arrest, drowsiness, confusion or silent chest. Start treatment immediately.

1. Put the pointer on the gauge of the peak flow meter to 0 or the lowest number on the meter.
2. Attach the mouthpiece to the peak flow meter.
3. While standing, take a deep breath.
4. Put the peak flow meter mouthpiece in your mouth and close your lips tightly around the outside of the mouthpiece. Don’t put your tongue inside the mouthpiece.
5. Breathe out as hard and as fast as you can for 1 or 2 seconds. A hard and fast breath usually produces a "huff" sound.
6. Check the number on the gauge and write it down.
7. Repeat the above 3 times and take the patient’s best PEF
8. Plot the best PEF on the normal values chart and calculate the percentage as below

**Measured PEF X 100%**

**Normal PEF**

*available in MDCalc

9. Record the PEF in the patient’s clinical notes
9. Epistaxis Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Wear PPE.
ASK THE PATIENT TO BLOW THEIR NOSE TO REMOVE ANY CLOTS & SPRAY THE NARES WITH OXYMETAZOLINE SPRAY
Have the patient squeeze the distal alae while sitting up, bent forward at the waist over a vomit bucket, and expectorating blood for 15mins. USE A WATCH!! Ask the patient NOT to swallow any blood. A clamping device constructed of four tongue blades secured together by 1-inch tape over the distal alae can be used to clamp the nose closed.

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO2, T°C)
- Perform brief, targeted history, physical exam
  - Nasal trauma from nose picking/blowing is the most common cause of epistaxis.
  - Hypertension DOES NOT cause epistaxis but may prolong it. Therapy should focus on control of the haemorrhage rather than reduction of the blood pressure. DO NOT PRESCRIBE ANTI-HYPERTENSIVE THERAPY FOR EPISTAXIS.
- DO NOT order lab investigations routinely
- For patients with severe or recurrent haemorrhage with a lot of clots, throwing up blood, or with unstable vital signs or underlying medical conditions, a FBC should be performed, as well as a type and screen.

<table>
<thead>
<tr>
<th>Bleeding Controlled</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Repeat vital signs (BP, PR, RR, SPO2, T°C)</td>
<td></td>
</tr>
<tr>
<td>Remove any cotton pledgets and observe the patient for bleeding for at least an hour after control. Encourage the patient to walk or perform other activities that he or she will need to resume when returning home.</td>
<td></td>
</tr>
<tr>
<td>Patients with underlying medication use (aspirin, NSAIDS, warfarin) or renal or hepatic dysfunction, order FBC, UEC &amp; LFTs and coagulation studies - consult an ENT Surgeon/Physician</td>
<td></td>
</tr>
<tr>
<td>If cause identified to be from nasal picking/blowing with no underlying medication use (aspirin, NSAIDS, warfarin) or renal or hepatic dysfunction, discharge patient (with ENT follow-up if recurrent).</td>
<td></td>
</tr>
<tr>
<td>Follow-up instructions - Vaseline or a similar moisturizing agent should be applied liberally in the nose TID for 7-10 days to promote healing of friable mucosa and superficial vessels.</td>
<td></td>
</tr>
</tbody>
</table>

| Yes | Insert a 15-cm piece of cotton pledget soaked in Adrenaline 1 mg + 5 mL Lignocaine 1% in the bleeding nostril for 10 mins. USE A WATCH!! |
| No  |    |

| Yes | Insert a 15-cm piece of cotton pledget soaked in injectable form of Tranexamic acid (500 mg in 5 mL) in the bleeding nostril for 10 mins. USE A WATCH!! |
| No  |    |

| Yes | Pack the bleeding nostril with a nasal tampon or a bacitracin ointment-soaked gauze (watch video http://bit.ly/2aTpWfa)
- The tampon should be coated with bacitracin ointment or xylocaine jelly to facilitate placement. |
| No  |    |

| Yes | Pack the contralateral naris with a nasal tampon or a bacitracin ointment-soaked gauze to provide a counterforce to promote tamponade |
| No  |    |

| Yes | Do NOT remove the contralateral nasal pack.
- Insert a lubricated foley catheter (size 12 or 14 F) until the tip and balloon is entirely in the nasopharynx. Fill the balloon with sterile water (usually 5-10cc) to allow it to be pulled snugly against the posterior nasal choana with anterior traction. The Foley is secured by placing an umbilical or c-clamp on the catheter at the level of the nasal ala with padding in between to prevent pressure injury. |
| No  |    |

| Yes | While the Foley is still in-situ, pack the nostril of the bleeding side using a nasal tampon or a bacitracin ointment-soaked gauze.
- The tampon should be coated with bacitracin ointment or KY-Jelly to facilitate placement. |
| No  |    |
10. Chest Pain (Acute Coronary Syndrome) Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Chest Discomfort Suggestive of Ischemia
(includes anginal equivalents (atypical symptoms) like exertional pain in the ear, jaw, neck, shoulder, arm, back, or epigastric area; exertional dyspnoea; nausea and vomiting; diaphoresis; and fatigue.

- Monitor, support ABCs in the Resuscitation Room (ER). Be prepared to provide CPR
- Obtain/review 12-lead ECG
  - Do a V4R if ST elevation in lead V1 with simultaneous ST depression in V2 - ? Right sided STEMI
  - Do V7 - V9 if ST depressions ≥ 1 mm with upright T-waves in ≥ 2 contiguous anterior precordial leads (V1 to V3) - ? Posterior STEMI
  - If there is ST elevation in aVR ≥ 1mm and aVR ≥ V1 with widespread horizontal ST depression, most prominent in leads I, II and V4-6 – consult a Cardiologist/Physician immediately for PCI (Left main coronary artery occlusion/Proximal LAD lesion/Severe sub endocardial ischaemia, nonlocalized)
  - Sinus Tachycardia, T wave inversion in III & V1, V3 or (S1, Q3, T3) pattern – Consider a PE – see 11. Pulmonary Embolus Algorithm
- Check vital signs (BP, PR, RR, SPO 2 , T, RBS)
- Start Oxygen IF SPO 2 < 90% or if patient is dyspnoeic. Maintain SPO 2 ≥ 90%
- Establish IV access and send blood samples for UEC
- Perform brief, targeted history, physical exam – Indicate time of symptoms onset
- Aspirin 300mg to chew (if not given, not allergic, no active upper GI bleeding or retinal bleeding, not a haemophiliac).
- For pain, DO NOT GIVE NSAIDS (e.g. ibuprofen, diclofenac) as this will increase the patient’s risk of death.
  Give morphine 2-4mg. DO NOT give morphine if:
  - SBP < 90mmHg (or 30 mm Hg below the patient’s known baseline),
  - Heart rate > 100 bpm, or < 50 bpm.
  - Right ventricular infarction (right ventricular infarction causes a preload dependent state)
  - Use of sildenafil or vardenafil within the previous 24 hours or tadalafil within the previous 48 hours.
- For persistent pain, consult a Cardiologist/Physician

- Consider other life-threatening causes of chest pain (pulmonary embolus, cardiac tamponade, aortic dissection, tension pneumothorax, oesophageal rupture)
- Review initial 12-lead ECG

Sequence of ECG changes seen during evolution of myocardial infarction
In the early stages of acute myocardial infarction the electrocardiogram may be normal or near normal; < ½ of patients with acute myocardial infarction have clear diagnostic changes on their first trace. About 10% of patients with a proved acute myocardial infarction (on the basis of clinical history and enzymatic markers) fail to develop ST segment elevation or depression. In most cases, however, serial electrocardiograms show evolving changes that tend to follow well recognised patterns.

<table>
<thead>
<tr>
<th>ST Elevation</th>
<th>MI Description</th>
<th>Coronaries affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2 – V5</td>
<td>Anterior</td>
<td>LAD</td>
</tr>
<tr>
<td>V1 – V2</td>
<td>Septal</td>
<td>Septal LAD</td>
</tr>
<tr>
<td>II, III, aVF</td>
<td>Inferior</td>
<td>RCx (20%) or RCA (80%)</td>
</tr>
<tr>
<td>V1 – V4</td>
<td>Anterolateral</td>
<td></td>
</tr>
<tr>
<td>V3 – V6, I, aVL</td>
<td>Antero-septal</td>
<td></td>
</tr>
<tr>
<td>I, aVL, V5, V6</td>
<td>Lateral</td>
<td>LCx</td>
</tr>
<tr>
<td>V7, V8, V9</td>
<td>Posterior</td>
<td>RCx</td>
</tr>
<tr>
<td>V1, V4R</td>
<td>RV</td>
<td>RCA</td>
</tr>
</tbody>
</table>

ST elevation ST-Elevation MI (STEMI)

ST depression > 0.5mm or dynamic T-wave inversion ≥ 2mm; strongly suspicious for ischemia High-Risk Unstable Angina/Non-ST-Elevation MI (UA/NSTEMI)

Consult a Cardiologist/Physician
Consider immediate transfer to an appropriate facility

Normal or Non-diagnostic changes in ST segment or T wave Intermediate/Low Risk UA
11. Pulmonary Embolism Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Clinical features suggestive of Pulmonary Embolism

- Monitor, support ABCs in Resuscitation room (ER). Be prepared to provide CPR and Thrombolysis
- Features of PE on ECG: Sinus Tachycardia, T wave inversion in III & V1, V3 or S1, Q3, T3 pattern. A normal ECG can be seen in 30% of patients
- Check vitals signs (BP, PR, RR, SPO2, T°C, RBS)
- Start Oxygen if SPO2 < 94% or if patient is dyspnoeic. Maintain SPO2 ≥ 94%
- Establish IV Access and send blood samples for FBC, UEC, & Coagulation screen
- Perform brief, targeted history, physical exam

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points</th>
<th>Probability of PE (%)</th>
<th>Interpretation of Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspected DVT</td>
<td>3.0</td>
<td>7.8 (5.9 – 10.1)</td>
<td>Low Probability</td>
</tr>
<tr>
<td>An alternative diagnosis is less likely than PE</td>
<td>3.0</td>
<td>40.7 (34.9 – 46.5)</td>
<td>Moderate to High Probability</td>
</tr>
<tr>
<td>Hear Rate &gt;100bpm</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immobilisation or surgery in the previous 4 weeks</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous DVT/PE</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemoptysis</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignancy (on treatment, treated in the last 6 months, or palliative)</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Score Range (Points) Probability of PE (%) Interpretation of Risk

Haemodynamically stable, Low Probability for PE

Pulmonary Embolism Rule-Out Criteria (PERC)
1. Is the patient > 49 years of age?
2. Is the pulse rate > 99 beats per minute?
3. Is the pulse oximetry reading < 95% while the patient breathes room air?
4. Is there a present history of haemoptysis?
5. Is the patient receiving exogenous oestrogen?
6. Does the patient have a prior diagnosis of venous thromboembolism?
7. Has the patient had recent surgery or trauma requiring endotracheal intubation or hospitalization in the previous 4 weeks?
8. Does the patient have unilateral leg swelling (visual observation of asymmetry of the calves)?

Any of the above criteria present?

- Yes
- No

CTPA*

Negative
- PE safely excluded consider other diagnosis
- Begin anticoagulation therapy
- Consult a Physician

Positive
- CTPA* Consider Thrombolysis
- Admit to ICU

Shock or Hypotension?

Yes
- Begin anticoagulation
- Consider Thrombolysis
- Admit to ICU

No
- CTPA* Negative

PE safely excluded consider other diagnosis
- Begin anticoagulation therapy
- Admit to ICU or floor as indicated

* Compression ultrasound of lower extremities can be performed as the initial diagnostic imaging modality in any of the following situations;
- no CT scan available
- patients with obvious signs of deep vein thrombosis (DVT) for whom venous ultrasound is readily available
- patients with relative contraindications for CT scan (e.g., borderline renal insufficiency, CT contrast agent allergy)
- in pregnant patients
- patients with a moderate to high clinical risk of PE with a negative or inconclusive CTPA or an inconclusive V/Q scan.

A positive finding in a patient with symptoms consistent with PE can be considered evidence for diagnosis of VTE disease and potentially eliminate the need to expose the patient to the radiation from either a CTPA or V/Q scan.

1Indications for Thrombolysis in PE (rule out contraindication to Thrombolysis)
- Cardiac Arrest
- SBP <90 mmHg for >15 minutes, if not caused by new-onset arrhythmia, hypovolaemia, or sepsis

Consult a Physician
Consider immediate transfer to an appropriate facility

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12. Hypertension Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

BP > 130/80 mmHg

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO₂, T°C, RBS)
- Start Oxygen if SPO₂ < 94%. Maintain SPO₂ ≥ 94%
- Perform brief, targeted history and physical exam
- Obtain/review 12-lead ECG (if indicated)
- Send samples for FBC, UEC, TSH and Urinalysis (for proteinuria) and PDT (as applicable)
- **DO NOT ADMINISTER ORAL ANTIHYPERTENSIVES** (e.g. nifedipine) **TO LOWER THE BLOOD PRESSURE IN THE ED.**
- Allow patient to rest awaiting results. Repeat BP checks hourly.

Are there any features of progressive or impending end organ damage (especially if BP > 180/110 mmHg)?

- **a) Neurological**
  - Cerebral vascular accident/cerebral infarction
  - Hypertensive encephalopathy
  - Subarachnoid haemorrhage
  - Intracranial haemorrhage
- **b) Cardiovascular**
  - Acute pulmonary oedema
  - Congestive heart failure
  - Myocardial ischemia/infarction
  - Acute left ventricular dysfunction
  - Aortic dissection
- **c) Other**
  - Acute renal failure/insufficiency
  - Retinopathy
  - Pre-eclampsia/Eclampsia
  - Micro angiopathic haemolytic anaemia

Headache/Epistaxis is **NOT** a hypertensive emergency, no matter how high the blood pressure. It is likely the headache/epistaxis is causing the hypertension, not the other way around. Treat the headache/epistaxis and the pressure will come down.

Known Hypertensive – Resume regular treatment; if unknown, **low dose thiazide type diuretic** for most; may consider ACE inhibitor, ARB, β-blocker, CCB. Follow-up as below (see Guidelines for prevention, detection, evaluation and management of high blood pressure in adults)

New Onset Hypertension - Final BP prior to discharge
- **BP > 160/100** – **low dose thiazide type diuretic** for most; may consider ACE inhibitor, ARB, β-blocker, CCB. (see Guidelines for prevention, detection, evaluation and management of high blood pressure in adults). Follow-up as below
- **BP < 160/100** – Follow-up as below

Daily BP checks at nearest clinic and follow-up in a Medical Clinic in 1 week with BP chart

See 13. Hypertensive Emergencies Algorithm
Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults

BLOOD PRESSURE MEASUREMENT TECHNIQUES

1. Have the patient relax, sitting in a chair (feet on floor, back supported) for >5 min.
2. The patient should avoid caffeine, exercise, and smoking for at least 30 min before measurement.
3. Ensure patient has emptied his/her bladder.
4. Neither the patient nor the observer should talk during the rest period or during the measurement.
5. Remove all clothing covering the location of cuff placement.
6. Measurements made while the patient is sitting or lying on an examining table do not fulfill these criteria.
7. Use a BP measurement device that has been validated and ensure that the device is calibrated periodically. *
8. Support the patient’s arm (e.g., resting on a desk).
9. Position the middle of the cuff on the patient’s upper arm at the level of the right atrium (the midpoint of the sternum).
10. Use the correct cuff size, such that the bladder encircles 80% of the arm, and note if a larger- or smaller-than-normal cuff size is used.
11. Either the stethoscope diaphragm or bell may be used for auscultatory readings.
12. At the first visit, record BP in both arms. Use the arm that gives the higher reading for subsequent readings.
13. Separate repeated measurements by 1–2 min.
14. For auscultatory determinations, use a palpated estimate of radial pulse obliteration pressure to estimate SBP. Inflate the cuff 20–30 mm Hg above this level for an auscultatory determination of the BP level.
15. For auscultatory readings, deflate the cuff pressure 2 mm Hg per second, and listen for Korotkoff sounds.
16. Record SBP and DBP. If using the auscultatory technique, record SBP and DBP as onset of the first Korotkoff sound and disappearance of all Korotkoff sounds, respectively, using the nearest even number.
17. Note the time of most recent BP medication taken before measurements.
18. Use an average of ≥ 2 readings obtained on ≥2 occasions to estimate the individual’s level of BP.
19. Provide patients the SBP/DBP readings both verbally and in writing.

### Categories of BP in Adults*

<table>
<thead>
<tr>
<th>BP Category</th>
<th>SBP</th>
<th>DBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;120 mm Hg</td>
<td>and</td>
</tr>
<tr>
<td>Elevated</td>
<td>120–129 mm Hg</td>
<td>and</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>130–139 mm Hg</td>
<td>or</td>
</tr>
<tr>
<td>Stage 2</td>
<td>≥140 mm Hg</td>
<td>or</td>
</tr>
</tbody>
</table>

*Individuals with SBP and DBP in 2 categories should be designated to the higher BP category.

DIAGNOSTIC WORKUP OF HYPERTENSION

- Assess risk factors and comorbidities
- Reveal identifiable causes of hypertension
- Assess presence of target organ damage
- Conduct history and physical examination
- Obtain/review 12-lead ECG, RBS, FBC, UEC, TSH, Urinalysis for proteinuria, Lipid profile
Blood Pressure (BP) Thresholds and Recommendations for Treatment and Follow-Up

* Calculate the 10-year risk for first atherosclerotic cardiovascular disease events (ASCVD; nonfatal myocardial infarction, coronary heart disease–related death, or fatal or nonfatal stroke) with the ASCVD Risk Calculator (available in MDCalc)

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**Introduction**

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

**How to do an ECG**

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

---

**Blood Pressure (BP) Thresholds and Recommendations for Treatment and Follow-Up**

- **Normal BP (BP <120/80 mm Hg)**
  - Promote optimal lifestyle habits
  - **Reassess in 1 y (Class IIa)**

- **Elevated BP (BP 120–129/<80 mm Hg)**
  - Nonpharmacologic therapy (Class I)
  - Reassess in 3-6 mo (Class IIa)

- **Stage 1 Hypertension (BP 130–139/80-89 mm Hg)**
  - Nonpharmacologic therapy (Class I)
  - Reassess in 3-6 mo (Class IIa)

- **Stage 2 Hypertension (BP ≥140/90 mm Hg)**
  - Clinical ASCVD or estimated 10-year CVD risk ≥10%*
    - **No**
      - Nonpharmacologic therapy and BP-lowering medication (Class I)
      - Reassess in 1 mo (Class I)
    - **Yes**
      - Nonpharmacologic therapy and BP-lowering medication†
      - Reassess in 1 mo (Class I)

* Using the ACC/AHA Pooled Cohort Equations. Note that patients with DM or CKD are automatically placed in the high-risk category. For initiation of RAS inhibitor or diuretic therapy, assess blood tests for electrolytes and renal function 2 to 4 weeks after initiating therapy.

† Consider initiation of pharmacological therapy for stage 2 hypertension with 2 antihypertensive agents of different classes. Patients with stage 2 hypertension and BP ≥160/100 mm Hg should be promptly treated, carefully monitored, and subject to upward medication dose adjustment as necessary to control BP. Reassessment includes BP measurement, detection of orthostatic hypotension in selected patients (e.g., older or with postural symptoms), identification of white coat hypertension or a white coat effect, documentation of adherence, monitoring of the response to therapy, reinforcement of the importance of adherence, reinforcement of the importance of treatment, and assistance with treatment to achieve BP target.
Introduction
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<table>
<thead>
<tr>
<th>Nonpharmacologic Intervention</th>
<th>Dose</th>
<th>Approximate Impact on SBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight loss</td>
<td>Weight/body fat</td>
<td>Ideal body weight is best goal but at least 1 kg reduction in body weight for most adults who are overweight. Expect about 1 mm Hg for every 1 kg reduction in body weight.</td>
</tr>
<tr>
<td>Healthy diet</td>
<td>DASH dietary pattern</td>
<td>Diet rich in fruits, vegetables, whole grains, and low-fat dairy products with reduced content of saturated and trans fat</td>
</tr>
<tr>
<td>Reduced intake of dietary sodium</td>
<td>Dietary sodium</td>
<td>&lt;1,500 mg/d is optimal goal but at least 1,000 mg/d reduction in most adults</td>
</tr>
<tr>
<td>Enhanced Intake of dietary potassium</td>
<td>Dietary potassium</td>
<td>3,500–5,000 mg/d, preferably by consumption of a diet rich in potassium</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Aerobic</td>
<td>- 120–150 min/wk, 65%–75% heart rate reserve</td>
</tr>
<tr>
<td></td>
<td>Dynamic Resistance</td>
<td>90–150 min/wk, 50%–60% 1 rep maximum, 6 exercises, 3 sets/exercise, 10 repetitions/set</td>
</tr>
<tr>
<td></td>
<td>Isometric Resistance</td>
<td>4 x 2 min (hand grip), 1 min rest between exercises, 30%–40% maximum voluntary contraction, 3 sessions/wk, 8–10 wk</td>
</tr>
<tr>
<td>Moderation in alcohol intake</td>
<td>Alcohol consumption</td>
<td>In individuals who drink alcohol, reduce alcohol† to; Men: ≤2 drinks daily, Women: ≤1 drink daily</td>
</tr>
</tbody>
</table>

*Type, dose, and expected impact on BP in adults with a normal BP and with hypertension.

†In the United States, one “standard” drink contains roughly 14 grams of pure alcohol, which is typically found in 12 ounces of regular beer (usually about 5% alcohol), 5 ounces of wine (usually about 12% alcohol) and 1.5 ounces of distilled spirits (usually about 40% alcohol).
# Evidence-Based Dosing for Antihypertensive Drugs

<table>
<thead>
<tr>
<th>Class</th>
<th>Drug</th>
<th>Usual Dose, Range (mg per day)*</th>
<th>Daily Frequency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Agents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiazide or</td>
<td>Chlorthalidone</td>
<td>12.5-25</td>
<td>1</td>
<td>- Chlorthalidone preferred based on prolonged half-life and proven trial reduction of CVD</td>
</tr>
<tr>
<td>thiazide-type</td>
<td>Hydrochlorothiazide</td>
<td>25-50</td>
<td>1</td>
<td>- Monitor for hyponatremia and hypokalemia, uric acid and calcium levels.</td>
</tr>
<tr>
<td>diuretics</td>
<td>Indapamide</td>
<td>1.25-2.5</td>
<td>1</td>
<td>- Use with caution in patients with history of acute gout unless patient is on uric acid-lowering therapy.</td>
</tr>
<tr>
<td></td>
<td>Metolazone</td>
<td>2.5-10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>ACE Inhibitors</strong></td>
<td>Benazepril</td>
<td>10-40</td>
<td>1 or 2</td>
<td>- Do not use in combination with ARBs or direct renin inhibitor</td>
</tr>
<tr>
<td></td>
<td>Captopril</td>
<td>12.5-150</td>
<td>2 or 3</td>
<td>- Increased risk of hyperkalemia, especially in patients with CKD or in those on K+ supplements or K+-sparing drugs</td>
</tr>
<tr>
<td></td>
<td>Enalapril</td>
<td>5-40</td>
<td>1 or 2</td>
<td>- May cause acute renal failure in patients with severe bilateral renal artery stenosis</td>
</tr>
<tr>
<td></td>
<td>Fosinopril</td>
<td>10-40</td>
<td>1</td>
<td>- Do not use if history of angioedema with ACE inhibitors.</td>
</tr>
<tr>
<td></td>
<td>Lisinopril</td>
<td>10-40</td>
<td>1</td>
<td>- Avoid in pregnancy</td>
</tr>
<tr>
<td></td>
<td>Moexipril</td>
<td>7.5-30</td>
<td>1 or 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perindopril</td>
<td>4-16</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quinapril</td>
<td>10-80</td>
<td>1 or 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ramipril</td>
<td>2.5-10</td>
<td>1 or 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trandolapril</td>
<td>1-4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>ARBs</strong></td>
<td>Azilsartan</td>
<td>40-80</td>
<td>1</td>
<td>- Do not use in combination with ACE inhibitors or direct renin inhibitor</td>
</tr>
<tr>
<td></td>
<td>Candesartan</td>
<td>8-32</td>
<td>1</td>
<td>- Increased risk of hyperkalemia in CKD or in those on K+ supplements or K+-sparing drugs</td>
</tr>
<tr>
<td></td>
<td>Eprosartan</td>
<td>600-800</td>
<td>1 or 2</td>
<td>- May cause acute renal failure in patients with severe bilateral renal artery stenosis</td>
</tr>
<tr>
<td></td>
<td>Irbesartan</td>
<td>150-300</td>
<td>1</td>
<td>- Do not use if history of angioedema with ARBs. Patients with a history of angioedema an with an ACEI can receive an ARB beginning 6 weeks after ACEI discontinued.</td>
</tr>
<tr>
<td></td>
<td>Losartan</td>
<td>50-100</td>
<td>1 or 2</td>
<td>- Avoid in pregnancy</td>
</tr>
<tr>
<td></td>
<td>Olmesartan</td>
<td>20-40</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telmisartan</td>
<td>20-80</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Valsartan</td>
<td>80-320</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>CCB—dihydropyridines</strong></td>
<td>Amiodipine</td>
<td>2.5-10</td>
<td>1</td>
<td>- Avoid use in patients with HfEF; amiodipine or felodipine may be used if required</td>
</tr>
<tr>
<td></td>
<td>Felodipine</td>
<td>5-10</td>
<td>1</td>
<td>- Associated with dose-related pedal edema, which is more common in women than men</td>
</tr>
<tr>
<td></td>
<td>Isradipine</td>
<td>5-10</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nicardipine SR</td>
<td>5-20</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nifidipine LA</td>
<td>60-120</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nisoldipine</td>
<td>30-90</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>CCB—nondihydropyridines</strong></td>
<td>Diltilazem SR</td>
<td>180-360</td>
<td>2</td>
<td>- Avoid routine use with beta blockers due to increased risk of bradycardia and heart block</td>
</tr>
<tr>
<td></td>
<td>Diltilazem ER</td>
<td>120-480</td>
<td>1</td>
<td>- Do not use in patients with HfEF</td>
</tr>
<tr>
<td></td>
<td>Verapamil IR</td>
<td>40-80</td>
<td>3</td>
<td>- Drug interactions with diltilazem and verapamil (CYP3A4 major substrate and moderate inhibitor)</td>
</tr>
<tr>
<td></td>
<td>Verapamil SR</td>
<td>120-480</td>
<td>1 or 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Verapami-delayed onset ER (various forms)</td>
<td>100-480</td>
<td>1 (in the evening)</td>
<td></td>
</tr>
</tbody>
</table>
Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for the investigation of cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction, atrial fibrillation, and the presence of bradycardia or tachycardia. The information from these 12 leads is combined to form a standard electrocardiogram.

Hypertensive Emergencies Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

BEGIN 12. HYPERTENSION ALGORITHM
Features of progressive or impending end organ damage
(especially if BP > 180/120 mmHg)?

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO$_2$, T°, RBS)
- Start Oxygen if SPO$_2$ < 94%. Maintain SPO$_2$ ≥ 94%
- Establish IV Access and send samples for FBC, UEC, Urinalysis (for proteinuria) and PDT (as applicable)
- Obtain/review 12-lead ECG
- Perform brief, targeted history, physical exam
- Consult a Physician/ Obstetrician for Eclampsia and consider treatments as below in consultation with a Physician/Obstetrician

See Hypertensive Emergencies Drug Infusions for Dosages and Precautions

**Neurological Emergencies**

<table>
<thead>
<tr>
<th>Preferred medications</th>
<th>Medications to avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Labetalol</td>
<td>- Nitroprusside</td>
</tr>
<tr>
<td>- Nitroglycerin</td>
<td>- Hydralazine</td>
</tr>
</tbody>
</table>

**Hypertensive Encephalopathy** - Reduce mean arterial pressure (MAP) 25% over 8 hours.

**Acute Ischemic Stroke** - Evidence exists that patients who have acute strokes have better outcomes with higher BPs. Antihypertensive therapy is not routinely recommended for patients with acute stroke and HTN.
- Patient otherwise eligible for acute reperfusion therapy except that BP is >185/110 mm Hg:
  - Labetalol
  - Other agents (hydralazine, enalaprilat, etc.) may be considered when appropriate
- If BP is not maintained at or below 185/110 mm Hg, do not administer rtPA
  - Management of BP during and after rtPA or other acute reperfusion therapy to maintain BP at or below 180/105 mm Hg:
    - Monitor BP every 15 minutes for 2 hours from the start of rtPA therapy, then every 30 minutes for 6 hours, and then every hour for 16 hours
    - If systolic BP >180–230 mm Hg or diastolic BP >105–120 mm Hg:
      - Labetalol
      - If BP not controlled or diastolic BP >140 mm Hg, consider IV sodium nitroprusside
- After treatment with fibrinolysis, the SBP should be maintained <180mmHg and DBP <105mmHg for 24 hours.

- In patients with markedly elevated blood pressure (SBP > 220 mm Hg or DBP > 120 mm Hg) who do not receive fibrinolysis, a reasonable goal is to lower blood pressure by 15% during the first 24 hours after onset of stroke.

**Acute Intracerebral Haemorrhage** - No evidence exists to suggest that HTN provokes further bleeding in patients with ICH. A precipitous fall in SBP may compromise cerebral perfusion and increase mortality. The controlled lowering of BP with IV labetalol (in the absence of bradycardia) is currently recommended only when the SBP is >200mmHg or the DBP is >110mmHg. Treatment based on clinical/radiographic evidence of increased intracranial pressure (ICP).
- If signs of increased ICP, maintain MAP just below 130mmHg (or SBP < 180mmHg) for first 24 hours after onset.
- Patients without increased ICP, maintain MAP < 110mmHg (or SBP < 160mmHg) for first 24 hours after symptom onset.

**Subarachnoid Haemorrhage** - Maintain SBP < 160mmHg until the aneurysm is treated or cerebral vasospasm occurs. Oral nimodipine is used to prevent delayed ischemic neurological deficits, but it is NOT indicated for treating acute hypertension.

**Cardiovascular Emergencies**

**Aortic Dissection** - Immediately reduce the SBP <120mmHg and maintain it at this level unless signs of end-organ hypofusion are present. Preferred treatment includes a combination of:
- a) narcotic analgesics (morphine sulphate),
- b) vasoconstrictors (nicardipine, nitroprusside),
- c) β-blockers (labetalol, esmolol) or calcium channel blockers (verapamil, diltiazem); Avoid β-blockers if there is:
  - aortic valvular regurgitation or
  - suspected cardiac tamponade.

**Acute Coronary Syndrome** - Treat if SBP >160 mmHg and/or DBP >100 mmHg. Reduce BP by 20-30% of baseline. Thrombolytics are contraindicated if BP is >185/100 mmHg. Preferred medications include β-blockers & Nitroglycerin

**Acute Heart Failure** - Treatment with vasodilators (in addition to diuretics) for SBP ≥ 140 mmHg. IV or sublingual nitroglycerin is the preferred agent.

**Other Disorders**

**Cocaine toxicity/Pheochromocytoma** - Hypertension and tachycardia from cocaine toxicity rarely require specific treatment.
- Benzodiazepines are the preferred agents for cocaine-associated acute coronary syndromes.
- Pheochromocytoma treatment guidelines are similar to that of cocaine toxicity. β-blockers can be added for BP control only after α-blockade.

**Preferred medications** - Diazepam, Phentolamine, Nitroglycerin/nitroprusside

**Medications to avoid** - β-adrenergic antagonists prior to phentolamine administration

**Preeclampsia/eclampsia** - In women with eclampsia or preeclampsia, SBP should be < 160 mmHg and DBP <110 mm Hg in the prepartum and intrapartum periods.
- If the platelet count is < 100,000 cells/mm$^3$ IV should be maintained below 150/100mmHg. Patients with eclampsia or preeclampsia should also be loaded with IV Magnesium sulphate 4gm diluted in 100mL NS over 15 mins then with an infusion of 2gm/hr to avoid seizures.

**Preferred medications** - Hydralazine, Labetalol, Nifedipine

**Medications to avoid** - Nitroprusside, Angiotensin-converting enzyme inhibitors, Esmolol
Hypertensive Emergencies Drug Infusions

*For adults with a compelling condition (i.e., aortic dissection, severe preeclampsia or eclampsia, or pheochromocytoma crisis), SBP should be reduced to < 140 mm Hg during the first hour and to < 120 mm Hg in aortic dissection. For adults without a compelling condition, SBP should be reduced by no more than 25% within the first hour; then, if stable, to 160/100 mm Hg within the next 2 to 6 hours; and then cautiously to normal during the following 24 to 48 hours.

<table>
<thead>
<tr>
<th>AGENT</th>
<th>MOA</th>
<th>DOSE</th>
<th>ONSET/DURATION OF ACTION (AFTER DISCONTINUATION)</th>
<th>PRECAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parenteral Vasodilators</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>Decreases coronary vasospasm, which increases coronary blood flow. Also, induces vessel dilatation, decreasing cardiac workload.</td>
<td>Initial 5 mcg/min; increase in increments of 5 mcg/min every 3–5 min to a maximum of 20 mcg/min.</td>
<td>2-5 min / 5-10 min</td>
<td>Use only in pts with acute coronary syndrome and/or acute pulmonary oedema. Do not use in volume-depleted pts.</td>
</tr>
<tr>
<td>Hydralazine</td>
<td>Decreases systemic resistance through direct vasodilation of arterioles.</td>
<td>Initial 10 mg via slow IV infusion (maximum initial dose 20 mg); repeat every 4–6 h as needed.</td>
<td>10 min / &gt; 1 hr</td>
<td>BP begins to decrease within 10–30 min and the fall lasts 2–4 h. Unpredictability of response and prolonged duration of action do not make hydralazine a desirable first-line agent for acute treatment in most pts.</td>
</tr>
</tbody>
</table>

| **Parenteral Adrenergic Inhibitors**                                                                                                           |
| Labetalol      | α, β1, β2 Blocker                     | Initial 0.3–1.0 mg/kg dose (maximum 20 mg) slow IV injection every 10 min or 0.4–1.0 mg/kg/h IV infusion up to 3 mg/kg/h. Adjust rate up to total cumulative dose of 300 mg. This dose can be repeated every 4–6 h. | 5-10 min / 15-30 min          | Contraindicated in reactive airways disease or chronic obstructive pulmonary disease. Especially useful in hyperadrenergic syndromes. May worsen HF and should not be given in pts with 2nd or 3rd degree heart block or bradycardia. |
| Esmolol        | Ultra-short-acting β-adrenergic blocker | Loading dose 500–1,000 mcg/kg/min over 1 min followed by a 50 mcg/kg/min infusion. For additional dosing, the bolus dose is repeated, and the infusion increased in 50 mcg/kg/min increments as needed to a maximum of 200 mcg/kg/min. | 1-5 min / 15-30 min          | Contraindicated in pts with concurrent beta-blocker therapy, bradycardia and/or decompensated HF. Monitor for bradycardia. May worsen HF. Higher doses may block beta2 receptors and impact lung function in reactive airway disease. |
14. Seizures Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**History of Seizure**

- Maintain and support ABCs
- Monitor vital signs (BP, PR, RR, SPO2, T°C)
- Start Oxygen if SPO2 < 94%. Maintain SPO2 ≥ 94%
- Check RBS

**First-time Seizure**

- Send samples for MPS, UEC, HIV, (Urinalysis if pregnant or post-partum)

**Known Epileptic or >1 seizure**

- Send samples for UEC, (MPS, HIV, Urinalysis if pregnant or post-partum, Anti-Epileptic Drug (AED) levels as applicable)

### Active seizure / Post ictal / Status Epilepticus

- Position patient on soft mattress/pillows on a trolley in left lateral position and open the airway with head tilt maneuver; maintain this position until patient is awake – DO NOT restrain a seizing patient
- Maintain and support ABCs. Provide O2 by Non-Rebreather mask at 15L/min
- Check RBS

#### Post ictal

- Still Seizing
- Or
- Recurrent Seizure

- Repeat Midazolam 0.1mg/Kg IV after 10 minutes from last dose
- Load with phenytoin at 20 mg/kg IV in NS strictly over 30 mins.
  - OR
  - Na Valproate 20mg/kg IV push if on ARVs
  - OR
  - Mg Sulphate 4gm/diluted in 100mL NS over 15 mins. Continue with an infusion of 2gm/hr

- If pregnant or post-partum, load with IV Magnesium sulphate 4gm diluted in 100mL NS over 15 mins. Continue with an infusion of 2gm/hr

### Patients with typical recurrent seizures related to previously treated epilepsy or eclamptic patients are unlikely to have life-threatening structural lesions. These patients DO NOT require MRI/CT.

An MRI (or CT scan) should be performed immediately when a provider suspects a serious structural lesion or:
- new focal deficits,
- persistent altered mental status (with or without intoxication),
- fever,
- recent trauma,
- persistent headache,
- history of cancer,
- history of anticoagulation
- suspension of AEDs,
- patients who have completely recovered from their seizure and for whom no clear-cut cause has been identified (e.g., hypoglycaemia, hypotension, drug overdose, eclampsia)

Additionally, for patients with first-time seizure, emergent MR/CT should be considered if any of the following is present:
- Age > 40 years
- Partial-onset seizure

Additionally, for patients with recurrent seizure (prior history of seizures) emergent MR/CT should be considered if any of the following is present:
- New seizure pattern or new seizure type
- Prolonged postictal confusion or worsening mental status

### Review with ALL results

Criteria for discharge:
- First onset single seizure in a patient < 40 year who has completely recovered from their seizure and for whom no clear-cut cause has been identified (e.g., hypoglycaemia, hypotension, drugs, idiopathic) and with normal investigations.
- No follow-up is necessary unless seizure recurs
- Known epileptic who has completely recovered from their seizure and for whom a clear-cut cause has been identified (e.g. non-compliance, sub-therapeutic drug levels) and with normal investigations. Patient should be loaded with anticonvulsants if non-therapeutic prior to discharge and adequate follow-up arranged.

Consult a Physician on ALL other patients. Consult an OB/GYN for all pregnant or post-partum patients
Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG

The six chest leads (V1 to V6) “view” the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

15. Syncope Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

History of Syncope

Syncope is a symptom complex that is composed of a brief loss of consciousness associated with an inability to maintain postural tone that “spontaneously” (i.e., no postictal period with a rapid recovery) and “completely” (no residual neurologic deficit) resolves without medical intervention. Near-syncope is defined as a patient almost losing consciousness, and it is approached in the same way as syncope.

Consider seizure - tongue biting, head turning during loss of consciousness, no recollection of abnormal behaviour, prolonged limb jerking (lasting minutes), incontinence post-event confusion, and prodromal aura.

Yes

Go to 14. Seizures Algorithm

No

• Check RBS – If RBS < 3.3 mmol/L – see 22. Hypoglycaemia Algorithm
• 12 lead ECG - Look for evidence of ischemia/infarction, dysrhythmias, atrioventricular blocks, Brugada syndrome (RBBB with J-wave elevation of ≥ 2 mm), prolonged QT interval, ventricular pre-excitation, hypertrophic cardiomyopathy
• Consider dangerous causes of syncope
  - Neuromuscular-mediated syncope
  - Subarachnoid haemorrhage
  - Seizure
  - Orthostatic hypotension-mediated syncope
  - Ectopic pregnancy
  - Gastrointestinal haemorrhage
  - Medication-induced orthostatic hypotension*

  Cardiovascular-mediated syncope
  - Dysrhythmias
  - Acute coronary syndromes (rare < 2%)
  - Aortic dissection
  - Pulmonary Embolism (rare < 1%)
  - Patients with bradycardia*

* patients who may benefit from intervention.

None of the above

The San Francisco Syncope Rule (SFSR) (available in MDCalc)
The SFSR uses five factors (CHESS predictors) to predict serious adverse outcomes at 7 or 30 days in patients presenting to the ED.

1. History of Congestive Heart Failure
2. Haematocrit < 30% (Hb < 10g/dL) (test if clinically indicated)
3. ECG abnormality (see above)
4. History of Shortness of breath
5. SBP < 90 mm Hg after arrival in the ED

SFSR is associated with a pooled negative predictive value of 97%, sensitivity of 87%, and negative LR of 0.28. Patients with negative SFSR scores had < 3% risk for serious outcomes.

Does the patient have ANY of the 5 SFSR predictors?

Yes

Consult a Physician

No

Discharge

emergencymedicinekenya.org

1
16. Trauma Management Pathway

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

SAMPLE HISTORY
- Signs and Symptoms
- Allergies
- Medication
- Past Medical History/Pregnancy
- Last meal/Last Tetanus Injection/Last Medication/Drug/Alcohol intake
- Events preceding presentation

ACTIVATE THE TRAUMA TEAM (see Trauma Team Activation Criteria on the next page)

Primary Survey (C-ABCDE)
STOP ANY EXTERNAL MASSIVE BLEEDING IMMEDIATELY
C-Spine – Cleared Clinically (see 17. C-Spine Clearance Algorithm) Perform Manual In-Line Stabilization (MILS) then apply Head Blocks or Blanket Rolls taped to the patient’s head and trolley. DO NOT APPLY A C-COLLAR
Airway – Open? Maintainable? Intubate?
Disability – GCS? (available in MDCalc) Pupils? RBS?
Expose patient

Resuscitation (C-ABCDE)
- If suspected trauma and not cleared clinically, Head Blocks or Blanket Rolls strapped to the patient’s head and trolley?
- Rapid Sequence Intubation?
- Supplementary Oxygenation? – Non-Rebreather mask
- Immediate decompression for Tension Pneumothorax with subsequent immediate Intercostal Chest Drain Insertion?
- Emergency intercostal Chest Drain for Massive Haemothorax or Open sucking chest wound

C – Control Active Bleeding including:
- Apply a Pelvic wrap to an open Book Pelvic Fracture
- Apply a Traction splint for Femur Fractures
- Insert 2 large bore IV lines and give appropriate fluid resuscitation (NS/RL/whole blood). Adult trauma patients with, or at risk of, significant bleeding should be given Tranexamic acid loading dose 15mg/kg over 10 min then infusion of 1.5mg/kg/h.
- FHG, UEC, GXM and request adequate supplementary blood and blood products

D – Correct Hypoglycaemia – 50mls 50% Dextrose IV
- Give appropriate analgesia e.g. Fentanyl 1μg/kg IV (see Analgesia Chart and 35. Pain Management Algorithm for Regional Anaesthesia)
- Give IV Phentoin (20mg/kg) for Severe Head Injury (GCS ≤ 8)

E – Check temperature and avoid hypo- or hyperthermia

Secondary Survey (Head-to-Toe Survey)
- Chest – Lacerations? Rib Fractures?
- Log roll patient – Lacerations? Spine tenderness?
- Do not forget to clean all open wounds with running tap water for at least 10 minutes and give Tetanus Toxoid. Give ANTIBIOTICS within 1 hour of injury for ALL COMPOUND FRACTURES. Therapeutic doses of cefazolin, clindamycin, for 48 hrs are appropriate; with contamination, consider anaerobic antibiotics (penicillins, clindamycin, metronidazole); NO ANTIBIOTICS are required for soft tissue injuries unless there is evidence of an infection.

Radiological Investigations
- Extended Focussed Assessment with Sonography in Trauma (EFAST) – ONLY for;
  - Penetrating chest trauma – Pneumothorax? Haemothorax? Pericardial Effusion?
  - Unstable blunt chest and abdominal trauma – Haemothorax? Hemoperitoneum?
  - Unexplained hypotension? - Free fluid in pleural, pericardial or peritoneal cavity
- CT-Abdomen – For the haemodynamically stable patient with suspected blunt abdominal trauma
- CT Head – ONLY for;
  - GCS <15 (for GCS 15 – see 18. Mild Traumatic Brain Injury Algorithm)
  - Skull fractures including Base of Skull Fractures (DO NOT ORDER SKULL X-RAYS)
- C-Spine X-rays (AP, Lateral AND Open Mouth) – see 17. C-Spine Clearance Algorithm. If doing a CT head, do CT Spine instead of C-spine X-rays if indicated.
- C-spine is NOT cleared on X-rays/CT BUT on resolution of patient symptoms
- Pelvic X-ray – ONLY for patients with;
  - lower abdominal pain
  - lower back pain
  - femur fractures
  - clinically tender pelvis
  - patients unable to mobilize
- Knee X-ray – See Ottawa Knee Rule in MDCalc
- Ankle X-ray – See Ottawa Ankle Rule in MDCalc

Where a reliable clinical assessment is not possible ALL the investigations should be done.
Trauma Team Activation Criteria

The Trauma team comprises a group of emergency department doctors/clinical officers and nurses, surgeons, anaesthetists and theatre staff, radiographers and other support personnel, who work together as a team to assess and manage the trauma patient. Their actions are coordinated by a team leader who should not touch the patient. The aim of the trauma team is to provide a safe and efficient evaluation of the patient. Identify all injuries and instigate definitive management of such injuries. Most trauma teams will have about 30 minutes to accomplish this and should work towards achieving this goal.

The Trauma Team should be activated immediately a patient who meets ANY of the criteria below arrives:

- Systolic BP < 90 mmHg
- Respiratory rate < 10 breaths/min or > 30 breaths/min
- GCS < 12 with torso or extremity trauma
- Pregnant patient (> 20 weeks) with foetal heart rate < 120 bpm or >160 bpm
- Amputation proximal to elbows or knees
- 2 or more proximal long bone fractures
- Suspected spinal cord injury
- Severe maxillofacial injury with airway compromise
- Burns > 15% TBSA
- Pregnant patient with penetrating injury or significant blunt injury
- Gunshot wound proximal to knee or elbow
- Significant penetrating wound to head, neck, chest, abdomen or groin
- Ejection from vehicle
- Pedestrian thrown (hit by a car) or rolled over
- Fall from a height > 6 metres (20 feet)
- Simultaneous arrival of 3 or more multi-trauma patients
- Emergency Doctor feels trauma team is necessary for an injured patient
Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

17. **C-Spine Clearance Algorithm**

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

See 16. Trauma Management Pathway
For Alert (Glasgow Coma Scale Score = 15) and Stable Trauma Patients
Where Cervical Spine (C-Spine) Injury is a Concern

Perform Manual in-Line Stabilization of the C-Spine
Maintain and support ABCs

(Canadian & Nexus C-Spine Rules available in MDCalc)

- Age ≥ 65 Years
- Glasgow Coma Scale score of 14 or less
- Decreased alertness secondary to intoxication
- Disorientation to person, place, time, or events
- Inability to remember 3 objects at 5 minutes
- Delayed or inappropriate response to external stimuli
- Any focal deficit on motor or sensory examination or paraesthesia in extremities

No

- Midline Neck Pain
- Midline C-spine Tenderness (C1 – T1)

Provide immediate adequate analgesia

No

- Able to Actively Rotate Neck 45° Left and Right Without Pain?
The doctor should allow the patient to perform the above movement while maintaining in-line stabilization without moving the patient’s neck

Able

- No Radiography Necessary
  Document clearly in patient’s clinical notes successful completion of ALL the above steps

Yes

- Perform C-spine immobilization with the patient flat on a trolley with Head Blocks or Blanket Rolls strapped to the patient’s head and trolley. DO NOT APPLY A C-COLLAR
- Keep patient immobilized as above UNTIL patient is reviewed and C-spine is cleared by the ED doctor / Orthopaedic surgeon
- Order ALL 3 views C-spine X-rays;
  - a cross-table lateral view - must be of good quality and adequately visualize the base of the occiput to the upper part of T1.
  - an anteroposterior view - must reveal the spinous processes of C2 to C7 and up to C7-T1
  - an open-mouth view to visualize the odontoid process of C2. Must visualize the entire dens and the lateral masses of C1.

DO NOT INTERPRET INADEQUATE IMAGES

- Obtain CT C-spine IF;
  - patient is to receive an immediate CT head. No c-spine X-rays are required initially
  - X-rays are inadequate
  - patient has persistent symptoms despite analgesia and negative X-rays
  - pathology is noted on c-spine X-rays

Review X-rays and/or CT C-spine images and the patient
C-Spine Cleared on Radiology?

Yes

- Consult an Orthopaedic Surgeon
- Maintain immobilization with the patient flat on a trolley with Head Blocks or Blanket Rolls strapped to the patient’s head and trolley

No

Remove Immobilization devices

Symptoms persist?

Yes

No

No
18. Mild Traumatic Brain Injury Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

See 16. Trauma Management Pathway

Adult in ED with GCS 15

Canadian CT Head Rule available in MDCalc

Assess for:
- Suspected open or depressed skull fracture
- Physical signs of basilar skull fractures (hemotympanum, ‘panda’ eyes, cerebrospinal fluid leakage from the ear or nose, Battle’s sign)
- Vomiting ≥ 2 or more episodes
- Age ≥ 65 years
- Retrograde amnesia ≥ 30 mins
- Dangerous mechanism of injury:
  - Ejection from a motor vehicle
  - Pedestrian struck
  - Fall from a height of > 0.9m or 5 steps
- Coagulopathy, bleeding disorder, or on anticoagulant or anti-platelet agent except aspirin

Discharge as below

Any positive finding?

Obtain Non-Contrast Head CT scan

CT Positive

Consult a Neurosurgeon
and assess for admission

Is patient on anticoagulant or anti-platelet agent except aspirin

Yes

No

Discharge as below

• If symptomatic or INR > 3, admit for 24 h observation
• If asymptomatic after 6 h ED observation and INR < 3, discharge with reliable adult
• Close follow-up in out-patient clinic
• Return for repeat CT if new or worsening symptoms

Discharge

A CT interpreted as normal by the Radiologist in a neurologically intact person with a normal mental status allows for safe discharge with appropriate instructions and avoids prolonged ER observation or hospital admission. WRITTEN and VERBAL Discharge Instructions (see MINOR HEAD INJURY DISCHARGE ADVICE) must be provided and should include symptoms to expect after a mild TBI, the time course, the overall positive prognosis, activity limitations, and the point at which a patient return to the ED for further testing.
Minor Head Injury Discharge Advice

On returning home it is important that, if possible, you are accompanied by a responsible adult. While unlikely, there is a small risk of developing complications, so if you experience any of the following symptoms in the next few days you should return to ED as soon as possible.

- Loss of consciousness
- New deafness in one or both ears
- Loss of balance or problems walking
- Any weakness in one or both arms or legs
- Any vomiting
- Clear fluid coming out of your ears or nose
- Drowsiness when you would normally be wide awake
- Increasing disorientation
- Problems understanding or speaking
- Blurred or double vision
- Severe headache not relieved by painkillers such as paracetamol
- Bleeding from one or both ears
- Any fits (collapsing or passing out suddenly)
- Inability to be woken

Dos and Don’ts

DO
- make sure you stay within reach of a telephone and medical help in the next few days
- have plenty of rest and avoid stressful situations
- show this factsheet to a friend or family member who can keep an eye on your condition
- take painkillers such as paracetamol for headaches

DON’T
- stay at home alone for 48 hours after leaving hospital
- drink alcohol until you feel better
- take aspirin or sleeping tablets without consulting a doctor
- return to work until you feel ready
- play any contact sport for at least three weeks without consulting your doctor
- return to driving until you feel you have recovered. If in doubt consult your doctor.

While most people recover quickly you may experience some of the following symptoms over the next few days and weeks, which don’t require a return to hospital:

- Headaches
- Feelings of dizziness
- Nausea
- Sensitivity to light or noise
- Sexual difficulties
- Sleep disturbance
- Memory problems
- Thinking and problem-solving
- Irritability
- Restlessness
- Impulsivity and self-control problems
- Difficulties with concentration
- Feeling depressed, tearful or anxious
- Fatigue
- Difficulties

In most cases these symptoms will resolve themselves within two weeks. However, in some cases they may persist much longer. Try not to rush back into normal activities, as this may delay recovery. If you still have any symptoms after two weeks we suggest you come back to the ED and take this factsheet with you. It may be possible to seek referral to a head injury specialist such as a neurologist or neuropsychologist.

For medical advice, contact the Emergency Department on: ____________________________
### 19. Bites (Animal & Human), Tetanus & Rabies

**Animal Bites**
If rabies is a concern, **scrub the wound with soap and water for at least 15 minutes**, then rinse and apply a disinfectant (e.g. iodopovidone) as soon as possible after exposure. The use of antibiotics in patients with animal bites is controversial, and some studies have shown little benefit. However, pre-emptive early antimicrobial therapy for 3–5 days is recommended for patients who:
- are immunocompromised;
- are asplenic;
- have advanced liver disease;
- have pre-existing or resultant oedema of the affected area;
- have moderate to severe injuries, especially to the hand or face; or
- have injuries that may have penetrated the periosteum or joint capsule

**ALL Human bites** should receive:
- prophylactic antibiotics
- consider post-exposure prophylaxis for HIV within 72hrs. The risk associated with bite injuries has not been quantified. The victim is usually at low risk unless the biter’s saliva is contaminated with blood. The risk is greater to the biter if blood is drawn from the victim’s wound because of exposure to mucous membranes.
- Hepatitis B vaccine preferably ≤ 24 hours if not previously immunized

**Treatment:**
**DO NOT SUTURE ANIMAL AND HUMAN BITES.** The above wounds should be irrigated copiously, dressed, left open to drain, and examined daily to detect signs of infection. During the first few days after injury, elevation of the injured body part, especially if swollen, accelerates healing. This should be accomplished using a passive method (a sling for outpatients or a tubular stockinet and an intravenous pole for inpatients). **ALL infected wounds should be treated.** If no signs of infection, delayed primary closure may be done 72 hours after the injury.

**Antibiotics**
- **Amoxicillin/Clavulanate 1gm BD x 5-7 days**
- **In Penicillin Allergic Patients:**
  - Clindamycin 300 mg PO QID/600 mg IV TDS OR Azithromycin 500mg PO OD for 3 days

**PLUS**

#### Tetanus Toxoid 0.5mg IM

<table>
<thead>
<tr>
<th>Previous doses of Adsorbed Tetanus Toxoid</th>
<th>Clean and minor wounds</th>
<th>All other wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetanus toxoid</td>
<td>TIG</td>
<td>Tetanus toxoid</td>
</tr>
<tr>
<td>&lt; 3 doses or unknown</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>≥ 3 doses</td>
<td>Only if last dose given ≥10 yrs ago</td>
<td>No</td>
</tr>
</tbody>
</table>

**Rabies Post-Exposure Prophylaxis**

The WHO rabies exposure categories are:
- **Category I**
  - Touching or feeding animals, licks on intact skin
- **Category II**
  - Nibbling of uncovered skin, minor scratches or abrasions without bleeding
- **Category III**
  - Single or multiple transdermal bites or broken skin with saliva from animal licks, exposure due to direct contact with bats

**Rabies Immunoglobulin (RIG)**

<table>
<thead>
<tr>
<th></th>
<th>No Pre-EP</th>
<th>Pre-EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Ig - 20U/Kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR Equine Ig - 40U/Kg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Rabies Vaccine**

<table>
<thead>
<tr>
<th>Intradermal (ID)</th>
<th>No Pre-EP</th>
<th>Pre-EP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dose: 0.1ml</td>
<td>Days 0, 3, and 7 (1–2–2): injections of two 0.1 ml doses of vaccine at different intradermal sites</td>
<td>One Booster dose (intramuscular or intradermal) at one site on both Days 0 and 3. OR One Booster intradermal dose at four sites in one visit. This consists of four injections of 0.1 ml equally distributed over the left and right deltoids, thigh, or suprascapular areas at a single visit</td>
</tr>
</tbody>
</table>

**Intramuscular (IM)**

**Dose: 1 vial**

<table>
<thead>
<tr>
<th>Recommended sites: Deltoids, lateral thighs or suprascapular areas that drain into regional lymph glands</th>
<th>Recommended sites for children aged &lt;2 years: the anterolateral thigh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabies vaccine should not be administered in the gluteal area, as induction of an adequate immune response is less reliable.</td>
<td>Reduced 'Essen' vaccine schedule (1–1–1–1) on Days 0, 3, 7, and 14 in healthy patients. A fifth dose is recommended for immunocompromised persons, between days 21 and 28.</td>
</tr>
</tbody>
</table>

| Zagreb Regimen (2–0–1–0–1) on Days 0, 7, and 21. On day 0, two doses of vaccines are to be injected into two of the deltoid or thigh sites. | | |

Patients bitten by healthy appearing domestic animals may delay rabies post exposure prophylaxis if the animal is quarantined. These animals should be observed for 10 days, and if they show no sign of infection during the observation period they may be released, and the patient does not need to be vaccinated. Signs of infection in an animal include excessive salivation, aggression, paralyzis, daytime activity in nocturnal animals, and impaired movement. If the animal shows any signs of infection, the patient should start the vaccination schedule and continue until the animal has been tested at an approved facility.
Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

---

Common Venomous Snakes of Kenya

FOR ALL SNAKEBITES VISIT A HEALTH FACILITY IMMEDIATELY!

Eastern Green Mamba
Dendroaspis angusticeps

Egyptian Cobra
Naja haje

Forest Cobra
Naja melanoleuca

Forest Night Adder
Causus lichtensteinii

Gaboon Viper
Bitis gabonica

Gold’s Tree Cobra
Naja flaviceps

Green Bush Viper
Atheris squamiger

Jameson’s Mamba
Dendroaspis jamesoni kaimosi

Kenya Horned Viper
Bitis arietans

Kenya Montane Viper
Mentallertia heinzi

Large Brown Spitting Cobra
Naja ashei

Mount Kenya Bush Viper
Bitis anatolica

North East African Carpet Viper
Naja melanoleuca

Puff Adder
Bitis arietans

Red Spitting Cobra
Naja pallida

Rhinoceros Viper
Bitis nasicornis

Rhombic Night Adder
Causus resimus

Rough-Scaled Bush Viper
Atheris squamiger

Savannah Vine Snake or Twig Snake
Thelotornis mossambicanus

Small-Scaled Mole Viper
Atheris hispida

Snouted Night Adder
Causus defilippi

Velvet Green Night Adder
Causus resonus

Yellow Bellied Sea Snake
Pelamis platurus

-common-venomous-snakes-of-kenya.png
Snake Bites

(BIO-KEN SNAKE FARM, +254 42-322303 or +254 733 290 324 for information on correct antivenom. http://www.bio-ken.com/)

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Cytotoxicity (Painful progressive swelling)</th>
<th>Neurotoxicity (Progressive weakness)</th>
<th>Haematotoxicity (Bleeding)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important snakes</td>
<td>Puff adder, Gabon viper, Kenya Horned Viper, Rhinoceros Viper, Red Carpet Viper, Ashe’s Spitting Cobra, Black-necked Spitting Cobra, Red Spitting Cobra</td>
<td>Eastern Green Mamba, Jameson’s Mamba, Black Mamba, Egyptian Cobra, Eastern Forest Cobra, Gold’s Tree Cobra</td>
<td>Coastal Boomslang, North East-African Carpet Viper (Echis), Vine Snake, Blanding’s Tree Snake</td>
</tr>
<tr>
<td>Clinical Picture</td>
<td>Mild: slow progressive painful swelling</td>
<td>Ptosis, diplopia, dilated pupils, difficulties in swallowing, salivation, progressive difficulty breathing, hypoxia</td>
<td>Bleeding from puncture sites, Minor lacerations, development of disseminated intravascular coagulopathy over time</td>
</tr>
<tr>
<td>Management</td>
<td>- Establish IV access</td>
<td>- Establish IV access</td>
<td>- Establish IV access</td>
</tr>
<tr>
<td></td>
<td>- Give analgesia</td>
<td>- Monitor oxygenation and ventilation closely (HDU)</td>
<td>- Give blood/blood component therapy if indicated</td>
</tr>
<tr>
<td></td>
<td>- Position the limb at the level of the heart</td>
<td>- Intubation and mechanical ventilation may be necessary</td>
<td>- Heparin, antifibrinolytics, thrombolytics are of no value and may be dangerous</td>
</tr>
<tr>
<td></td>
<td>- Give IV fluid for shock and renal failure</td>
<td>- Treat local complication appropriately</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Treat local complication appropriately</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Indications for Antivenom

Antivenom is NOT INDICATED if the patient is ASYMPTOMATIC

Polyvalent antivenom
- Swelling progressive at ≥15cm/hr
- Swelling to a knee or elbow from a foot or hand bite within 4 hours
- Swelling of a whole limb by 8 hours
- Swelling threatening the airway
- An associated coagulopathy
- Unexplained dyspnoea
- Consider antivenom if snake is unknown but envenomation is severe.

Polyvalent antivenom
- Triad of (either) 1. paraesthesia, 2. excessive salivation/metallic taste and sweating 3. dyspnoea in the absence of painful progressive swelling (mambas)
- Paralysis in the presence of significant swelling (non-spitting cobras)

Monovalent antivenom
- Active bleeding
- Positive 20 MINUTE WHOLE BLOOD CLOTTING TEST (20WBCT)
  - Take 2 ml of blood from the patient and pour it into a new, clean, dry glass test tube.
  - The test tube must be made of glass and NOT plastic. The tube MUST be new. Avoid old tubes that have been washed in detergent/soap.
  - Leave the test tube undisturbed at ambient temperatures for 20 min.
  - After waiting for 20 min gently tilt the test tube.
  - If the blood is all liquid (no clots) then the patient has incoagulable blood.
- Laboratory evidence of coagulopathy

Administration of Antivenom:
- Give the first dose (10ml) of antivenom intravenously at the slow rate of 1-2 ml per minute. Subsequent doses may be injected into a bag of saline drip, no more than 20 ml per 500ml bag to run in 30 mins. Repeat until symptoms resolve. Monitor breathing and other vital signs continuously. Remember not to have the drip running direct into the wounded limb which is already in danger from the pressure of swelling and should be kept elevated and well protected.
- Remember to have adrenaline (1:1,000) at the bedside in case of anaphylaxis. If the patient has known allergies (asthma etc.), draw up the adrenaline (0.3 - 0.5 ml for adults and 0.1 - 0.3 for children) and have antihistamine available in case allergic symptoms are overwhelming. Antihistamine is NOT recommended as routine treatment for snakebite.
- Monitor breathing and other vital signs continuously.
- DO NOT infiltrate the bite area with antivenom.
# 20. Burns Resuscitation Pathway (Assessment)

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**SAMPLE HISTORY**
- Signs and Symptoms
- Allergies
- Medication
- Past Medical History/Pregnancy
- Last meal
- Events preceding presentation

**ACTIVATE THE TRAUMA TEAM** (see Trauma Team Activation Criteria)

### Primary Survey (C-ABCDE)
- **C**-Spine – If suspected trauma, Cleared Clinically (see [17. C-Spine Clearance Algorithm](#))? Perform Manual In-Line Stabilization (MILS) then apply **Head Blocks** or **Blanket Rolls** taped to the patient’s head and trolley. **DO NOT APPLY A C-COLLAR**
- **Airway** – Open? Maintainable? Intubate? Indications for intubation include presence of pharyngeal burns, air hunger, stridor, carboxygenous sputum and hoarseness, unconscious patients with severe smoke inhalation, or patients with flame or flash burns involving the face and neck.
- **Breathing** – Rate? SPO2? Air entry bilaterally?
- **Circulation** – Active Bleeding Control? BP? CPR? Pulse? Signs of Shock?
- **Disability** – GCS? Pupils? RBS?
- **Expose patient**

### 1st Degree Burns
- Epidermis only
- Commonly caused by UV light or very short flash or flame exposure
- Skin is red, dry & hypersensitive
- No treatment except analgesia
- Leaves no scarring on healing

### 2nd Degree Burns
- **Superficial**;
  - Epidermis + Upper ⅓ of Dermis
  - Commonly caused by scald (spill or splash)
  - Red, moist, weeping. cob blisters that blanche with pressure
  - Painful - due to nerve exposure, & heals from 7-14days
  - Leaves no scarring on healing but there is potential pigmenitary changes
- **Deep**;
  - Epidermis + Upper ⅔ of Dermis
  - Commonly caused by scald, flame, chemicals, oil & grease
  - Cheesy white, wet or waxy dry; Do not blanche with pressure
  - Healing takes > 21days
  - Severe scarring & risk of contractures

### 3rd Degree Burns (Full Thickness Burns)
- Full Epidermis + Dermis are destroyed leaving no cells to heal
- Commonly caused by scald, steam, flame, chemicals, oil, grease & high voltage electricity
- Grey to charred & black, insensate, contracted, pale, leathery tissue
- Severe scarring & high risk of contractures

### 4th Degree Burns
- Muscle involvement

### 5th Degree Burns
- Bone involvement - Especially in epileptics who convulse during burning

### Total Body Surface Area (TBSA)

**Burns Estimation**
- Lund and Browder Charts for area of body burnt

<table>
<thead>
<tr>
<th>Area</th>
<th>Under 1</th>
<th>2-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Thorax (front)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Thorax (back)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Arm (right)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Arm (left)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Hand (right)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Hand (left)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Buttock (right)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Buttock (left)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Genitals</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Leg (right)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Leg (left)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Feet (right)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Feet (left)</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Total burn area

Do not include first degree burns in the calculation of % TBSA. The surface area of a patient’s palm (including fingers) is roughly 1% of TBSA. Palmar surface can be used to estimate relatively small burns (< 15% of total surface area) or very large burns (> 85%, when unburnt skin is counted). For medium-sized burns, it is inaccurate.
Burns Resuscitation Pathway (Resuscitation)

**Resuscitation (C-ABCDE)**

**CONSULT A SURGEON IMMEDIATELY AS YOU BEGIN RESUSCITATION OF ANY BURNS PATIENT WITH 3RD OR 4TH DEGREE BURNS AND CIRCUMFERENTIAL BURNS (also see Trauma Team Activation Criteria)**

C – If suspected C-Spine trauma and NOT cleared clinically, **Head Blocks** or **Blanket Rolls** strapped to the patient’s head and trolley?

A – Rapid Sequence Intubation? **Avoid succinylcholine in patients with burns > 24hrs** due to risk of hyperkalaemia. Indications for intubation include presence of pharyngeal burns, air hunger, stridor, carbonaceous sputum and hoarseness, unconscious patients, hypoxic patients with severe smoke inhalation, or patients with flame or flash burns involving the face and neck.

B – Supplementary Oxygenation? If suspected **carbon monoxide poisoning** (restlessness, headache, nausea, poor co-ordination, memory impairment, disorientation, or coma), give **100% oxygen via a Non-Rebreather mask at 15L/min for 24 hrs**

C – Control Active Bleeding

- Do not include first degree burns in the calculation of % TBSA
- Patients with < 10% TBSA burns can be resuscitated orally (unless the patient has an electrical injury or associated trauma). This needs on-going evaluation and the patient may still require an IV line.
- Patients with burns involving ≥ 20% of TBSA will require intravenous fluid resuscitation. Insert 2 large bore IV/IO lines and give appropriate fluid resuscitation (RL/N/whole blood). **Parkland Formula** (available in MDCalc) – Total fluids over 24hrs = 4ml/kg/%TBSA. Give ⅔ of this volume within the first 8hrs of the burns then the next ⅔ over the next 16hrs + maintenance fluid for children < 30 kg. Aim for a urine output of 1 ml/kg/hour in children younger than 2 years (or who weigh < 30 kg) and 0.5 ml/kg/hour in adults and older children. If urine output is not adequate, increase fluids for the next hour to 150% of calculated volume until urine output is adequate.
- GXM and request adequate supplementary blood and blood products if necessary

D – Correct Hypoglycaemia – 50mls 50% Dextrose IV

- **Give appropriate analgesia e.g. Fentanyl 1μg/kg IV** (see Analgesia Chart); Consider procedural sedation with Ketamine for wound dressing (see 39. Procedural Sedation and Analgesia (PSA))

E – Check temperature and provide warmth to the patient

- Cool any burns < 3 hours old with cold tap water for at least 30 minutes and then dry the patient. In patients undergoing external cooling who have burns covering ≥ 10% of TBSA, monitor body temperature for hypothermia.
- Remove all clothes, jewellery, necrotic tissue & debris
- Wash wound with mild soap and tap water
- Wash wound with mild soap and tap water
- DO NOT BURST BLISTERS. Blisters left intact heal faster and become infected less often.

**Secondary Survey (Head-to-Toe Survey) and Other Considerations**

- In neck burns, a pillow is placed under the patient’s head to hyperextend the neck at the shoulders to prevent contractures
- Chest wall burns - Do a checker-box release - **consult a Surgeon**
- Upper limb burns should be nursed elevated at 45°
- Evaluate 3rd & 4th Degree Burns and circumferential burns for possible escharotomy, **consult a Surgeon**
- Give Tetanus Toxoid.
- **Topical antimicrobial agents** or bioengineered substitutes should be applied to all clean, debrided wounds except superficial burns. Prophylaxis with **systemic antibiotics** is currently **NOT RECOMMENDED** for patients with severe burns other than perioperatively.

**Disposition**

Minimum criteria for transfer to a burns centre (Modified from the Australian and New Zealand Burn Association (ANZBA) protocol)

**Burn injury patients who should be referred to a burn unit include the following:**

- All burn patients less than 1 year of age
- All burn patients from 1-2 years of age with burns > 5% total body surface area (TBSA)
- Patients in any age group with third-degree burns of any size
- Patients older than 2 years with partial thickness burns greater than 10% TBSA
- Patients with burns of special areas – face, hands, feet, genitalia, perineum or major joints
- Patients with electrical burns, including lightning burns
- Chemical burn patients
- Patients with inhalation injury resulting from fire or scald burns
- Patients with circumferential burns of the limbs or chest
- Burn injury patients with pre-existing medical disorders that could complicate management, prolong recovery or affect mortality
- Any patient with burns and concomitant trauma
- Paediatric burn cases where child abuse is suspected
- Burn patients with treatment requirements exceeding the capabilities of the referring centre
- Septic burn wound cases
21. Post Rape Care (PRC) Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

This algorithm should be used with reference to the documents in the latest National Guidelines on Management of Sexual Violence in Kenya available at www.emergencymedicinekenya.org/rape

< 72 hours

- Assess, monitor and support ABCs. Monitor vital signs. Get same sex chaperone.
- Fill PRC Consent form.
- Fill PART A of PRC form in triplicate.
- As you examine the patient, collect specimens as detailed below and store them in a secure locked cupboard.
- Put all clothes in BROWN PAPER BAGS (NOT PLASTIC) and label with patient details.
- Give STAT PEP within 72 hours.
  - TDF/3TC (300mg/300mg) 2tab OD + ATV/r (400/199mg) with food 1 tab OD for 28 days.
  - AZT (300mg) can be used when TDF cannot be used Do NOT delay PEP administration awaiting lab results.
- Order investigations as PART A of PRC form and fill in results: HIV (do pre-test counselling).

RAPE SURVIVOR

> 72 hours

- Assess, monitor and support ABCs. Monitor vital signs. Get same sex chaperone.
- Fill PRC Consent form.
- Fill PART A of PRC form in triplicate.
- Put all clothes in BROWN PAPER BAGS (NOT PLASTIC) and label with patient details.
- Order investigations as PART A of PRC form and fill in results: HIV (do pre-test counselling).

On discharge:
- Confirm PART A & B of PRC form are filled. Attach blue copy to patient’s file and give white copy to patient. Leave the green copy in the PRC booklet.
- Confirm patient understands drug regimen
- Give patient belongings in well-labelled brown bag
- Nearest Gender Based Violence Recovery Centre (GBVRC) booking in one week
- Give patient discharge summary with all the follow-up dates as listed above

Follow-up
- Counselling. Trauma counselling in 2, 4, 6 and 12 weeks + Adherence counselling
- Gender Based Violence Recovery Centre (GBVRC) for PEP follow-up at 7, 14 and 28 days. Repeat CBC, ALT, CR in 2 weeks, PDT in 4 weeks, HIV test in 4, 12 & 24 weeks
- HIV care clinic if HIV positive

1. Emergency Contraception within 120 hours (females 15-49 years)
- Levonorgestrel 0.75mg - 2 tabs stat

2. STI Prevention:
- I.M Ceftriaxone 250mg stat or PO Cefixime 400mg stat + PO Azithromycin 1g stat + PO Tinidazole/Metronidazole 2g stat. Tinidazole/Metronidazole can be deferred to be taken at home if alcohol ingested or given emergency contraceptives.
- OR
- PO Doxycycline 100mg BD for 14 days + Ciprofloxacin 500mg stat + Tinidazole 2g stat.

3. Hepatitis B Vaccination (If not previously vaccinated and not known HBV positive) should be offered within 14 days.
- I.M 1.0 ml Hepatitis B vaccine at 0, 1 & 6 months.

4. Tetanus Prophylaxis (Do not give TT if the survivor has received 3 or more doses previously and the last dose is within 5 years)
- I.M 0.5 ml of T.T stat

7. HPV vaccine females 9-26 years and males 9-21 years.
- I.M Cervarix 0.5 ml at 0, 1 & 6 months OR
- Gardasil® at 0, 2 & 6 months

5. Hepatitis B Vaccination (If not previously vaccinated and not known HBV positive) should be offered within 14 days.
- I.M 0.1 ml Hepatitis B vaccine at 0, 1 & 6 months.

4. Tetanus Prophylaxis (Do not give TT if the survivor has received 3 or more doses previously and the last dose is within 5 years)
- I.M 0.5 ml of T.T stat

5. HPV vaccine females 9-26 years and males 9-21 years.
- I.M Cervarix 0.5 ml at 0, 1 & 6 months OR
- Gardasil® at 0, 2 & 6 months

6. Refer for IMMEDIATE VOLUNTARY COUNSELLING BEFORE DISCHARGE. The Counsellor MUST complete PART B of PRC form.

On discharge:
- Confirm PART A & B of PRC form are filled. Attach blue copy to patient’s file and give white copy to patient. Leave the green copy in the PRC booklet.
- Confirm patient understands drug regimen
- Give patient belongings in well-labelled brown bag
- Nearest Gender Based Violence Recovery Centre (GBVRC) booking in one week
- Give patient discharge summary with all the follow-up dates as listed above

Follow-up
- Counselling. Trauma counselling in 2, 4, 6 and 12 weeks + Adherence counselling
- Gender Based Violence Recovery Centre (GBVRC) for follow-up. PDT in 4 weeks, HIV test in 4, 12 & 24 weeks
- HIV care clinic if HIV positive

CONTACT THE KENYA POLICE TO COLLECT ALL SPECIMENS & CLOTHES (MUST BE IN LABELLED BROWN PAPER BAGS (NOT PLASTIC))
22. Hypoglycaemia Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Hypoglycaemia (RBS < 3.3 mmol/L)

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO₂, T° C)
- Start Oxygen if SPO₂ < 94%. Maintain SPO₂ ≥ 94%

Able to tolerate PO

- Give 15gm of simple carbohydrate PO
- AND/OR
  - A full complex starchy carbohydrate meal e.g. rice, ugali, wholemeal

50mls 50% Dextrose IV*

Symptoms resolved and RBS > 3.3mmol/L

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO₂, T° C)
- Start Oxygen if SPO₂ < 94%. Maintain SPO₂ ≥ 94%

Repeat Algorithm

After 2 rounds of the algorithm, begin continuous infusion of 5% Dextrose saline at 110mls/hr

- Provide patient with a full complex starchy carbohydrate meal e.g. rice, ugali, wholemeal or begin continuous infusion of 5% Dextrose saline at 110mls/hr
- Treat underlying cause
- Maintain blood glucose level above 4.4 mmol/L
- Consider thiamine 100mg IVI for malnourished and alcoholic patients followed by 100mg PO BD for 6 weeks
- Consult a Physician appropriately

*Dextrose Rule of 50

How to correct hypoglycaemia:
- Neonate 5 ml/kg of 10% Dextrose (10×5=50)
- Infant 2 ml/kg of 25% Dextrose (25×2=50)
- Older child or Adult 1 ml/kg of 50% Dextrose (50×1=50)

How to make different Dextrose solutions:
- 50 ml of 50% Dextrose + 50 ml NS = 25% Dextrose
- 50 ml of 50% Dextrose + 150 ml NS = 12.5% Dextrose
Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

23. Hyperglycaemia Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Hyperglycaemia (RBS > 14mmol/L)

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO2, T°C)
- Start Oxygen if SPO2 < 94%. Maintain SPO2 ≥ 94%
- Establish IV Access and send samples for **UEC and Urinalysis**
- Obtain/review 12-lead ECG (if indicated)
- Perform brief, targeted, history and physical exam
- **DO NOT GIVE INSULIN**

HCO3- < 18mmol/L + No Ketones in urine + Serum Osmolality < 320mOsm/kg

No

Go to 24. Diabetic Ketoacidosis/Hyperosmolar Hyperglycaemic State (HHS) Algorithm

Yes

Uncomplicated Hyperglycaemia

- Identify and Treat precipitating illness; consider ACS, Sepsis

Known Diabetic

- Confirm compliance with medication
  - If not compliant, resume previous regimen
  - If compliant, optimize dosages
- Advice on lifestyle Modification
- Review RBS daily at nearest facility and keep record
- Review in out-patient medical clinic after 5 days
- Refer to Diabetic clinic if poorly controlled

Newly Diagnosed Diabetic

- Lifestyle modification advice
  - Start on Metformin as below
    - Begin with low-dose metformin - 500 mg BD with meals (breakfast and/or dinner).
    - Review RBS daily at nearest facility and keep record
    - Review in out-patient medical clinic after 5 days
    - After 5–7 days, if GI side effects have not occurred, advance dose to 850mg or 1gm before breakfast and dinner.
    - If GI side effects appear as doses advanced, can decrease to previous lower dose and try to advance dose later.
    - The maximum effective dose is usually 850 mg BD, with modestly greater effectiveness with doses up to 3 g per day. GI side effects may limit the dose that can be used.
- Refer to Diabetic clinic
24. Diabetic Ketoacidosis (DKA) / Hyperosmolar Hyperglycaemic State (HHS) Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Begin 23. Hyperglycaemia Algorithm

Ketones in Urine + HCO₃⁻ < 18mmol/L

- Diabetes Ketoacidosis

RBS > 33.3mmol/L + Serum Osmolality > 320mosm/kg

- Hyperosmolar Hyperglycaemic State (HHS)

No Ketones in urine + Serum Osmolality < 320mosm/kg

- Uncomplicated Hyperglycaemia

Go to 23. Hyperglycaemia Algorithm

1. Fluid Protocol

(Ringer’s Lactate)

- If Hypovolaemic Shock, give fluid boluses at 15 to 20mL/kg; Repeat until BP stable. Consider Inotropes if no response to fluid resuscitation.

- If Hypovolaemic but No Shock; Give 15 - 20 mL/kg/hr Ringer’s Lactate

DO NOT give > 50 mL/kg of isotonic solution in the first 4 hours of treatment because of the risk of cerebral oedema.

- If CORRECTED serum sodium is < 135 mmol/L, continue treatment with Ringer’s Lactate at 250-500 mL/hour

- If CORRECTED serum sodium is ≥ 135 mmol/L, continue treatment with 0.45% NaCl instead of Ringer’s Lactate at 250-500 mL/hour

Success in fluid therapy is reflected by an improvement in hemodynamic and hydration status and pH values, a satisfactory urine output of 1 to 2 mL/kg/hour, and clinical progress.

2. Potassium Protocol

- DO NOT give potassium if patient is anuric or serum K⁺ > 5.3mmol/L

<table>
<thead>
<tr>
<th>Serum K⁺ (mmol/L)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5.3</td>
<td>DO NOT give K⁺, but check potassium levels hourly and start replacement when K⁺ &lt; 5.3mmol/L</td>
</tr>
<tr>
<td>3.3 to 5.3</td>
<td>Add 20-30 mmol K⁺/1L fluid/hour to IV fluids until K⁺ &gt; 4.0-5.0mmol/L range</td>
</tr>
<tr>
<td>&lt; 3.3</td>
<td>Hold insulin. Add 20-30 mmol K⁺/L fluid/hour. Continuous cardiac monitoring until K⁺ &gt; 3.3mmol/L</td>
</tr>
</tbody>
</table>

Venous Glucose reaches < 11.1 mmol/L (DKA) < 16.7 (HHS)

3. Insulin Protocol

- DO NOT give insulin until you have K⁺ levels > 3.3mmol/L

- Give 0.3u/kg SC bolus then 0.2u/kg SC every 2 hours

- Hourly RBS monitoring

- Target RBS drop 3-4mmol/L/hr

- If the RBS does not fall by 3-4 mmol/L/hr, give a bolus of 0.1u/kg SC and continue with the SC doses

- Change IV fluid infusion to 5 % Dextrose with 0.45% NaCl at 150-250mL/hr

- Decrease insulin to 0.1u/kg SC every 2 hours

- Maintain glucose between 8.3 – 11.1mmol/L (DKA)/ 13.9 - 16.7mmol/L (HHS) and continue insulin infusion and fluid hydration until ketosis or hyper osmolality resolves

Useful formulas in DKA (available in MDCalc)

- Anion gap = Na⁺ - ([Cl⁻ + HCO₃⁻])

- Serum sodium correction = Na⁺ measured + 1.6 * (Glucose - 5.6) (all values in mmol/l)

- Serum potassium correction during acidaemia = [K⁺] - (0.6 mmol/L X (7.4 - measured pH)) X 10

- Serum osmolality (mosm/L) = 2 [Na⁺ + K⁺] (mmol/L) + Glucose (mmol/L) + BUN (mmol/L)

- Total body water deficit (L) = 0.6men/children or 0.5women x body weight (kg) X [serum Na⁺/140 - 1]
Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

The information from these 12 leads is combined to form a standard electrocardiogram.

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### Electrolyte Abnormalities Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

<table>
<thead>
<tr>
<th>Hyponatraemia (&lt; 130 mmol/L)</th>
<th>Hypernatremia (&gt; 150 mmol/L)</th>
<th>Hypokalaemia (&lt; 3 mmol/L)</th>
<th>Hyperkalaemia (&gt; 5.5 mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For hypotensive patients, give NS 20 mL/kg bolus and repeat until vital signs are stable</td>
<td>Consult a Physician for ALL Patients</td>
<td>For hypotensive patients, give RL 20 mL/kg bolus and repeat until vital signs are stable</td>
<td>For hypotensive patients, give NS 20 mL/kg bolus and repeat until vital signs are stable</td>
</tr>
<tr>
<td>Consult a Physician for ALL Patients</td>
<td>For patients with severe symptoms (vomiting, cardiorespiratory distress, abnormal or deep somnolence, seizures or coma (GCS ≤ 8) (usually in the 100 to 110 mmol/L range), regardless of whether hyponatraemia is acute or chronic: Start IV infusion of 150 ml 3% hypertonic saline over 20 min. Repeat infusion checking the serum sodium concentration every 20 min until a target of 5 mmol/l increase in serum sodium concentration is achieved or until the symptoms improve, whichever comes first.</td>
<td>Mild-Moderate hypokalaemia (2 -3 mmol/L)</td>
<td>Give calcium to protect the heart (not bind K+)</td>
</tr>
<tr>
<td>Do not expect patients with severe symptoms to completely recover immediately, as it may take some time for the brain to fully recover.</td>
<td>If patients have mild or moderate hypokalaemia may need only oral potassium replacement therapy if nausea or vomiting is not the cause of the hypokalaemia. Giving 40 to 60 mmol of elemental potassium orally every 2 to 4 hours for 3 days.</td>
<td>Patients who have mild or moderate hypokalaemia (2 -3 mmol/L)</td>
<td>Give 10mls 10% CaCl₂ (6.8mmol) over 10mins OR 30mls 10% Calcium Gluconate (6.6mmol) over 10mins</td>
</tr>
<tr>
<td>Severe hypokalaemia (&lt; 2mmol/l)</td>
<td>Give 40 mmol K⁺ in 1L RL over 1 hour with continuous ECG monitoring.</td>
<td>Give 2gm magnesium sulphate along with potassium replacement.</td>
<td>Repeat 1 &amp; 2 above if repeat K⁺ is &gt; 5.5 mmol/l</td>
</tr>
<tr>
<td>Give 40 mmol K⁺ in 1L RL over 1 hour with continuous ECG monitoring.</td>
<td>Additionally, restoration of normokalaemia relies on the establishment of normomagnesemia as both K⁺ and Mg²⁺ co-transport in the kidney.</td>
<td>Consult a Physician for ALL Patients</td>
<td>Re-check RBS hourly</td>
</tr>
<tr>
<td>Nebulise Salbutamol 10 to 20 mg in 4 ml of NS over 10 minutes - 25-40% of patients do not respond secondary to tachyphylaxis.</td>
<td>Serum potassium will be lowered approximately 10 to 30 minutes after the above measures are performed, and the effect will last for 2 to 6 hours.</td>
<td>Consult a Physician for ALL Patients</td>
<td></td>
</tr>
</tbody>
</table>

---

**Hyponatraemia**

- < 130 mmol/L

**Hypernatremia**

- > 150 mmol/L

**Hypokalaemia**

- < 3 mmol/L

**Hyperkalaemia**

- > 5.5 mmol/L
Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

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26. Sepsis & Septic Shock Diagnostic Criteria

(SOFA and qSOFA Scores available on MDCalc)

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**A. Sequential [Sepsis-Related] Organ Failure Assessment Score**

<table>
<thead>
<tr>
<th>System</th>
<th>Score</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PaO₂/FiO₂, mm Hg (FIP)</td>
<td></td>
<td>≥400 (≥3:3)</td>
<td>&lt;400 (≥3:3)</td>
<td>&lt;400 (≥40)</td>
<td>&lt;400 (≥26-2) with respiratory support</td>
<td>&lt;300 (≥13:3) with respiratory support</td>
</tr>
<tr>
<td>Coagulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Platelet count, x10⁹/μL</td>
<td></td>
<td>≥150</td>
<td>&lt;150</td>
<td>&lt;100</td>
<td>&lt;50</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Liver</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Biliubin, mg/dL (μmol/L)</td>
<td></td>
<td>≥1.2 (≥20)</td>
<td>&lt;1.2-1.9 (20-32)</td>
<td>≥2.0-5.9 (33-101)</td>
<td>6.0-11.0 (102-204)</td>
<td>&gt;12.0 (≥204)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td></td>
<td></td>
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<tr>
<td>MAP ≥70 mm Hg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>MAP &lt;70 mm Hg</td>
<td></td>
<td></td>
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<tr>
<td>Epinephrine &lt;5 or dobutamine &gt;50 mg</td>
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<tr>
<td>Epinephrine 5-15 or norepinephrine 0.1-0.3</td>
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<tr>
<td>Norepinephrine 0.1-0.3</td>
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<td></td>
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<tr>
<td>Central nervous system</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Glasgow Coma Scale score²</td>
<td></td>
<td>≥15</td>
<td>13-14</td>
<td>10-12</td>
<td>6-9</td>
<td>≤5</td>
</tr>
<tr>
<td>Renal</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine, mg/dL (μmol/L)</td>
<td></td>
<td>&lt;1.2 (≤110)</td>
<td>≥1.2-1.9 (110-170)</td>
<td>≥2.0-3.4 (171-299)</td>
<td>≥3.5-4.9 (300-440)</td>
<td>≥5.0 (≥440)</td>
</tr>
<tr>
<td>Urea output, mL/d</td>
<td></td>
<td>≤500</td>
<td>≤200</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: PaO₂, fraction of inspired oxygen; MAP, mean arterial pressure; PaO₂, partial pressure of oxygen.

² Glasgow Coma Scale scores range from 3-15; higher score indicates better neurological function.

The baseline Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score should be assumed to be zero unless the patient is known to have preexisting (acute or chronic) organ dysfunction before the onset of infection. qSOFA indicates quick SOFA; MAP, mean arterial pressure.
**Introduction**

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

**How to do an ECG**

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

---

**Sepsis & Septic Shock Algorithm**

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

See 26. Sepsis & Septic Shock Diagnostic Criteria

**TO BE COMPLETED WITHIN 1 HOUR OF IDENTIFICATION OF SEPSIS/SEPTIC SHOCK**

- Monitor, support ABCs
- Check vital signs (BP, PR, RR, SPO2, T°C, RBS)
- Start Oxygen IF SPO2 < 94%. Maintain SPO2 ≥ 94%
- Establish IV Access and send samples for FBC, MPS, LFTs, UEC
- Perform brief, targeted history, physical exam
- Obtaining appropriate cultures before antimicrobial therapy is initiated if such cultures do not cause significant delay in the start of antimicrobial(s). Draw 2 sets of blood cultures 10mL each (both aerobic and anaerobic bottles) from different sites.
- Administer 30ml/kg NS or RL for Hypotension
- Give ANTIBIOTICS
  - Ceftriaxone 2gm IV stat
  - For probable Neutropenic patients or if patient has been admitted in hospital in the last 3 months (Hospital Acquired Infection)
    - Imipenem 500 mg IV infusion over 3 hrs then QID for general sepsis
  OR
  - Meropenem 1gm IV infusion over 3 hrs then TDS for possible CNS infections
- Give antipyretic if indicated (Paracetamol 1gm IV)
- CXR; Urinalysis + MCS; ? Stool MCS; ? CSF MCS
- Monitor urine output hourly

**Repeat vital signs (BP, MAP, PR, RR, SPO2, T°C) after 1 hour**

**Features of SHOCK despite adequate fluid resuscitation (> 30ml/kg)?**
- MAP < 65mmHg
- Signs of shock (tachypnoea, cool clammy skin, cool peripheries, hypotensive, tachycardia)
- Urine output < 0.5mL/kg/hour

**Yes**

- Consult a Physician and continue with the algorithm
- Start peripheral vaspressors if MAP < 65mmHg in the face of life-threatening hypotension, even when hypovolemia has not yet been resolved - Norepinephrine (0.1–1.3 µg/kg/min) and/or Adrenaline (0.05-0.3µg/kg/min). Titrate vaspressors to a MAP ≥ 65 mmHg to preserve tissue perfusion.
- Consult a Physician
- Consider Admission

**No**

- Hemodynamic stability achieved with adequate fluid resuscitation (> 30ml/kg) and vaspressor therapy?
  - MAP < 65mmHg
  - Signs of shock as above
  - Urine output < 0.5mL/kg/hour

**Yes**

- Admit HDU/ICU

**No**

- Give Hydrocortisone 200mg IV
- Admit HDU/ICU
27. Antimicrobial Guide

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

For detailed guidelines and other conditions not listed below, refer to your hospital's guidelines for antimicrobial use.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Comments/Caveats</th>
<th>Recommended Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>URTI/Sinusitis</td>
<td>The most common cause of URTIs is viral and thus no antibiotics are necessary</td>
<td>Amoxicillin/Clavulanate 1gm PO BD x 5-10 days is the first line therapy for most adults who meet the criteria for ABRS</td>
</tr>
<tr>
<td></td>
<td>A clinician should diagnose Acute Bacterial Rhinosinusitis (ABRS) when</td>
<td>In Penicillin-Allergic Patients:</td>
</tr>
<tr>
<td></td>
<td>symptoms or signs of Acute Rhinosinusitis (ARS) when</td>
<td>Azithromycin 500mg PO OD x 3 days</td>
</tr>
<tr>
<td></td>
<td>a) purulent nasal drainage accompanied by nasal obstruction, facial pain/pressure/fullness, or both persists without evidence of improvement for at least 10 days beyond the onset of upper respiratory symptoms or b) symptoms or signs of ARS worsen within 10 days after an initial improvement (double worsening).</td>
<td>Supportive therapy:</td>
</tr>
<tr>
<td></td>
<td>DO NOT ORDER A CT SCAN TO DIAGNOSE SINUSITIS</td>
<td>• Decongestants (α-adrenergic) - xylometazoline hydrochloride for 3 days.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Saline irrigation - Nasal saline irrigation, alone or in conjunction with other adjunctive measures, may improve quality of life, decrease symptoms, and decrease medication use for ABRS, particularly in patients with frequent sinusitis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Muscylitics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Antihistamines have no role in the symptomatic relief of ABRS in non-atopic patients.</td>
</tr>
<tr>
<td>Pharyngitis/Tonsillitis</td>
<td>The most predictable clinical parameter for GABHS pharyngitis is reported to be the Centor Score (available on MDcalc) a) Age &lt; 15 years (+1) or ≥ 45 years (-1) b) History of fever &gt; 38°C c) Absence of cough d) Swollen and tender anterior cervical lymph nodes e) Tonsillar exudates or swelling</td>
<td>Adult patients with acute exudative adult pharyngitis who report ≥ 4 Centor Score ONLY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benzathine penicillin G 1.2MU IM stat OR Amoxicillin/Clavulanate 1gm PO BD x 5-10 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patients who are allergic to Penicillin Azithromycin: 500 mg PO on day 1 followed by 250 mg PO OD for 4 days</td>
</tr>
<tr>
<td>Laryngitis</td>
<td>Mostly viral</td>
<td>No Antibiotics necessary</td>
</tr>
<tr>
<td>Acute Gastroenteritis</td>
<td>Any diarrhoeal illness lasting &gt; 1 day, especially if accompanied by the following features should prompt evaluation of a faecal specimen; • bloody diarrhoea • moderate–severe disease (systemically ill/toxic appearing patients) • symptoms lasting &gt;7 days • immunocompromised patients • recent use of antibiotics</td>
<td>Food-borne toxigenic diarrhoea usually requires only supportive treatment, not antibiotics.</td>
</tr>
<tr>
<td></td>
<td>A Stool Culture is NOT NECESSARY OR COST-EFFECTIVE in most cases of diarrhoea without systemic disease or dysentery unless an unusual bacterial cause is suspected</td>
<td>Treatment of salmonellosis with antibiotics (including quinolones) can prolong the carrier state and lead to a higher clinical relapse rate.</td>
</tr>
<tr>
<td></td>
<td>Typhoid - Bone marrow culture is the most sensitive routinely available diagnostic tool. Stool culture is positive only in up to 30-40% of cases but is often negative by the time that systemic symptoms bring patients to hospital. Blood cultures are positive in 40-80% of patients. Serologic tests e.g. the Widal test are of limited clinical utility because positive results may represent previous infection.</td>
<td>Treat ONLY patients with; • bloody diarrhoea • moderate–severe disease (systemically ill/toxic appearing patients) • symptoms lasting &gt;7 days • immunocompromised patients • recent use of antibiotics</td>
</tr>
<tr>
<td></td>
<td>Ciprofloxacin 500 mg PO BD x 3 days. The duration of treatment may be extended by 2-3 days for moderate-to-severe cases.</td>
<td>Ciprofloxacin 500 mg PO BD x 3 days. The duration of treatment may be extended by 2-3 days for moderate-to-severe cases.</td>
</tr>
<tr>
<td></td>
<td>The antimotility agent loperamide (Imodium) may reduce the duration of diarrhoea when given with antibiotics for traveller's diarrhoea. A loperamide/simethicone combination has demonstrated faster and more complete relief. Loperamide may cause dangerous prolongation of illness in patients with some forms of bloody or inflammatory diarrhoea and, therefore, should be restricted to patients with non-bloody stool.</td>
<td></td>
</tr>
</tbody>
</table>
**Introduction**

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

### How to do an ECG

The **six chest leads** (V1 to V6) view the heart in the horizontal plane. The information from the **limb electrodes** is combined to produce the **six limb leads** (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

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<table>
<thead>
<tr>
<th>Condition</th>
<th>Comments/Caveats</th>
<th>Recommended Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary Tract Infection (UTI)</td>
<td>Cloudiness of the urine is most often due to protein or crystal presence, and malodorous urine may be due to diet or medication use. A urinalysis with quantitative urine WBC counts should <strong>NOT</strong> be used alone to support a diagnosis of UTI or start antimicrobial therapy in any patient population.</td>
<td>Uncomplicated Cystitis Ciprofloxacin 500 mg PO BD x 3 days OR Nitrofurantoin 100mg TDS x 3 days</td>
</tr>
<tr>
<td></td>
<td>A negative Leukocyte Esterase AND a negative urine Nitrate largely rule out infection in pregnant women, elderly patients, family medicine, and urology patients. The combination of a negative leukocyte esterase and negative nitrite test demonstrated a UTI negative predictive value of 88% (95% confidence interval [CI] 84–92%).</td>
<td>Uncomplicated Pyelonephritis, Outpatient Therapy Ceftriaxone 1 g IV stat PLUS Ciprofloxacin 500 mg PO BD x 7 days</td>
</tr>
<tr>
<td></td>
<td>Pyuria in a urine specimen, in the absence of symptoms (Asymptomatic Bacteriuria), is <strong>NOT AN INDICATION</strong> for antimicrobial therapy. Urine cultures are <strong>NOT RECOMMENDED</strong> in most cases of uncomplicated UTIs in adult women.</td>
<td>UTI during Pregnancy, Outpatient Therapy Cefuroxime 500 mg PO BD for 7 days OR Nitrofurantoin 100mg TDS x 3 days</td>
</tr>
<tr>
<td>Complcated UTI</td>
<td><strong>Male gender</strong>&lt;br&gt;<strong>Structural or functional anatomic abnormalities</strong>&lt;br&gt;<strong>Renal stones</strong>&lt;br&gt;<strong>Indwelling catheters</strong>&lt;br&gt;<strong>Renal transplant</strong>&lt;br&gt;<strong>Neurogenic bladder</strong>&lt;br&gt;<strong>Recent urologic procedure</strong></td>
<td>Complicated UTI Ciprofloxacin 500 mg PO BD x 14 days</td>
</tr>
<tr>
<td>Inpatient therapy</td>
<td><strong>Sepsis</strong>&lt;br&gt;<strong>Pregnancy</strong>&lt;br&gt;<strong>Urinary tract obstruction</strong>&lt;br&gt;<strong>Persistent vomiting</strong>&lt;br&gt;<strong>Poor outpatient follow-up</strong></td>
<td>Uncomplicated Pyelonephritis, Inpatient Therapy Ceftriaxone 1g IV QD 10-14 days OR Ciprofloxacin 400 mg IV BD x 10-14 days</td>
</tr>
<tr>
<td>Sepsis &amp; Septic Shock</td>
<td>See Severe Sepsis &amp; Septic Shock Algorithm</td>
<td>UTI during Pregnancy, Inpatient Therapy Ceftriaxone 1-2 g IV OD</td>
</tr>
<tr>
<td></td>
<td>Give <strong>ANTIBIOTICS as an EMERGENCY</strong> (within the <strong>FIRST HOUR</strong> of recognition of Sepsis/Septic Shock)&lt;br&gt;<strong>Ceftriaxone 2gm IV stat</strong>&lt;br&gt;For probable Neutropenic patients or if patient has been admitted in hospital in the last <strong>3 months</strong> (Hospital Acquired Infection)&lt;br&gt;<strong>Imipenem 500 mg IV infusion over 3 hrs then QID for General sepsis</strong> OR <strong>Meropenem 1 gm IV infusion over 3 hrs then TDS for possible CNS infections</strong></td>
<td></td>
</tr>
</tbody>
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### Community Acquired Pneumonia

In addition to a constellation of suggestive clinical features, a demonstrable infiltrate by chest radiograph or other imaging technique, with or without supporting microbiological data, is required for the diagnosis of pneumonia.

The strongest indications for **blood cultures** are **severe CAP** and in **immunocompromised patients** or those with **significant co morbidities**, as these patients are more likely to be infected with pathogens other than *S pneumoniae*.

**Co morbidities:**
- Chronic heart, lung or renal disease
- Diabetes mellitus
- Alcoholism
- Malignancy
- Asplenia
- Immunosuppressant condition or drugs

<table>
<thead>
<tr>
<th>Condition</th>
<th>Comments/Caveats</th>
<th>Recommended Therapy</th>
</tr>
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</table>
| Community Acquired Pneumonia | In addition to a constellation of suggestive clinical features, a demonstrable infiltrate by chest radiograph or other imaging technique, with or without supporting microbiological data, is required for the diagnosis of pneumonia. The strongest indications for **blood cultures** are **severe CAP** and in **immunocompromised patients** or those with **significant co morbidities**, as these patients are more likely to be infected with pathogens other than *S pneumoniae*. **Co morbidities:** Chronic heart, lung or renal disease, Diabetes mellitus, Alcoholism, Malignancy, Asplenia, Immunosuppressant condition or drugs. | Outpatient Treatment Amoxicillin/Clavulanate 1gm PO BD x 7 - 10 days  
In Penicillin-Allergic Patients: Azithromycin: 500 mg PO on day 1 followed by 250 mg PO OD for 4 days  

| Inpatient Therapy | • CURB65 ≥ 2 (available in MDCalc)  
• Patient factors requiring hospitalization |  

**HCAP risk factors?**
- Hospitalization for 2 or more days of the past 90 days  
- Resides in nursing home or long-term care facility  
- Received chemotherapy, IV antibiotics, or wound care within the prior 30 days  
- Attended a hospital or haemodialysis clinic in the last 30 days  

| HCAP risk factors? | Inpatient Treatment Amoxicillin/Clavulanate 1.2gm IV T x 7 - 10 days PLUS Azithromycin 500mg IV OD x 7 - 10 days |  

Healthcare Associated Pneumonia (HCAP)  
**Antipseudomonal beta-lactam** Imipenem 500mg IV infusion over 3 hours QID

### Malaria

**Defining Criteria for Severe Malaria**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Finding</th>
<th>Uncomplicated Malaria</th>
</tr>
</thead>
</table>
| Impaired consciousness (cerebral malaria) | A Glasgow coma score < 11 in adults or a Blantyre coma score < 3 in children  
Generalized weakness so that the person is unable to sit, stand or walk without assistance | Arteether + Lumefantrine - Coartem® 80/480 1 tablet at 0, 8, 24, 36, 48 and 60 hours (six doses).  
| Prostration |  |  |
| Multiple convulsions | > 2 episodes within 24 h |  |
| Acidosis | A base deficit of > 8 mEq/L or, if not available, a plasma bicarbonate level of < 15 mmol/L or venous plasma lactate ≥ 5 mmol/L. Severe acidosis manifests clinically as respiratory distress (rapid, deep, laboured breathing). |  |
| Hypoglycaemia | Blood or plasma glucose < 2.2 mmol/L (≤ 40 mg/dL) |  |
| Severe malarial anaemia | Haemoglobin concentration ≤ 5 g/dL or a haematocrit of ≤ 15% in children < 12 years of age (< 7 g/dL and < 20%, respectively, in adults) with a parasite count > 10 000/μL. |  |
| Renal impairment | Plasma or serum creatinine > 265 μmol/L (3 mg/dL) or blood urea > 20 mmol/L. |  |
| Jaundice | Plasma or serum bilirubin > 50 μmol/L (3 mg/dL) with a parasite count > 100 000/μL. |  |

**Severe Malaria**

IV Artesunate 2.4mg/kg at 0, 12 and 24 hours and daily until patient can take oral. Children weighing < 20 kg should receive a higher dose of artesunate (3 mg/kg bw per dose) to ensure equivalent exposure to the drug.
## Introduction
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### Conditions

<table>
<thead>
<tr>
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<th>Comments/Caveats</th>
<th>Recommended Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malaria cont...</strong></td>
<td><strong>Defining Criteria for Severe Malaria</strong></td>
<td><strong>Finding</strong></td>
</tr>
<tr>
<td>Pulmonary oedema</td>
<td>Radiologically confirmed or oxygen saturation &lt; 92% on room air with a respiratory rate &gt; 30/min, often with chest in-drawing and crepitations on auscultation</td>
<td><strong>Uncomplicated Malaria</strong> Artemether + Lumefantrine - Coartem® 80/480 1 tablet at 0, 8, 24, 36, 48 and 60 hours (six doses).</td>
</tr>
<tr>
<td>Significant bleeding</td>
<td>Including recurrent or prolonged bleeding from the nose, gums or venepuncture sites; haematemesis or melena</td>
<td><strong>Severe Malaria</strong> IV Artesunate 2.4mg/kg at 0, 12 and 24 hours and daily until patient can take oral. Children weighing &lt; 20 kg should receive a higher dose of artemesute (3 mg/kg bw per dose) to ensure equivalent exposure to the drug.</td>
</tr>
<tr>
<td><strong>Hyperparasitemia</strong></td>
<td>P. falciparum parasitaemia &gt; 10%</td>
<td></td>
</tr>
</tbody>
</table>

| Community-Acquired Severe Intra-Abdominal Infection, Biliary, and Extra-Biliary Infections | Empiric coverage of Enterococcus is recommended | Piperacillin-Tazobactam 4.5gm IV QID |

| Cellulitis/ Abscesses/ Folliculitis/ Carbuncle/ Furuncle | Most abscesses are Staph aureus. Most cellulitis is Group A beta-haemolytic streptococcus (although some is Staph aureus) Empiric therapy for Streptococcus pyogenes (beta-haemolytic streptococcus) is recommended Clindamycin is bacteriostatic, potential for cross-resistance and emergence of resistance in erythromycin-resistant strains; inducible resistance in MRSA Effective treatment of abscesses entails incision, thorough evacuation of the pus, and probing the cavity to break up oulations. Gram stain, culture, and systemic antibiotics are rarely indicated unless there is extensive surrounding cellulitis, fever, multiple lesions, severely impaired host defences, or cutaneous gangrene. | Oral Therapy Beta-haemolytic Streptococcus coverage: Amoxicillin/Clavulanate 1gm PO BD x 7 days OR Clindamycin 450 mg PO QID x 7-10 days Parenteral Therapy (Inpatient) Beta-haemolytic Streptococcus and MSSA Coverage Cefazolin 1gm IV q8 hours for 7-10 days OR Clindamycin 600 mg IV q8 hours for 7-10 days |

| Necrotizing skin & soft tissue infections | Surgical intervention is the major therapeutic modality in cases of necrotizing fasciitis. Necrotizing fasciitis falls into two groups; • The spontaneous extremity cellulitis is usually Group A Streptococcus and sometime Staph aureus. • The second group includes head and neck, abdominal/groin and is frequently polymicrobial. | Consult a Surgeon |
### Condition

**STI – Urethritis, Epididymitis, Orchitis, Proctitis, Cervicitis**

#### Comments/Caveats

**Minimum criteria** for clinical diagnosis of PID (all 3 should be present):

a) Bilateral lower abdominal (uterine) tenderness (sometimes radiating to the legs)
b) Cervical motion tenderness - Positive cervical motion tenderness is defined as increased discomfort from a normal pelvic examination, as stated by the patient. Of note, **cervical motion tenderness** is **neither sensitive nor specific for gynaecologic pathology**, is a **sign of nonspecific peritoneal inflammation**, 
c) Bilateral adnexal tenderness (with or without a palpable mass)

One or more of the following additional criteria can be used to enhance the specificity of the minimum criteria and support a diagnosis of PID:

- oral temperature >38.3°C;
- abnormal cervical or vaginal mucopurulent discharge;
- presence of abundant numbers of WBC on saline microscopy of vaginal fluid; and
- laboratory documentation of cervical infection with N. gonorrhoea or C. trachomatis.

### Recommended Therapy

**STI – Urethritis, Epididymitis, Orchitis, Proctitis, Cervicitis**

- Ceftriaxone 250mg IM stat
  - **PLUS**
  - Azithromycin 1gm PO stat

**PID**

- **Mild-Moderate disease**
  - Ceftriaxone 250mg IM stat
  - **PLUS**
  - Doxycycline 100mg PO BD x 14 days
  - **WITH or WITHOUT**
  - Metronidazole 500mg PO BD x 14 days

- **Severe disease/In-patient therapy** - Suggested criteria:
  - surgical emergencies (e.g., appendicitis) cannot be excluded;
  - the patient is pregnant;
  - the patient does not respond clinically to oral antimicrobial therapy;
  - the patient is unable to follow or tolerate an outpatient oral regimen;
  - the patient has severe illness, nausea and vomiting, or high fever; or
  - the patient has a tubo-ovarian abscess.

- Amoxicillin/Clavulanate 1.2g IV BD
  - **PLUS**
  - Doxycycline 100mg IV/PO BD x 14 days
Introduction

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<tr>
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<th>Comments/Caveats</th>
<th>Recommended Therapy</th>
</tr>
</thead>
</table>
| HIV Post Exposure Prophylaxis (PEP) | • Exposed individual must be HIV negative at baseline  
• Exposure must have occurred within the past 72 hours  
• Exposure must be high-risk. Faeces, nasal secretions, saliva, sputum, sweat, tears, urine, and vomitus are not considered to be infectious unless they are visibly bloody.  
Estimated per-unprotected act risk for acquisition of HIV by exposure route | PEP should be initiated as soon as possible after exposure, but no later than after 72 hours.  
Consult local guidelines for the recommended regimens |

<table>
<thead>
<tr>
<th>Exposure route</th>
<th>% Risk</th>
<th>Regimen</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood transfusion</td>
<td>90%</td>
<td>Tenofovir/Lamivudine TDF/3TC (300/300mg)</td>
<td>1 tablet OD</td>
<td>Zidovudine AZT (300mg) can be used as an alternative when TDF cannot be used</td>
</tr>
<tr>
<td>Needle-sharing injection-drug use</td>
<td>0.67%</td>
<td>PLUS</td>
<td>PLUS</td>
<td></td>
</tr>
</tbody>
</table>
Dolutegravir (DTG) (50mg) | 1 tablet OD with food |
| Receptive anal intercourse | 0.5% |  
Abacavir/Lamivudine ABC/3TC | Consult local guidelines for the weight-based dosages |
| Percutaneous needle stick | 0.3% | PLUS |  
Lopinavir/Ritonavir LPV/r | Zidovudine AZT (300mg) can be used as an alternative when ABC cannot be used |
| Receptive penile-vaginal intercourse | 0.1% |  
Insertive anal intercourse | 0.06% |  
Insertive penile-vaginal intercourse | 0.1% |  
Receptive oral intercourse | 0.01% |  
Insertive oral intercourse | 0.005% | |

The overall rate of HIV transmission through percutaneous inoculation is reported to be 0.3% (95% confidence interval [CI] 0.2–0.5); the risk of acquiring an HIV infection is greater for percutaneous injuries that involve:  
- hollow-bore needles that have been in contact with an artery or vein,  
- when blood is visible on the device,  
- a deep needle stick, and  
- when the source patient has advanced HIV disease.  
Splashes or infectious material to mucous membranes or broken skin may also transmit HIV infection (estimated risk per exposure, 0.09%; 95% CI 0.006–0.5). Exposure of intact skin to contaminated blood has not been identified as a risk for HIV transmission.  
• Counsel on risks and benefits of PEP and obtain verbal consent for testing (HIV, FHG, UEC, LFTs, HBV and HCV)  
• Voluntary HIV testing for source individuals  
• Offer PEP as soon as high-risk exposure is established and exposed individual tests HIV negative at baseline (if HIV testing not available, can provide 1-2 days of PEP to cover until HIV test performed)  
• Pregnancy testing  
• Cr (if TDF-containing regimen) and Hb (if AZT-containing regimen), however PEP should be offered even when lab tests are not available. Do not delay administration of PEP while waiting for lab results  
• Hepatitis B vaccination (if not previously immunized & not known HBV positive)  
PEP should be continued for 28 days (dispense all 28 days of treatment at the first visit)  
• Follow up client at 7 days, 14 days, and 28 days after starting PEP  
• Follow up HIV antibody testing at 3 months, if negative, test again at 6 months after which annual testing applies  
• Assess for and manage side effects due to PEP  
• Follow up with gastroenterologist if positive HBV, HCV and/or abnormal LFTs
28. Epigastric Pain Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Adult with Epigastric Pain
- Monitor and support ABCs – See Analgesia Chart

Perform a focused history and physical examination, evaluating:
- Duration of symptoms
- Risk factors for potentially serious conditions – ACS, Pancreatitis, DKA, Cholecystitis, Perforate Ulcer, Pre-eclampsia/Eclampsia, HELLP

• Check vital signs (BP, PR, RR, SPO2, T°C, RB5)
• Start Oxygen if SPO2 < 94%. Maintain SPO2 ≥ 94%
• Obtain/review 12-lead ECG if > 40 years old, diabetic or hypertensive

Other Causes of Epigastric Pain
Treat accordingly

Probable Dyspepsia
- Stool H. Pylori Antigen Test (see indications)
- Antacid Gel PRN + Ranitidine 50 mg IV

H. Pylori Positive
Symptomatic Treatment
- Antacid Gel 20-60mins after meals and at bedtime or PRN (for symptom control)
- Paracetamol (stop ALL NSAID use)
- Dietary advice
PLUS
Eradication Therapy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPI</td>
<td>Standard dose BD*</td>
<td>14 days</td>
</tr>
<tr>
<td>Clarithromycin</td>
<td>500 mg BD</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin</td>
<td>1000 mg BD</td>
<td></td>
</tr>
<tr>
<td>Metronidazole</td>
<td>400 mg BD</td>
<td></td>
</tr>
</tbody>
</table>

*Standard doses are esomeprazole 20 mg, lansoprazole 30 mg, omeprazole 20 mg, pantoprazole 40 mg, and rabeprazole 20 mg

Consider OGD (see indications below)

H. Pylori Negative
Symptomatic Treatment
- Antacid Gel 20-60mins after meals and at bedtime or PRN (for symptom control)
- Paracetamol (stop ALL NSAID use)
- Dietary advice
PLUS
Acid Suppression Therapy
- PPI standard dose x 4 weeks

Consider OGD (see indications below)

Indications for Oesophagastroduodenoscopy (OGD)
- age ≥ 60 yr
- bleeding
- anaemia
- early satiety
- unexplained weight loss (>10% body weight)
- progressive dysphagia
- odynophagia
- persistent vomiting
- a family history of gastrointestinal cancer
- previous oesophagogastric malignancy
- previous documented peptic ulcer
- lymphadenopathy
- an abdominal mass

Indications for Stool H. pylori Antigen testing
1. Active peptic ulcer disease (PUD),
2. History of PUD (unless previous cure of H. pylori infection has been documented),
3. Low-grade gastric mucosa-associated lymphoid tissue (MALT) lymphoma,
4. History of endoscopic resection of early gastric cancer (EGC)
5. Patient with un-investigated dyspepsia under the age of 60 years and without alarm features
6. Patients taking long-term, low-dose aspirin
7. Patients with unexplained iron deficiency anaemia despite an appropriate evaluation
8. Adults with idiopathic thrombocytopenic purpura (ITP)
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How to do an ECG

The six chest leads (V1 to V6) “view” the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

Upper Gastrointestinal Bleeding Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Upper Gastrointestinal Bleeding can vary in presentation, but most cases present in one or more of four ways as follows:

a) Melena (69%): the passage of dark and pitchy stools stained with blood pigments or with altered blood. Melena is caused by the passage of at least 50 mL of blood in the upper GI tract. Bacteria degrade the blood into haematin or other haemachromes. Melena should not be confused with the dark stools that result from ingestion of iron or bismuth.

b) Haematemesis (30%): the vomiting of bright red blood and indicates an upper GI site of bleeding, usually above the ligament of Treitz.

c) Coffee-ground emesis (28%): emesis consisting of dark, altered blood mixed with stomach contents

d) Haematochezia (15%): the passage of bloody faeces

SHOCKED (HYPOTENSIVE)

- Monitor, support ABCs in ER; Intubate patient if airway is at risk from massive haematemesis
- Check vital signs (BP, PR, RR, SPO2, T° C, RBS)
- Start Oxygen if SPO2 < 94%. Maintain SPO2 ≥ 94%
- Establish 2 large bore IV accesses (14-16G).
- Give rapid fluid boluses at 20mL/Kg Ringer’s Lactate/Hartmann’s soln; repeat if necessary.
- Start blood transfusions ONLY if Hb < 7 g/dL
- Send samples for FBC, UEC, LFTs, Coagulation screen.
- Crossmatch 6 units of packed cells.
- Perform brief, targeted history, physical exam including a rectal exam
- Insert NGT ONLY if intubated or has recurrent vomiting uncontrolled by anti-emetics

NOT SHOCKED

- Monitor, support ABCs in ER; Intubate patient if airway is at risk from massive haematemesis
- Check vital signs (BP, PR, RR, SPO2, T° C, RBS)
- Start Oxygen if SPO2 < 94%. Maintain SPO2 ≥ 94%
- Establish a large bore IV access (14-16G).
- Start IV Fluids TKVO – Ringer’s Lactate (RL)/Hartmann’s soln. Start blood transfusions ONLY if Hb < 7 g/dL
- Send samples for FBC, UEC, LFTs, Coagulation screen.
- Perform brief, targeted history, physical exam including a rectal exam

- IV omeprazole (80-mg bolus followed by 8 mg/h for 72 h). Use pantoprazole if patient is on Clopidogrel.
- Monitor vital signs every 15 min until stable, then hourly.
- Correct hypotension with repeat fluid boluses/blood transfusion
- Monitor urine output - Aim for > 0.5mL/Kg/h

- Consult Gastroenterologist
- Admit HDU/ICU

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30. Suicidal & Homicidal Evaluation

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**Process for Care and Discharge of Patients with Suicide Risk from EDs**

- **Assess patient capacity to make healthcare decisions**
  - **Capacity Yes**
  - **Capacity No**

- **Continue with medical assessment; treat or observe as appropriate**

- **Suicide attempt as reason for visit**

**Decision Support Tool for Secondary Screening**

(A “yes” response is equal to 1)

<table>
<thead>
<tr>
<th>TRANSITION QUESTION: CONFIRM SUICIDAL IDEATION</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you had recent thoughts of killing yourself? Is there other evidence of suicidal thoughts, such as reports from family or friends? <strong>(NOTE: Not part of scoring.)</strong></td>
<td></td>
</tr>
<tr>
<td>1 THOUGHTS OF CARRYING OUT A PLAN</td>
<td>Y</td>
</tr>
<tr>
<td>Recently, have you been thinking about how you might kill yourself? <strong>If yes, consider the immediate safety needs of the patient.</strong></td>
<td></td>
</tr>
<tr>
<td>2 SUICIDE INTENT</td>
<td>Y</td>
</tr>
<tr>
<td>Do you have any intention of killing yourself?</td>
<td></td>
</tr>
<tr>
<td>3 PAST SUICIDE ATTEMPT</td>
<td>Y</td>
</tr>
<tr>
<td>Have you ever tried to kill yourself?</td>
<td></td>
</tr>
<tr>
<td>4 SIGNIFICANT MENTAL HEALTH CONDITION</td>
<td>Y</td>
</tr>
<tr>
<td>Have you had treatment for mental health problems? Do you have a mental health issue that affects your ability to do things in life?</td>
<td></td>
</tr>
<tr>
<td>5 SUBSTANCE USE DISORDER</td>
<td>Y</td>
</tr>
<tr>
<td>Have you had four or more (female) or five or more (male) drinks on one occasion in the past month or have you used drugs or medication for non-medical reasons in the past month? Has drinking or drug use been a problem for you?</td>
<td></td>
</tr>
<tr>
<td>6 IRRITABILITY/AGITATION/AGGRESSION</td>
<td>Y</td>
</tr>
<tr>
<td>Recently, have you been feeling very anxious or agitated? Have you been having conflicts or getting into fights? Is there direct evidence of irritability, agitation, or aggression?</td>
<td></td>
</tr>
</tbody>
</table>

**Provide patient-centered care**

- **Score 0**
  - **Provide ED-based Brief Suicide Prevention Interventions**

- **Score 1+**
  - **Consult mental health specialist for further evaluation & suicide risk assessment**
  - **Make level of care determination**

**Inpatient Care**

**Admit**

**Outpatient Care**

**Discharge**

**Refer**
Introduction

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Brief Suicide Prevention Interventions

For all patients with suicidal ideation who are being discharged:
1. Provide at least one of the following brief suicide prevention interventions prior to discharge.
2. Include crisis center/hotline information with every brief intervention provided.
3. Involve significant other(s) in the intervention if present.

- **Brief Patient Education**: Discuss the condition, risk and protective factors, type of treatment and treatment options, medication instructions, home care, lethal means restriction, follow-up recommendations, and signs of a worsening condition and how to respond. Provide verbal and written information on the nearest crisis hotline.
- **Safety Planning**: Work with the patient to develop a list of coping strategies and resources that he or she can use during or before suicidal crises. Use the Safety Planning resources (paper version or mobile app) provided in the full guide.
- **Lethal Means Counselling**: Assess whether the patient has access to firearms or other lethal means (e.g., prescription medications), and discuss ways to limit access until the patient is no longer feeling suicidal. Follow the Lethal Means Counselling Recommendations for Clinicians sheet available from Means Matter.
- **Rapid Referral**: During the ED visit, schedule an outpatient mental health appointment for the patient within seven days of discharge. If no appointments are available, review additional suggestions in the full guide and/or refer the patient for a follow-up with a primary care provider.
- **Caring Contacts**: Follow up with discharged patients via postcards, letters, e-mail or text messages, or phone calls. See sample messages in the full guide. These communications can be automated.

Discharge Planning Checklist

Involve the patient in the decision-making process. Shared decision-making lowers patient stress, gives patients a sense of control, and leads to better outcomes. Patients with suicide risk report higher satisfaction when they are involved in decisions about their care.

- Patient involved in planning
- Follow-up appointment scheduled for a date within one week of discharge
- Discharge plan reviewed verbally and understood by patient
- Barriers and solutions discussed
- Crisis center phone number provided
- Access to lethal means reviewed and discussed
- Written instructions and education materials provided, including what to do if the patient’s condition worsens and when to return to the ED
- Patient confirms his or her understanding of the patient care plan
- Relevant health information transmitted to referral providers
- Patient senses the provider’s care and concern
Introduction

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31. Management of the severely agitated or violent patient

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

- Ensure staff safety
- Attempt to calm patient using verbal techniques
- Place physical restraints if necessary
- Monitor, support ABCs.
- Establish IV/O2 monitor if possible. Check vital signs (BP, PR, RR, SPO2, T°C, RBS) if possible.

Call for security or police for any concern about violence or potential violence

Is rapid sedation needed?

Chemical restraint

Severely violent patient

- Haloperidol 5mg to 10mg IV/IM
- OR
- Midazolam 5mg to 10mg IV/IM
- OR
- Midazolam 5mg to 10mg IV/IM
- PLUS
- Haloperidol 5mg to 10mg IV/IM

Intoxication with CNS stimulant or undifferentiated patient

- Midazolam 5mg to 10mg IV/IM
- OR
- Midazolam 5mg IV/IM
- PLUS
- Haloperidol 5mg IV/IM

Intoxication with CNS depressant (e.g. ethanol)

- Haloperidol 5mg to 10mg IV/IM

Known psychotic/psychiatric disorder

- Haloperidol 5mg to 10mg IV/IM
- OR
- Haloperidol 5mg to 10mg IV/IM
- PLUS
- Midazolam 5mg to 10mg IV/IM

Cooperative patient

- Midazolam 5mg to 10mg PO

In elderly patients, reduce the dose of any antipsychotic by half

Sedation achieved?

Yes

- Establish IV/O2 monitor if not already in place.
- Check vital signs (BP, PR, RR, SPO2, T°C, RBS)

No

- Titrate chemical restraints to desired effect.

- Establish IV/O2 monitor if not already in place.
- Check vital signs (BP, PR, RR, SPO2, T°C, RBS)

Assess for medical causes of agitation

- Hypoglycaemia
- Hypoxia
- Drug overdose
- Poisoning
- Infection
- Intracranial lesion
- Others

GENERAL PRINCIPLES

Select one sedative (benzo) and one antipsychotic agent and titrate these to a targeted SAT. Avoid switching agnosic classes as unpredictable use longer acting agents where possible. To avoid the roller coaster effect of agitationsubsequence-sedation.

If using RAPID TAKEDOWN agents, be prepared to MANAGE THE ARWY inc. RSI & CICO.

Assessment should occur in a designated safe area of hospital (available calls & duress alarm). Assesses situation and patient including airway, anaesthesia and risk to self and others.

Administer medications with patient supine, one staff member to each limb and one to give drugs AVOID PRONE RESTRAINT.

SELECTION ASSESSMENT TOOL (SAT)

<table>
<thead>
<tr>
<th>SAT</th>
<th>Responsiveness</th>
<th>Speech</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>combative, violent, out of control</td>
<td>continual loud outbursts</td>
</tr>
<tr>
<td>+2</td>
<td>very anxious &amp; agitated</td>
<td>loud outbursts</td>
</tr>
<tr>
<td>+1</td>
<td>anxious or restless</td>
<td>normal, talkative</td>
</tr>
<tr>
<td>0</td>
<td>awake &amp; calm, cooperative</td>
<td>normal</td>
</tr>
<tr>
<td>-1</td>
<td>aslep, refuses to voice</td>
<td>slurring or marked slowing</td>
</tr>
<tr>
<td>-2</td>
<td>responds to physical stimulation</td>
<td>few recognisable words</td>
</tr>
<tr>
<td>-3</td>
<td>no response to stimulation</td>
<td>nil</td>
</tr>
</tbody>
</table>
### 32. Poisoning

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

#### Decontamination

**Activated Charcoal**

Use ONLY within **ONE HOUR** of ingestion of a potentially toxic amount of medication. It is **NOT effective** beyond this period unless in multi-dose indications.

Multipledose (30gm in 400mls 4-6hrly) activated charcoal should only be considered if a patient has ingested a life-threatening amount of; Theophylline, Phenobarbital, Dapsone Carbamazepine, or Quinine. (Mnemonic - These People Drink Charcoal Quickly)

**DO NOT PERFORM GASTRIC LAVAGE**

Clinical studies have failed to show that gastric lavage improves the severity of illness, recovery times, or the ultimate medical outcomes and may be associated with life-threatening complications (aspiration pneumonitis, oesophageal or gastric perforation, fluid and electrolyte imbalances, arrhythmia).

#### Antidotes

<table>
<thead>
<tr>
<th>Antidote</th>
<th>Indications</th>
<th>Dose</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>N-acetylcysteine (NAC)</td>
<td>If it is likely that the patient has ingested &gt; 150 mg/kg (or &gt;10 g) of paracetamol In contrast, NAC is <strong>not recommended</strong> for patients with; an unknown ingestion time, a paracetamol concentration below detectable limits along with normal AST levels.</td>
<td>150 mg/kg IV over 1 hr then 50mg/kg over the next 4 hrs then 100mg/kg over the next 16hrs IV NAC should be infused as a 3% solution (30 g of NAC in D5W to a total volume of 1L)</td>
<td>Anaphylactoid reaction if given too fast</td>
</tr>
<tr>
<td>Atropine</td>
<td>Organophosphate/Carbamate poisoning causing rhinorrhea, lacrimation, dyspnoea, vomiting, fasciculations, weakness, inability to ambulate, convulsions, respiratory insufficiency, coma. Miosis alone is <strong>not</strong> an indication for atropine administration.</td>
<td>2mg IV repeated every 5 minutes until the therapeutic endpoint is reached i.e. until pulmonary secretions are dried (reflected by improved oxygenation) and ease of breathing [or ease of ventilation].</td>
<td>Excessive doses of atropine can result in delirium, agitation, and tachycardia and hypertension. Tachycardia is <strong>not</strong> a contraindication to atropine administration.</td>
</tr>
<tr>
<td>Ethanol</td>
<td>Ethylene Glycol or Methanol poisoning</td>
<td><strong>PO:</strong> Loading dose: 0.8g/kg in a 20% ethanol solution diluted in juice.</td>
<td>Higher maintenance doses are used in patients with chronic alcoholism or during haemodialysis.</td>
</tr>
<tr>
<td>Flumazenil</td>
<td>Excessive sedation known to be due to the use of benzodiazepines in a patient without known contraindications (e.g., procedural sedation).</td>
<td>10µg/kg IV over 15 seconds. Repeat every 2-3mins to a maximum of 1mg (usual range 0.3 to 0.6mg). *Fomepizole dosing available in MDCalc</td>
<td>The administration of flumazenil to patients with undifferentiated coma can precipitate seizures in benzodiazepine-dependent patients and has been associated with seizures, arrhythmia, and hypotension in patients with co-ingestion of certain medications, such as tricyclic antidepressants.</td>
</tr>
<tr>
<td>Naloxone</td>
<td>Respiratory depression secondary to an opioid overdose</td>
<td>Dilute one ampoule (0.4mg/ml) into 10ml (0.04mg/ml) and give 1 ml every 1 to 2 minutes. A therapeutic effect is usually seen after 3 to 4 ml</td>
<td>Rapid injection may result in an acute withdrawal syndrome, with severe sympathetic effects such as hypertension, tachycardia and pulmonary oedema - can precipitate a myocardial infarction in patients at risk of IHD.</td>
</tr>
</tbody>
</table>

---
33. Organophosphate Poisoning Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

DECONTAMINATION AND PERSONAL PROTECTION

- WEAR PERSONAL PROTECTIVE EQUIPMENT (Gloves, Gowns and Masks)
- REMOVE ALL CLOTHING from and gently cleanse the patient with soap and water. Consider clothing and PPEs as hazardous waste and discard accordingly

The action of acetylcholine released into a synaptic cleft or neuromuscular junction is normally terminated when the enzyme acetylcholinesterase cleaves acetylcholine into choline and acetic acid. Organophosphates bind to the active site of the cholinesterase enzymes causing an increase in the acetylcholine concentration and a marked hyper stimulation of the cholinergic system, which is responsible for the predominant signs of toxicity.

Muscarinic Manifestations
- Ophthalmic: Conjunctival injection, lacrimation, miosis, blurred vision, diminished visual acuity, ocular pain
- Respiratory: Rhinorrhea, stridor, wheezing, cough, excessive sputum, chest tightness, dyspnoea, apnoea
- Cardiovascular: Bradycardia, hypotension
- Dermal: Flushing, diaphoresis, cyanosis
- Gastrointestinal: Nausea, vomiting, salivation, diarrhoea, abdominal cramping, tenesmus, faecal incontinence
- Genitourinary: Frequency, urgency, incontinence
- Nicotinic Manifestations
- Cardiovascular: Tachydyssrhythmias, hypertension
- Striated muscle: Fasciculations, twitching, cramping, weakness, paralysis
- Central Nervous System
- Anxiety, restlessness, depression, confusion, ataxia, tremors, convulsions, coma, anorexia, respiratory depression
- *Parasympathetic nervous system manifestations (DUMB/ILS – Diarrhoea, Urination, Miosis, Bradycardia, Bronchoconstriction, Bronchorrhea) Emesis, Lacrimation, Salivation

Indications for Atropine treatment
(Miosis alone is NOT an indication for atropine administration)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhinorrhea, lacrimation, or mild dyspnoea</td>
<td>Mild</td>
</tr>
<tr>
<td>Inability to ambulate, dyspnoea, vomiting, fasciculations, weakness</td>
<td>Moderate</td>
</tr>
<tr>
<td>Convulsions*, coma, respiratory insufficiency</td>
<td>Severe</td>
</tr>
</tbody>
</table>

* Tachycardia can occur in organophosphate poisoning due to stimulation of the sympathetic ganglia as well as respiratory distress and hypoxia. Tachycardia is NOT a contraindication to atropine administration.

Atropine doses should be repeated every 5 minutes until the therapeutic endpoint (Atropinisation) is reached i.e. until pulmonary secretions are dried [reflected by improved oxygenation] and ease of breathing [or ease of ventilation]), a pulse rate > 80 beats per minute and systolic blood pressure > 80mm/Hg.

Start atropine infusion when atropinisation achieved (~ 0.05mg/kg/hour). E.g. for a 70kg patient give 3.5 mg of atropine per hour as an infusion. Put 10mg of atropine in 200mLs of fluid run at 40 – 80mLs per hour (2-4mg/hr) depending on response.

Precautions - Excessive doses of atropine can result in deleterious effects including delirium, agitation, and tachycardia and hypertension. Atropine will likely NOT improve miosis or skeletal muscle paralysis (nicotinic receptors); therefore, reversal of these effects is not a therapeutic endpoint. Attempting to reverse these findings with atropine can result in administration of excessive doses of atropine.

Seizure control
(Midazolam 0.1mg/kg or Diazepam 0.2mg/kg)

Benzodiazepines are needed to prevent or treat nerve agent–induced seizures in moderate to severe toxicity because anticholinergic treatment is increasingly less effective from 5 – 40 minutes post exposure. Phenytoin does NOT affect GABA-A and has been found to be ineffective in controlling organophosphate –induced seizures. Benzodiazepines should be infused rapidly to unresponsive patients who have been exposed to organophosphates, because such patients may have non-convulsive seizures due to the onset of paralysis.

Pralidoxime (2-PAM)

WHO recommendation is > 30-mg/kg IV/IM bolus followed by > 8-mg/kg/hour IV infusion

(Adults: 2 g IM or slow IV infusion over 15 to 30 minutes followed by a 500-mg/hour infusion)

Neither atropine nor benzodiazepines will alleviate symptoms affecting the nicotinic system (CNS, NMJ, autonomic ganglia). 2-PAM should be given to any patient exposed to an organophosphate nerve agent who is showing any systemic toxicity especially fasciculations or weakness. The initial dose should be given as quickly as possible. Caution: Delivering 2-PAM more rapidly than recommended can result in hypertension. This is usually self-limited, but in extreme cases, phenotolamine 5 mg IV may be effective. Laryngospasm and rigidity can also occur with rapid IV administration.

Disposition

- Consult a Physician
- Continue atropine infusion until the therapeutic endpoint (Atropinisation) is reached i.e. until pulmonary secretions are dried [reflected by improved oxygenation] and ease of breathing [or ease of ventilation])
- Admit ALL symptomatic patients. Severe poisoning should be admitted to an ICU
34. Alcohol (Methanol) Poisoning Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

Suspected Methanol Poisoning

Methanol toxicity commonly affects the neurological, ophthalmological, and gastrointestinal systems:

1. Within the first 24 hours, central nervous system (CNS) depression, euphoria, and inebriation occur.
2. This is followed by a latent period (between 6 and 30 hours) during which methanol is metabolized to formic acid, which ultimately leads to systemic effects.
3. Ophthalmologic symptoms can range from blurry vision, decreased visual acuity, and photophobia to blindness or the classic “snowstorm” vision. A complaint of blurred vision with a relatively clear sensorium should strongly suggest the diagnosis of methanol poisoning. Initially, visual fields are not affected, and patients may have a central scotoma (blind spot). If unrecognized and not appropriately treated, these changes will result in:
   - permanent blindness,
   - absent papillary response, and
   - permanent optic nerve atrophy.
4. Methanol toxicity causes gastrointestinal symptoms such as abdominal pain with or without evidence of pancreatitis and/or hepatotoxicity.

In severe cases, the odour of formaldehyde may be present on the breath or in the urine. Untreated methanol poisoning is associated with a rate of death of 28% and a rate of visual deficits or blindness of 30% in survivors.

- Monitor, support ABCs; Consider Advanced Airway or nursing in recovery position for airway protection
- Check vital signs (BP, PR, RR, SPO₂, T°C, RBS).
  - Start Oxygen if SPO₂ < 94%. Maintain SPO₂ ≥ 94%
  - If Hypoglycaemic (RBS < 3.3 mmol/L), give 50mls 50% dextrose IV (see 22. Hypoglycaemia Algorithm). Also, give 100mg Thiamine IV followed by 100mg PO BD for 6 weeks.
- Send samples for FBC, UEC, LFTs. Correct any electrolyte imbalances (see 25: Electrolyte Abnormalities Algorithm)
- Start IV Fluids – If hypotensive give repeated NS/RL boluses at 20ml/kg until perfusion is restored (MAP > 65) and dehydration is corrected. More rapid administration and large amounts of fluid may be needed in some patients. When stable, start 5% dextrose saline infusion at 3L/24 hrs
- Perform brief, targeted history, physical exam
- DO NOT PERFORM GASTRIC LAVAGE. If the patient’s airway is protected, anecdotal evidence supports the use of gastric aspiration if large amounts of alcohol have been ingested and the patient can be treated very quickly (within an hour) after the ingestion.
- DO NOT GIVE ACTIVATED CHARCOAL unless the patient has co-ingested other poisons (see 32. Poisoning Algorithm for indications and contraindications for activated charcoal)

Give Ethanol (also see 32. Poisoning Algorithm)
Based on in vitro studies, ethanol’s affinity for alcohol dehydrogenase is more than that of methanol by 15-fold and thus competes for the enzyme preventing methanol from being metabolized to the toxic metabolite, formic acid. Ethanol may be given orally or through an intravenous infusion.

**Oral Dose:**
Loading dose: 0.8g/kg in a 20% ethanol solution diluted in juice.
Maintenance dose: 80mg/kg/h; increase to maintain a serum ethanol concentration of 100-150mg/dL

**IV Dose:**
Loading dose: 0.6 - 0.8 g/kg in a 10% ethanol solution in DSW (volume/volume).
Maintenance dose:
80 to 130 mg/kg/h

Higher maintenance doses are used in patients with chronic alcoholism or during haemodialysis.

Side effects of ethanol treatment include; hypoglycaemia, CNS depression, intoxication, thrombophlebitis, and hypotension.

- Consult a Physician
- Monitor, support ABCs, Vital signs (BP, PR, RR, SPO₂, T°C, RBS), and UEC.
- Consider haemodialysis for large methanol ingestions, severe metabolic acidosis (pH < 7.25-7.30), vision abnormalities, renal failure, electrolyte abnormalities not responsive to conventional treatment, haemodynamic instability refractory to intensive care treatment and serum concentration > 50mg/dL
- Transfer to ICU
35. Pain Management Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient's individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**ACUTE SOMATIC PAIN**

**Evaluate:** Focused history, detailed pain assessment
Assign **SEVERITY SCORE (1-10)**

- **MILD PAIN (1-3/10)**
  - PO Paracetamol or NSAID + Adjuvant interventions (Non-Pharmacologic)

- **MODERATE PAIN (4-6/10)**
  - As for mild pain + Weak opioids e.g. PO tramadol, codeine, hydrocodeine

- **SEVERE PAIN (7-10/10)**
  - As for mild pain + Strong opioids e.g. morphine, fentanyl + non-opioid analgesics

Investigate and treat the cause of pain.

**See Analgesia Chart**
- Reassess pain within 15 minutes to ensure relief, monitor patient appropriately, and document
- Repeat analgesic, titrate to a higher dose, initiate a more potent analgesic or combine analgesics with different mechanisms of action as is appropriate to relieve pain
- Treat the cause of pain as OP/IP, and consult/refer appropriately
- Beware of contraindications, allergies, toxicity, interactions with other meds etc.
- Pethidine (meperidine) has an active metabolite (nor-meperidine) that causes neuroexcitation (apprehension, tremors, delirium, and seizures) and may interact with antidepressants (contraindicated with MOI and best avoided with SSRIs), so it is **NOT RECOMMENDED** for repetitive use. It is also highly addictive.
- Use the PO, SC or IV route, except when that is not possible
- Adjuvant interventions include IMMOBILIZATION, SPLINTAGE, POSITIONING, ELEVATION, ICE etc.

**NSAIDS** are the recommended 1st line therapy for **Sickle Cell Pain Crisis, Renal Calculi** and **Acute Gout**.

**Metoclopramide** is the recommended 1st line therapy for **Acute Migraine Headaches**

**REGIONAL ANAESTHESIA**

**Indications**
- Acute pain management for wounds, fractures and dislocations
- Alternative to procedural sedation
- Alternative to narcotics in certain patient populations (e.g. head injured patient, patients with concomitant mental status change, patients given buprenorphine)

**Contraindications**
- Allergy to local anaesthetic agents
- Active infection at the site of injection
- Injuries at risk of compartment syndrome
- Uncooperative patient
- Pre-existing neurologic deficit
- Anticoagulation (relative)

**Technique** – [www.nysora.com](http://www.nysora.com)

**Types**
- Wrist (Ulnar, Median and Radial nerve) block for the hand
- Digital nerve blocks for fingers and toes
- Femoral nerve block for the anterior thigh, femur, knee and skin anaesthesia over the medial aspect of the leg below the knee
- Facial and dental nerve blocks
- Ankle blocks for the foot
- Haematoma blocks

**Anaesthetic - Lidocaine**
- Dose – 3mg/kg
- Onset of action – < 2 mins
- Duration – 60 mins
**36. Low Back Pain Algorithm**

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**Adult with Low Back Pain (LBP)**
- Monitor and support ABCs
- Provide immediate analgesia – see Analgesia Chart

Perform a focused history and physical examination, evaluating:
- Duration of symptoms
- Risk factors for potentially serious conditions (tumour, infection, cauda equina syndrome, ankylosing spondylitis or vertebral compression fracture).
- Symptoms suggesting radiculopathy or spinal stenosis
- Presence and level of neurologic involvement - All patients should be evaluated for the presence of rapidly progressive or severe neurologic deficits, including motor deficits at more than 1 level, faecal incontinence, and bladder dysfunction.
- Psychosocial risk factors

Any potentially serious conditions (RED FLAGS) strongly suspected?
The possibility of low back pain due to problems outside the back, such as Ectopic pregnancy, Pancreatitis, Nephrolithiasis, or Aortic Aneurysm, or Systemic illnesses, such as endocarditis or viral syndromes, should be considered.

**Perform diagnostic studies to identify cause**
(see Diagnostic Work-up for Low Back pain)

**DO NOT** routinely obtain imaging or other diagnostic tests in patients with nonspecific low back pain. Early, routine imaging and other tests usually cannot identify a precise cause, do not improve patient outcomes, and incur additional expenses.

Specific cause identified

**Yes**
- Consult appropriately

**No**
- Advice about self-care;
  - Advice to remain active
  - Application of superficial heat

- Discuss non-invasive treatment options;
  - Pharmacologic;
    - 1st line – NSAIDs
    - 2nd line – Tramadol – for severe, disabling pain that is not controlled (or is unlikely to be controlled) with acetaminophen and NSAIDs.
  - Non-pharmacologic – Physiotherapy

Arrive at shared decision regarding therapy trial
Educate patient

Patient accepts risks and benefits of therapy

**Yes**
- Discharge with Analgesia and for Physiotherapy.
  Reassess in 4 weeks in Orthopaedic Clinic if necessary

**No**
- Refer to Orthopaedic Clinic

Continue self-care and non-invasive options (analgesia and physiotherapy)
Discharge and reassess in 4 weeks in Orthopaedic Clinic if necessary

**RED FLAGS FOR LOW BACK PAIN (TUNAFISH)**
- Trauma
- Unexplained weight loss
- Neurologic symptoms
- Age > 50 years
- Fever
- Intravenous drug use
- Steroid use
- History of cancer
## Diagnostic Work-up for Low Back Pain

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Key features on history or physical examination</th>
<th>Imaging*</th>
<th>Additional studies*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>History of cancer with new onset of LBP</td>
<td>MRI</td>
<td>ESR</td>
</tr>
<tr>
<td></td>
<td>Unexplained weight loss</td>
<td>Lumbosacral plain radiography</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Failure to improve after 1 month</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age &gt;50 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple risk factors present</td>
<td>Plain radiography or MRI</td>
<td></td>
</tr>
<tr>
<td>Vertebral infection</td>
<td>Fever</td>
<td>MRI</td>
<td>ESR and/or CRP</td>
</tr>
<tr>
<td></td>
<td>Intravenous drug use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recent infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cauda equina syndrome</td>
<td>Urinary retention</td>
<td>MRI</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Motor deficits at multiple levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fecal incontinence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saddle anesthesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertebral compression fracture</td>
<td>History of osteoporosis</td>
<td>Lumbosacral plain radiography</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Use of corticosteroids</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Older age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankylosing spondylitis</td>
<td>Morning stiffness</td>
<td>Anterior-posterior pelvis plain radiography</td>
<td>ESR and/or CRP, HLA-B27</td>
</tr>
<tr>
<td></td>
<td>Improvement with exercise</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alternating buttock pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Awakening due to back pain during the second part of the night</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Younger age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe/progressive neurologic deficits</td>
<td>Progressive motor weakness</td>
<td>MRI</td>
<td>Consider EMG/NCV</td>
</tr>
</tbody>
</table>

Herniated disc (Recommendation 4)

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Key features on history or physical examination</th>
<th>Imaging*</th>
<th>Additional studies*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Back pain with leg pain in an L4, L5, or S1 nerve root distribution</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Positive straight-leg-raise test or crossed straight-leg-raise test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Symptoms present &gt;1 month</td>
<td>MRI</td>
<td>Consider EMG/NCV</td>
</tr>
</tbody>
</table>

Spinal stenosis (Recommendation 4)

<table>
<thead>
<tr>
<th>Possible cause</th>
<th>Key features on history or physical examination</th>
<th>Imaging*</th>
<th>Additional studies*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radiating leg pain</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Older age (Pseudoclaudication a weak predictor)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Symptoms present &gt;1 month</td>
<td>MRI</td>
<td>Consider EMG/NCV</td>
</tr>
</tbody>
</table>

*Level of evidence for diagnostic evaluation is variable.
37. Management of Pain in Sickle Cell Disease Algorithm

This clinical pathway is intended to supplement, rather than substitute for, professional judgment and may be changed depending upon a patient’s individual needs. Failure to comply with this pathway does not represent a breach of the standard of care.

**Patient presents with acute pain**
- Monitor and support ABCs
- Check vital signs (BP, PR, RR, SPO2, T°C, RBS).
- Start Oxygen IF SPO2 < 92% or if patient is dyspnoeic. Maintain SPO2 ≥ 92%
- Perform brief, targeted history, physical exam
- Determine probable cause and precipitating factors for pain e.g. infection
- Establish IV Access and send blood samples as below.

**Related to SCD**
- **No** Perform appropriate work-up
- **Yes**

**Start D5 ½ Normal Saline (NS)* at a maintenance rate unless the patient is overtly hypovolemic (sepsis, diarrheal illness, vomiting) in which case resuscitate appropriately.**

*In vitro and in vivo studies have shown that lowering of serum osmolality with hypotonic fluid can reduce erythrocyte sickling. Over-hydration — especially with isotonic crystalloid — does not cure crisis and may have detrimental effects.

**Mild or Moderate pain**
- **Yes**
  - **Administer IV dose of opiate**
    - Tramadol IV/SC - 50-100mg over 3-5mins. Max 400mg/d
    - Fentanyl 1μg/kg every 1-2hrs
  - **Consider adjuvant therapy** (IV paracetamol 15mg/kg)

- **No**
  - **Assess degree of relief every 15-30 mins**
    - **Yes**
    - **Drop in pain score of ≥ 2**
    - **Assess degree of relief every 15-30 mins**
    - **Yes**
      - **Drop in pain score of ≥ 2**
    - **No**
      - **Consult a Physician/Haematologist**

**Assess degree of relief every 15-30 mins**
- **No**
  - **Drop in pain score of ≥ 2**

**Mild pain**
- **Yes**
  - **Manage cause/precipitating factor**
  - **Disposition with short (< 72 hours) opiate/NSAIDs prescription with haematology follow-up**

**Full Blood Count (FBC);**
- Most patients with HbSS disease have a baseline haemoglobin level of 6 to 9 g/dL and tolerate this level of anaemia well because of physiologic adaptations.
- WBC is NOT a particularly sensitive nor specific indicator for infection

**Reticulocyte count** - normally elevated (>5%). Levels < 5% are a serious cause for concern as it signifies bone marrow hypo activity. In patients with worsened scleral icterus, back pain, fever, or signs that suggest haemolysis, additional tests would include; LFTs and LDH

**Renal function tests**

Blood typing and screening is necessary if haemoglobin has dropped > 1 mg/dL below baseline or if there is concern that the patient may need a transfusion. Indications for blood transfusion; Severe anaemia - ↓ Hb > 2g/dL below steady state or < 6g/dL; Acute chest syndrome; Priapism; CVA in children; Before surgery
38. Procedural Sedation and Analgesia (PSA)

SEE THE EMERGENCY DEPARTMENT PROCEDURAL SEDATION AND ANALGESIA PHYSICIAN CHECKLIST

Procedural sedation is the technique of administering sedatives or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function.

Potential indications for procedural in the ED: fracture reduction, joint reduction, incision and drainage, chest tube placement, electrocardioversion, upper endoscopy (with a gastroenterologist), foreign body removal, burn or wound debridement

Patient selection: A pre-procedural history and physical exam, as documented in the ED record, should reflect a focused evaluation of the airway, cardiovascular status, pulmonary status, allergies, and history of prior adverse reactions to sedatives or anaesthetics. PSA may not be ideal for patients with significant chronic morbidities e.g. sleep apnoea, COPD, low baseline oxygen saturations or blood pressure, or anatomic features that would make bag valve mask (BVM) ventilation or maintaining an airway difficult.

Preparation: Monitoring equipment (continuous telemetry, pulse oximetry, BP; consider continuous end tidal CO2 monitoring), peripheral IV, Ringer’s Lactate/Hartmann’s Solution, medications for PSA, naloxone (if opiates are given), equipment for procedure (e.g. scalpel), team (minimum one practitioner for sedation, one for procedure – ONE OF THEM MUST BE PROFICIENT IN AIRWAY MANAGEMENT), airway equipment (oxygen source, nasal cannula/face mask, BVM, suction), rescue airway equipment (endotracheal tube, laryngoscope, LMA, nasal trumpet)

OBTAIN CONSENT for ALL PSA Procedures

Medication for PSA - give both an Analgesic AND a Sedative unless using Ketamine which is both

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Analgesic/ Sedative</th>
<th>Onset/Peak Effect</th>
<th>Duration of Action</th>
<th>Adverse Effects</th>
<th>Comments/Caveats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketamine</td>
<td>1 mg/kg IV over 30-60 seconds</td>
<td>Analgesic and Sedative</td>
<td>Onset 1min; Peak effect 1 min</td>
<td>5 - 10mins</td>
<td>Laryngospasm (0.3%), hyper salivation, vomiting, emergence reaction</td>
<td>Ketamine is preferred for patients with hemodynamic instability or renal insufficiency.</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.5 – 3 µg/kg IV over 3-5mins</td>
<td>Analgesic</td>
<td>Immediate onset, Peak effect 2-3mins</td>
<td>30 - 45mins</td>
<td>Chest wall rigidity and respiratory depression may occur with rapid IV administration</td>
<td>Fentanyl is preferred for a rapid onset of analgesia in acutely distressed patients.</td>
</tr>
<tr>
<td>Midazolam</td>
<td>0.05 – 0.15mg/kg IV</td>
<td>Sedative</td>
<td>Onset 3-5 mins; Peak effect 15-30 mins</td>
<td>20 - 60mins</td>
<td>Respiratory depression, hypotension</td>
<td>Midazolam has a rapid onset and short duration and is classed as an ultra-short acting benzodiazepine and is 2 to 3 times more potent than diazepam, so can produce significant respiratory depression. Blood pressure decreases, and heart rate increases as compensation for a decreased SVR, although CO remains unchanged.</td>
</tr>
</tbody>
</table>
Introduction
Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG
The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

Difficult Airway Features
Difficult Laryngoscopy: Look externally, Evaluate 3-3-2 rule, Mallampati score, Obstruction, Neck Mobility
Difficult BVM Ventilation: Beard, Obese, No teeth, Elderly, Sleep Apnea / Snoring
Difficult LMA: Restricted mouth opening, Obstruction, Distorted airway, Stiff lungs or c-spine
Difficult Cricothyroidotomy: Surgery, Hematoma, Obesity, Radiation distortion or other deformity, Tumor*

Is this patient a good candidate for ED procedural sedation and analgesia?
The less cardiorespiratory reserve, the more difficult airway features, and the less procedural urgency, the more likely the patient should not receive PSA in the emergency department. If not a good candidate for ED-based PSA, other options include regional or local anesthetic; PSA or GA in the operating room; or endotracheal intubation in the ED.

Pre-Procedure Preparation
- Analgesia - maximal patient comfort prior to PSA
- Informed consent for PSA and procedure
- Patient on monitor: telemetry, NIBP, SpO2, EtCO2
- Oxygenate with NC O2 and high flow face mask O2
- Select and draw up PSA agent(s)
- Reversal agents and paralytic vials at bedside
- Prepare for endotracheal intubation

Airway Equipment
- Ambu bag connected to oxygen
- Laryngoscopy handles and blades
- Suction, oral & nasal airways
- Endotracheal tubes & stylets
- LMA with lubricant and syringe
- Colorimetric capnometer
- Bougie & difficult airway equipment

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dose*</th>
<th>Contraindications</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketamine</td>
<td>1-2 mg/kg iv over 30-60 sec or 4-6 mg/kg IM, repeat half dose prn</td>
<td>Absolute: age &lt; 3 months, schizophrenia Relative: major posterior oropharynx procedures; history of airway instability, tracheal surgery, or tracheal stenosis; active pulmonary infection or disease; cardiovascular disease; CNS masses, abnormalities, or hydrocephalus</td>
<td>Preferred for longer procedures; avoid if hypertension/ tachycardia is a concern; have midazolam available to manage emergency distress; muscle tone is preserved or increased; post-procedure emesis may be mitigated by prophylactic ondansetron</td>
</tr>
<tr>
<td>Etomidate</td>
<td>0.1-0.15 mg/kg iv, then 0.05 mg/kg q3-5 min prn</td>
<td>Intra-procedure myoclonus or hypertonicity, as well as post-procedure emesis, are common</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>1-2 mcg/kg iv, then 1 mcg/kg q3-5 min prn</td>
<td>Comparatively delayed onset of action; do not re-dose too quickly</td>
<td></td>
</tr>
<tr>
<td>Midazolam</td>
<td>0.5 mg/kg iv, then .05 mg/kg q3-5 min prn</td>
<td>Pregnancy, allergy to benzyl alcohol Comparatively delayed onset of action; do not re-dose too quickly</td>
<td></td>
</tr>
<tr>
<td>Pentobarbital</td>
<td>1 mg/kg iv, then 1 mg/kg q3-5 min prn</td>
<td>Pregnancy, porphyria Use for painless procedures where analgesia is not needed</td>
<td></td>
</tr>
<tr>
<td>Vecuronium</td>
<td>0.01-0.1 mg/kg iv or IM typical adult dose 0.4 mg, max 2 mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.01 mg/kg iv (typical adult dose 0.2 mg) over 20 seconds, max 1 mg</td>
<td>Only use in benzodiazepine naïve patient</td>
<td></td>
</tr>
</tbody>
</table>

*All doses should be reduced in the elderly and in patients with marginal hemodynamics

Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for investigating cardiac arrhythmias and is also useful in diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

How to do an ECG

The six chest leads (V1 to V6) “view” the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.

PSA Intervention Sequence

- Proceed down intervention sequence as slowly as patient condition permits
- Jaw thrust as illustrated above - thumbs on maxilla, four fingers posterior to ramus
- Laryngospasm notch is behind the eulrobe, between mastoid process and condyle of mandible – bilateral, firm pressure medially and cephalad (up and in)
- If rescue ventilation is required, bag slowly and gently
- see emupdates.com/psa for details

Post-procedure Assessment

- Adverse events
  - none / hypoxia (< 90%) / aspiration / hypotension / agitation / other: 
- Interventions taken
  - none / bag valve mask / LMA / ETT / reversal agent / hypotension Rx / admission for PSA / other: 
- Adequacy of PSA
  - nondistressed / mild distress / severe distress
- Procedure
  - successful / unsuccessful
- MD or RN at bedside until patient responds to voice
- Telemetry, EtCO2, SpO2 monitoring until patient responding to questions appropriately
- If reversal agent used, observation two hours after answering questions appropriately
- Mental status and ambulation at baseline at time of discharge/disposition

Fasting Grid

<table>
<thead>
<tr>
<th>Oral intake in the prior 3 hours</th>
<th>Emergent Procedure</th>
<th>Urgent Procedure</th>
<th>Non-urgent procedure</th>
<th>Urgent Procedure</th>
<th>Semi-urgent procedure</th>
<th>Non-urgent procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing</td>
<td>All levels of sedation</td>
<td>All levels of sedation</td>
<td>All levels of sedation</td>
<td>All levels of sedation</td>
<td>All levels of sedation</td>
<td>All levels of sedation</td>
</tr>
<tr>
<td>Clear liquids only</td>
<td>All levels of sedation</td>
<td>All levels of sedation</td>
<td>Up to and including brief deep sedation</td>
<td>Up to and including extended moderate sedation</td>
<td>Minimal sedation only</td>
<td>Minimal sedation only</td>
</tr>
<tr>
<td>Light snack</td>
<td>All levels of sedation</td>
<td>Up to and including brief deep sedation</td>
<td>Up to and including dissociative sedation; non-extended moderate sedation</td>
<td>Minimal sedation only</td>
<td>Minimal sedation only</td>
<td>Minimal sedation only</td>
</tr>
<tr>
<td>Heavier snack or meal</td>
<td>All levels of sedation</td>
<td>Up to and including extended moderate sedation</td>
<td>Minimal sedation only</td>
<td>Minimal sedation only</td>
<td>Minimal sedation only</td>
<td>Minimal sedation only</td>
</tr>
</tbody>
</table>

Minimal sedation only ➔ Dissociative sedation; brief or intermediate-length, moderate sedation
Extended moderate sedation ➔ Brief deep sedation ➔ Intermediate or extended-length deep sedation

Additional Comments

MD Name  Sign  Date/Time


R. Strayer / F. Andrus emupdates.com 11.28.2013
## Introduction

Electrocardiography is a fundamental part of cardiovascular assessment. It is an essential tool for diagnosing cardiac disorders such as myocardial infarction. Familiarity with the wide range of patterns seen in the electrocardiograms of normal subjects and an understanding of the effects of noncardiac disorders on the trace are prerequisites to accurate interpretation.

The information from these 12 leads is combined to form a standard electrocardiogram.

### Analgesia Chart

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Equianalgesic dose</th>
<th>Onset/Peak Effect</th>
<th>Duration of Action</th>
<th>Adverse Effects</th>
<th>Comments/Caveats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>IV - 0.1mg/kg; max. 0.3mg/kg</td>
<td>10mg</td>
<td>IV - Onset 3-5 mins; Peak effect 15-30 mins</td>
<td>IV - 3 - 4 hrs</td>
<td>Respiratory depression; Hypotension partly due to histamine release</td>
<td>Acute severe pain (trauma) or persistent pain. Morphine is better preferred for obstetric pain.</td>
</tr>
<tr>
<td></td>
<td>SC - 0.1-0.2mg/kg</td>
<td></td>
<td>SC – Onset 15-30 mins</td>
<td>SC – 4 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>IV - 0.5 – 3 µg/kg over 3-5mins</td>
<td>100µg</td>
<td>IV - Immediate onset, Peak effect 2-3mins</td>
<td>IV – 30 - 45mins</td>
<td>Chest wall rigidity and respiratory depression may occur with rapid IV administration</td>
<td>Acute severe pain. (trauma) Fentanyl is preferred for a rapid onset of analgesia in acutely distressed patients. Fentanyl is preferred for patients with hemodynamic instability or renal insufficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SC – Onset 7 - 15mins</td>
<td>SC – 1 – 2 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pethidine</td>
<td>IV - 0.5-1mg/kg</td>
<td>75 mg</td>
<td>IV - 1-3 mins SC - 30-90 mins</td>
<td>IV – 2 - 4 hrs</td>
<td>High doses may cause respiratory depression, agitation, muscle fasciculations, seizures or histamine induced hypotension</td>
<td>Moderate-to-severe pain (migraine, trauma, acute abdominal pain) It may be used in obstetric practice to relieve labour pain. Pethidine has an analgesic potency approximately equal to one-fifth that of morphine. Pethidine has an active metabolite (nor-meperidine) that causes neuro excitation (aprehension, tremors, delirium, and seizures) and may interact with antidepressants (contraindicated with MOI and best avoided with SSRIs), so it is NOT RECOMMENDED for repetitive use. It is also highly addictive.</td>
</tr>
<tr>
<td></td>
<td>SC - 1-2mg/kg</td>
<td></td>
<td></td>
<td>SC – 3 – 4 hrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tramadol</td>
<td>IV/SC - 50-100mg over 3-5mins</td>
<td>80mg</td>
<td>IV/SC – 45 mins</td>
<td>IV/SC - 9 - 10 hrs</td>
<td>&gt; 400 mg/d are associated with an increased risk of seizures.</td>
<td>Moderate-to-severe pain. Tramadol is 5 to 10 times less potent than morphine. There is consequently an absence of respiratory depression, a low sedative effect, and less potential for dependence. There is a high incidence of nausea and vomiting. Slow administration over 3 - 5 minutes decreases the incidence of nausea and vomiting. Tramadol does not promote the release of histamine.</td>
</tr>
<tr>
<td></td>
<td>Max 400mg/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paracetamol</td>
<td>IV – 15mg/kg</td>
<td>-</td>
<td>IV – 15mins (at end of infusion)</td>
<td>IV – 4hrs</td>
<td>Mild-to-moderate pain</td>
<td>Can be used to supplement opioid analgesics</td>
</tr>
<tr>
<td>Diclofenac</td>
<td>IV – 75mg IM – 75mg</td>
<td>-</td>
<td>IV – 5-10 mins IM – 15mins</td>
<td>IV – 6-8hrs</td>
<td>Gastrointestinal bleeding; Bleeding secondary to platelet inhibition, and Development of renal insufficiency</td>
<td>Mild-to-moderate pain. Can be used to supplement opioid analgesics e.g. renal colic All NSAIDs elevate SBP (median 5 mmHg). This effect predisposes to the development of congestive heart failure and may contribute to the risk of accelerated atherothrombotic disease. Patients with hypovolemia or hypoperfusion, the elderly, and those with pre-existing renal impairment may be more susceptible to NSAID-induced renal injury.</td>
</tr>
</tbody>
</table>

**IM administration is generally NOT RECOMMENDED** due to its multiple disadvantages: Painful administration, Unpredictable absorption, Complications involving tissue fibrosis and abscesses, and Rapid declines in analgesic effect.

Subcutaneous (SC) administration provides similar pharmacokinetics with greater patient comfort. The SC route should replace the IM route for opioids.
Introduction
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How to do an ECG

The six chest leads (V1 to V6) "view" the heart in the horizontal plane. The information from the limb electrodes is combined to produce the six limb leads (I, II, III, aVR, aVL, and aVF), which view the heart in the vertical plane. The information from these 12 leads is combined to form a standard electrocardiogram.
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