Management of decompensated shock
SBP < 90 mmHg

Targets
SBP > 90 mmHg
MAP >60 mmHg
UOP – 0.5ml/kg/hr

Patient with adequate UOP, normal HR, signs and symptoms of euvolemia, even if SBP <90-70 consider as No Shock eg; CLCD

STEP 01

Heart Rate
- Low → Follow Bradyarrhythmia Algorithm Cause Correction
- High/ Normal → Sinus Tachycardia
  - Yes → Correct the cause, proceed to step 02
  - No → Follow Tachyarrhythmia Algorithm

STEP 02

Exclude the possibility of Anaphylaxis → Follow Anaphylaxis and Allergy Algorithm

STEP 03

Exclude obstructive shocks
1. Tension Pneumothorax
2. Cardiac Tamponade
3. Pulmonary Embolism

→ Follow Obstructive Shock Management Algorithm

STEP 04

Lung Examination

Dry Lung

Hypovolemic
Cardiogenic shock
Distributive
Neurogenic
Correct cause simultaneously- see next page

0.9% NaCl or Hartman's 250cc bolus

Reassess in 5 min, lungs, and BP

SBP < 90 mmHg

Dry Lung

Repeat 250 cc boluses until target BP, provided lungs are dry (Be cautious about dengue)

Wet Lung

Noradrenaline Infusion, titrate to achieve the target BP

SBP > 90 mmHg

No further boluses, continue monitoring

Wet Lung

- B/L Crepitations
- POCUS B/L B lines > 3
- **Hypovolemic -** Leptospirosis with acute pulmonary edema/ AKI
- **Cardiogenic LVF**
- **Distributive** - Sepsis with wet lung

Noradrenaline Infusion
0.05 – 0.5 mcg/kg/min via infusion pump
Titrate to achieve the target BP
Lepto with AKI, arrange urgent HD

STEP 05

Find the cause and treat → Follow Shock Management Algorithms
- Hypovolemic Shock
- Cardiogenic Shock
- Distributive Shock

Source: Major presentations in Medical Practice. ISBN 978-624-6246-12-9

Causes for shock with Dry Lungs

(No crepitations, POCUS B/L B lines<3)

Refer relevant guide lines when giving fluids

- **Hypovolaemia**

- Vomiting/diarrhoea/dehydration/poor oral intake

-Dengue critical phase

-Burns

-Leptospirosis without acute pulmonary oedema/ Pulmonary involvement

-DKA/HHS

-Traumatic/non-traumatic bleeding

-Drug overdose-eg CCB/Beta blocker

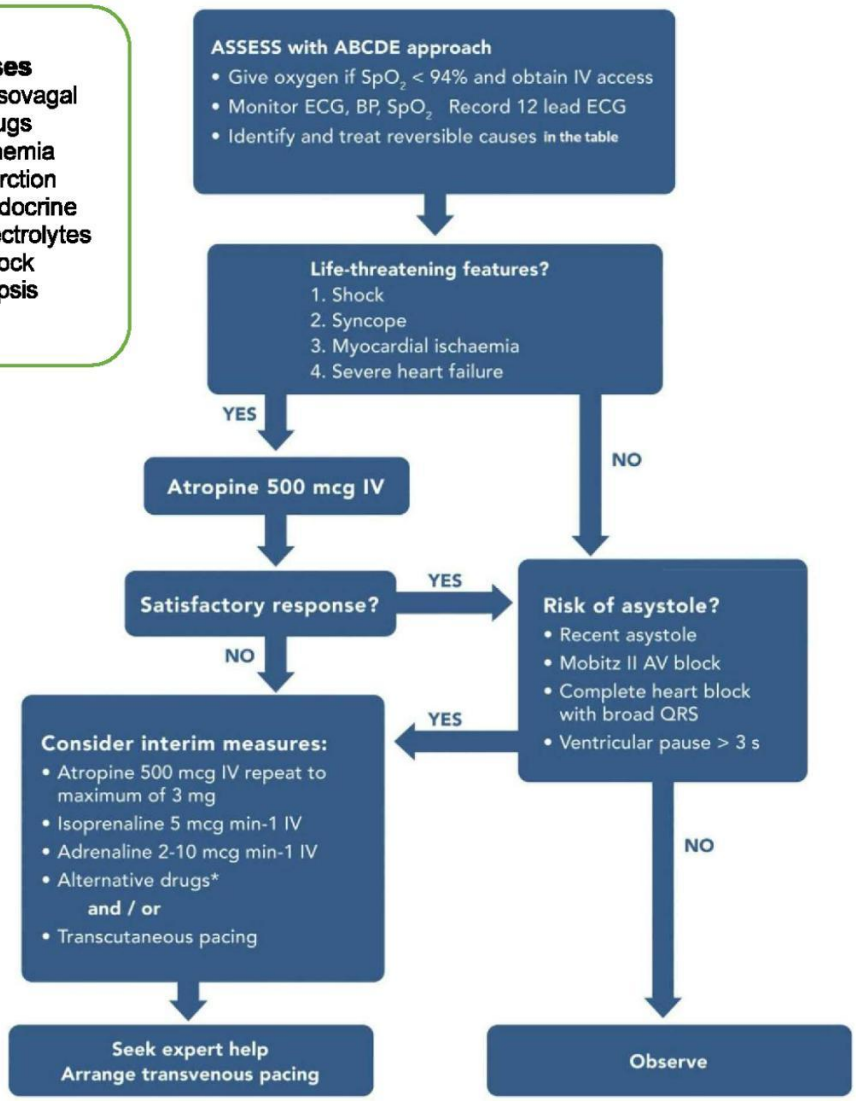
-Endocrine-Addisonian crisis-suspect if history of steroid use, hypoglycaemia

-Myxoedema coma

- **Cardiogenic RVF**
- **Distributive shock**- sepsis with dry lung
- **Neurogenic shock**-start with IVF and start inotropes early

BRADYCARDIA

Causes
V- vasovagal
D- drugs
I -ischemia
I -infarction
E -endocrine
E- electrolytes
S -shock
S -sepsis



"Alternatives include.

1. Aminophylline
2. Dopamine
3. Glucagon (il bradycardia is caused by beta-blocker
4. Or calcium channel blocker overdose)
5. Glycopyrrolate can be used instead of atropine

Trans cutaneous pacing

1. Connect 3 lead ECGs in defibrillator
2. Rotate to fixed pacing mode
3. Select pacing rate 60
4. Pacing output 1mA/kg
5. Conscious sedation with midazolam/ fentanyl
6. Start pacing button
7. Look at the spike (circuit is complete now)
8. Look for capture beats
9. Increase output up to desired heart rate
10. Look for mechanical capturing with pulse
11. Once desired heart rate achieved (HR 60 bpm), with a pulse rate of 60 bpm add another 5mA and continue pacing
12. Try to identify cause and correct it

Source: European Resuscitation Council Guidelines 2021 https://www.erc.edu/assets/documents/RESUS-8903-ALS.pdf

TACHYCARDIA ALGORHYTHM (with pulse)

if sinus tachycardia - correct the cause only
If not sinus tachycardia - follow the algorithm

SVT	VT/Acute AF
100-150 J	150 J
270 J	270 J
270 J	270 J

Assess with ABCDE approach

- Give oxygen if appropriate and obtain IV access
- Monitor ECG, SPO2,12LEAD ECG
- Identify and treat reversible causes in the table

Life threatening features?

1. Shock
2. Syncope
3. Myocardial ischaemia
4. Severe heart failure

YES

Synchronised DC shock up to 3 attempts

- Amiodarone 300mg IV over 10-20min and repeat shock

followed by;

- Amiodarone 900mg over 24hrs

Causes
D-drugs
I-infection
I-ischemia
E-electrolytes
E-endocrine
S-shock
S-sepsis
S- stimulants

UNSTABLE

STABLE
Seek expert help

NO

Is the QRS narrow (< 0.12 s)?

BROAD QRS
Is QRS regular?

IRREGULAR

Possibilities include:

- **Atrial fibrillation with bundle branch block** treat as for irregular narrow complex
- **Polymorphic VT** (e.g. torsades de pointes) give magnesium 2 g over 10 min

REGULAR

If VT (or uncertain rhythm):

- Amiodarone 300 mg IV over 10–60 min
- then 900mg over 24hrs

If previously confirmed **SVT with bundle branch block**: give adenosine as for regular narrow complex tachycardia

NARROW QRS
Is QRS regular?

REGULAR

Vagal manoeuvres

If ineffective:

- Give Adenosine (if no pre-excitation)
  - 6 mg rapid IV bolus
  - If unsuccessful, give 12 mg
  - If unsuccessful, give 18 mg
- Monitor ECG continuously

Normal sinus rhythm restored??

YES

Probable re entry PSVT

- Record 12 lead ECG
- If recurs give adenosine again and consider choice of antiarrhythmic prophylaxis

NO

Seek expert help

- Possible atrial flutter Control rate eg. beta blocker

IRREGULAR

Probable atrial fibrillation:

- Beta blockers or diltiazem
- Consider digoxin or amiodarone if evidence of heart failure
- Anticoagulated if duration>48hrs

❖ *In acute AF before electrical cardioversion, give iv heparin 5000 U bolus*
❖ *In stable SVT/VT if failed chemical cardioersion, go for electrical cardioversion*

Obstructive Shock

Obstructive shock			
	Tension Pneumothorax	Cardiac Tamponade	Pulmonary embolism
History	• Sudden onset SOB • Chest pain • History of trauma • History of chronic lung disease	• Trauma to chest	• Sudden onset pleuritic chest pain • Shortness of Breath • Risk factors for DVT • **Modified Well Score** for probability assessment
Examination	• Tachypnoea, air hunger • SBP < 90mmHg • Tachycardia • Unilateral Hyper-resonance and reduced air entry • Tracheal deviation • Engorged neck veins	• Increased JVP • Muffled heart sounds • SBP <90mmHg • Tachypnoea • B/L air entry present	• Tachypnoea • Fine basal crepitation • Low SPO2 • Tachycardia • Loud P2
Investigation/ Adjuncts	• SPO2 – reduced • POCUS Lung- Absent lung sliding Barcode sign Cardiac- Fixed dilated IVC Hyperdynamic RV with systolic collapse	• ECG- Small complexes in ECG • POCUS- Fluid in Pericardium Fixed dilated IVC RV diastolic collapse LV hyperdynamic	• ABG – Hypoxia Hypocapnoea, Respiratory alkalosis • ECG- Tachycardia, P pulmonale (lead II) Right axis deviation, RBBB S1Q3T3 • POCUS-RV dilation LV systolic collapse

Tension Pneumothorax- Management

- Require immediate decompression
  - Using either Large bore cannula 14G/ catheter
  - Or, Finger thoracostomy
- Followed by intercostal tube insertion

Needle decompression

STEP 1. Administer high-flow oxygen and ventilate as necessary.

STEP 2. Surgically prepare the site chosen for insertion.
For pediatric patients- the 2nd intercostal space midclavicular line
For adults- the 4th or 5th intercostal space anterior to the midaxillary line

STEP 3. Anesthetize the area if time and physiology permit.

STEP 4. Insert large bore cannula 14G or catheter with a Luer-Lok 10 cc syringe attached into the skin. Direct the needle just over the rib into the intercostal space, aspirating the syringe while advancing.
(Adding 3 cc of saline may aid the identification of aspirated air.)

STEP 5. Puncture the pleura.

STEP 6. Remove the syringe and listen for the escape of air when the needle enters the pleural space to indicate relief of the tension pneumothorax. Advance the catheter into the pleural space.

STEP 7. Stabilize the catheter and prepare for chest tube insertion.

Finger Thoracostomy / Intercostal Tube Insertion

STEP 1. Position the patient with the ipsilateral arm extended overhead and flexed at the elbow.

STEP 2. Widely prep and drape the lateral chest wall, include the nipple, in the operative field.

STEP 3. Identify the site - **4th or 5th intercostal space, between the anterior and midaxillary lines**. (This site corresponds to the level of the nipple or inframammary fold.)

STEP 5. Inject the site liberally with local anesthetic from skin down to parietal pleura.

While the local anesthetic takes effect, use the thoracostomy tube to measure the depth of insertion. Premeasure the estimated depth of chest tube by placing the tip near the clavicle with a gentle curve of chest tube toward incision. Evaluate the marking on the chest tube that correlates to incision, ensuring the sentinel hole is in the pleural space. Often the chest tube markings will be at 10 14 at the skin, depending on the amount of subcutaneous tissue (e.g., obese patients).

STEP 6. Make a 2- to 3-cm incision parallel to the ribs at the predetermined site, and bluntly dissect through the subcutaneous tissues just above the rib.

STEP 7. Puncture the parietal pleura with the tip of the clamp while holding the instrument near the tip to prevent sudden deep insertion of the instrument and injury to underlying structures. Advance the clamp over the rib and spread to widen the pleural opening.

Air or fluid will be evacuated.

With a sterile gloved finger, perform a finger sweep to clear any adhesions and clots. (i.e., perform a finger thoracostomy)

STEP 8. Place a clamp on the distal end of the tube. Using either another clamp at the proximal end of the thoracostomy tube or a finger as a guide, advance the tube into the pleural space to the desired depth.

STEP 9. Look and listen for air movement and bloody drainage; "fogging" of the chest tube with expiration may also indicate tube is in the pleural space.

STEP 10. Remove the distal clamp and connect the tube thoracostomy to an underwater seal apparatus with a collection chamber.

STEP 11. Secure the tube to the skin with heavy, nonabsorbable suture.

STEP 12. Apply a sterile dressing and secure it with wide tape.

STEP 13. Obtain a chest x-ray.

STEP 14. Reassess the patient.

Cardiac Tamponade – Management

- Definitive management is to perform an emergency thoracotomy or sternotomy by a qualified surgeon.

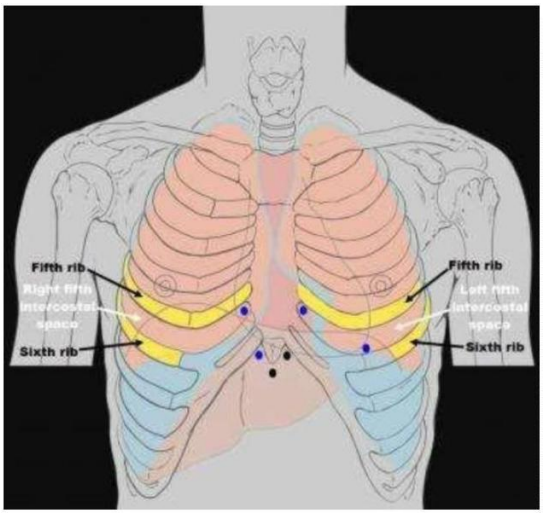
- In the absence of the facilities for emergency surgery, pericardiocentesis should be performed as a temporary measure to drain the collection in the pericardial space using either land-mark technique or ultrasound guidance.

Emergent needle pericardiocentesis

- Patient positioning
  The semi recumbent position at a 30- to 45-degree angle is preferred. The supine position is an acceptable alternative.

- Apply supplemental oxygen, Ensure IV access and connect to a cardiac monitor and continuous pulse oximetry.
  If time permits, insert a NG tube to decompress the stomach and decrease the risk of gastric perforation.

- Identify the anatomic landmarks **(xiphoid process, 5th and 6th ribs)**
  The most commonly used sites are **the left sternocostal margin or the subxiphoid approach**.



Pericardiocentesis needle insertion sites. The subxiphoid and the left sternocostal margin are the most commonly used sites (black dots).

Adapted image from Wikimedia Commons/Patrick J Lynch, Medical Illustrator, and C Carl Jaffe, MD, Cardiologist.

- Use the antiseptic solution to clean and surgically prepare the subxiphoid area, and then apply sterile drapes to delineate the surgical site.

- Infiltrate local anesthetic solution from skin to deeper tissues.

- Puncture the skin using a No. 11 blade scalpel (between the xiphoid process and the left sternocostal margin).

- Use a long 18-22G needle (spinal/epidural needle) connected to a 20mL/ 50mL syringe with 5 mL of normal saline.

- Insert the spinal needle through the skin incision at a 45-degree angle to the abdominal wall and 45 degrees off the midline sagittal plane and direct it toward the left shoulder.

(If time permits, needle insertion should be performed under direct ultrasonographic guidance. An ECG chest lead can be attached to the needle: ST elevation or ventricular ectopic signal contact with ventricle)

- Slowly advance the spinal needle up to a depth of 5 cm, while applying negative pressure on the syringe until a return of fluid is visualized, cardiac pulsations are felt, or an abrupt change in the ECG waveform is noted.

  If the ECG waveform shows an injury pattern (ST segment elevation), then slowly withdraw the needle until the pattern returns to normal.

- Withdraw as much fluid as possible; when the syringe is filled, stabilize the needle against the patient's torso, remove the filled syringe, and replace it with another one. An alternative setup to replacing syringes is using a 3-way stopcock and intravenous tubing, which allows the physician to aspirate pericardial fluid into the syringe and, after turning the stopcock, eject the fluid into a basin or a collection bag. As pericardial fluid is aspirated, the needle may move closer to the heart, and if an injury pattern appears on the ECG waveform, then the needle should be slowly withdrawn.

- Remove the needle when fluid can no longer be aspirated.

Pulmonary Embolism (PE)- Management

- Apply supplemental oxygen to maintain SPO2 >90%
- Consider High flow nasal oxygen/ NIV/ invasive ventilation if unstable
  (HFNO/ NIV is preferred over invasive ventilation)
- Cautious volume loading - ≤500mL IV 0.9% NaCl or Ringer's Lactate over 15-30min.s
  In patients with normal-low CVP/ underfilled IVC
- Use vasopressors (IV Noradrenaline- 0.1micrograms/ kg/ min)
  +/- inotropes (IV Dobutamine 2-20micrograms/ kg/ min)
- Start parenteral anticoagulation (LMWH) in patients with high or intermediate clinical probability of PE while awaiting the results of diagnostic tests
- Reperfusion with systemic thrombolytics or percutaneous catheter directed treatment or surgical embolectomy are the definitive treatment
- Systemic thrombolytics –

  rtPA i) 100mg over 2 hours

  ii) 0.6mg/kg (max 50mg) over 15min-
  (This is the accelerated regimen for rtPA in pulmonary embolism; it is not officially approved, but it is sometimes used in extreme haemodynamic instability such as cardiac arrest)
- If thrombolytic therapy is administered during a cardiac arrest, cardiopulmonary resuscitation should be continued for at least 60_90 min before terminating resuscitation attempts

<u>Contraindications for thrombolysis</u>

Absolute

- History of haemorrhagic stroke or stroke of unknown origin
- Ischaemic stroke in previous 6 months
- Central nervous system neoplasm
- Major trauma, surgery, or head injury in previous 3 weeks
- Bleeding diathesis
- Active bleeding

Relative

- Transient ischaemic attack in previous 6 months
- Oral anticoagulation
- Pregnancy or first post-partum week
- Non-compressible puncture sites
- Traumatic resuscitation
- Refractory hypertension (systolic BP >180 mmHg)
- Advanced liver disease
- Infective endocarditis
- Active peptic ulcer

Modified wells score

Features	Score (points)
Clinical signs and symptoms of DVT	3.0
No alternative diagnosis	3.0
Heart rate >100 beats/min	1.5
Immobilization ≥3 days or surgery in the previous 4 weeks	1.5
Previous DVT or PE	1.5
Hemoptysis	1.0
Malignancy with active treatment in the past 6 months or under palliative care	1.0
Pretest clinical probability	
PE unlikely	≤4.0
PE likely	>4.0

PE = Pulmonary embolism, DVT = Deep vein thrombosis

Hypovolaemic Shock

Hypovolaemic shock				
	Haemorrhagic	Dehydration	Burns	Dengue
History	• History of trauma- RTA/ Assault	• Vomiting/ diarrhoea • Reduced intake	• History of burn	• Fever • Arthralgia • Myalgia. • Retro orbital pain • RHC Pain
Examination	• Visible bleeding • Fractures • Tense abdomen • Pallor • Tachycardia • SBP <90mmhg	• Sunken eyes • Dry mucus membranes • Reduced UOP • Thirst • Tachycardia • SBP may be normal	• Burns involving large surface area **(>20%TBSA)** • Tachycardia • SBP may be normal	• Weak thready pulse • Narrow pulse pressure (<25mmhg) or SBP<90mmhg
Investigation/ Adjuncts	• POCUS (E-FAST) Free fluid in the lungs/ abdomen • Low Hb in ABG	BU-high VBG- DM/RBS HAGMA-DKA		• Increased PCV • POCUS- abdomen/lung Peri-cholecystic fluid, pleural effusion

Dehydration

WHO classification on dehydration

	Dehydration category		
	No Dehydration Fluid deficit- <50ml/kg (<5% of Body Weight)	**Some dehydration** Fluid deficit 50- 100ml/kg (5-10% of B.W)	**Severe dehydration** Fluid deficit >100ml/kg (>10% of B.W)
General	Well Alert	Restless Irritable	Lethargic Unconscious
Eyes	Normal	Sunken	Sunken
Thirst	Not thirsty	Thirsty drink eagerly	Drinks poorly
Skin turgor	Goes back quickly	Goes back slowly	Goes back slowly
CRFT	Normal	3-4 sec	>4 sec
Pulse volume	Normal	Normal- reduced	Weak/ thready
Pulse rate	Normal	Normal- increase	>100 or <60 bpm
UOP	Normal	Reduced	minimal

Management Algorithms

- No dehydration -> Go to management **Plan A**
  Replace the on-going losses + Maintenance
- Some dehydration -> Go to management **Plan B**
  Deficit correction + Replace the on-going losses + Maintenance
- Severe dehydration -> Go to dehydration **Plan C**
  Manage shock if present
  ⇩
  Deficit correction + Replace the on-going losses + Maintenance

<table>
<tr><th>Plan A</th><th>Plan B</th><th>Plan C</th></tr>
<tr><td>Choice of fluid- ORS or
Salted drinks

(and plain water in addition)

Avoid commercially prepared fluids (ex: fruit juices, carbonated drinks, etc.)</td><td>Choice of fluid- ORS or
Salted drinks

(and plain water in addition)</td><td>• <u>If in shock</u>
IV/IO 0.9% NaCl 20ml/kg
↓
Repeat every 10 mins
Can repeat up to 60ml/kg
Until vital signs and mental status improve to normal</td></tr>
<tr><td>• <u>Replace on-going losses</u>

Replace losses with each stool

<2y – 50-100ml/stool
2-10y – 100-200ml/stool
>10y – as much as they drink</td><td>• <u>Deficit correction</u>

Calculation

75ml/kg in initial 4 hours</td><td rowspan="4">• <u>Deficit correction</u>
(Rapid IV rehydration)

IV Ringers lactate or Normal saline 100ml/kg

<u>In < 1y old</u>
Give 30ml/kg bolus within 1st hour (Can repeat if radial pulse is still weak)
Remaining 70 ml/kg within next 5 hours.

<u>>1year old</u>
Give 30 ml/kg within 30 mins (Can repeat till strong radial pulse is present)
Remaining 70 ml/kg within next 2.5 hours</td></tr>
<tr><td rowspan="3">• <u>Give maintenance fluid</u>
Calculation
In child-
for 24 hours
For 1st 10kg- 100ml/kg
For 2nd 10kg- 50ml/kg
Remaining –20ml/kg

In adult-
1.5ml/kg/hour</td><td>• <u>Replace on going losses</u>
As in Plan A</td></tr>
<tr><td>• <u>Give maintenance fluid</u>
As in Plan A</td></tr>
<tr><td rowspan="2">Assess every 15- 30 mins to confirm patient is taking the prescribed amount of fluid
↓
Assess after 4 hours
↓</td></tr>
<tr><td>• <u>Give maintenance fluid</u>
As in Plan A</td><td>• <u>Replace on going losses</u>
As in Plan A</td><td>Assess every 15- 30 mins till strong radial pulse is present
↓
Then 1 hourly
↓
After that 3- 6hours</td></tr>
<tr><td></td><td>Reassess dehydration –
If,
▪ No dehydration -> Plan A
▪ Some dehydration -> plan B
▪ Severe dehydration -> repeat plan C</td><td>Reassess dehydration –
If,
▪ No dehydration -> Plan A
▪ Some dehydration -> plan B
▪ Severe dehydration -> repeat plan C</td></tr>
</table>

Deangue Shock

Early detection of shock

In a patient with features of Dengue Haemorrhagic Fever,

- Compensated shock
  Circulatory failure manifested by narrow pulse pressure (less than or equal to 20mmHg).
- Decompensated shock
  Hypotension (SBP <90mmHg or reduction of SBP by >20% or mean BP <60mmHg)
- Profound shock
  Blood pressure and pulse is un-detectable

It is important to detect the patient before going into shock status (Pre-shockstage)

Symptoms suggestive of Pre-shock/Shock (from 3rd day of illness)

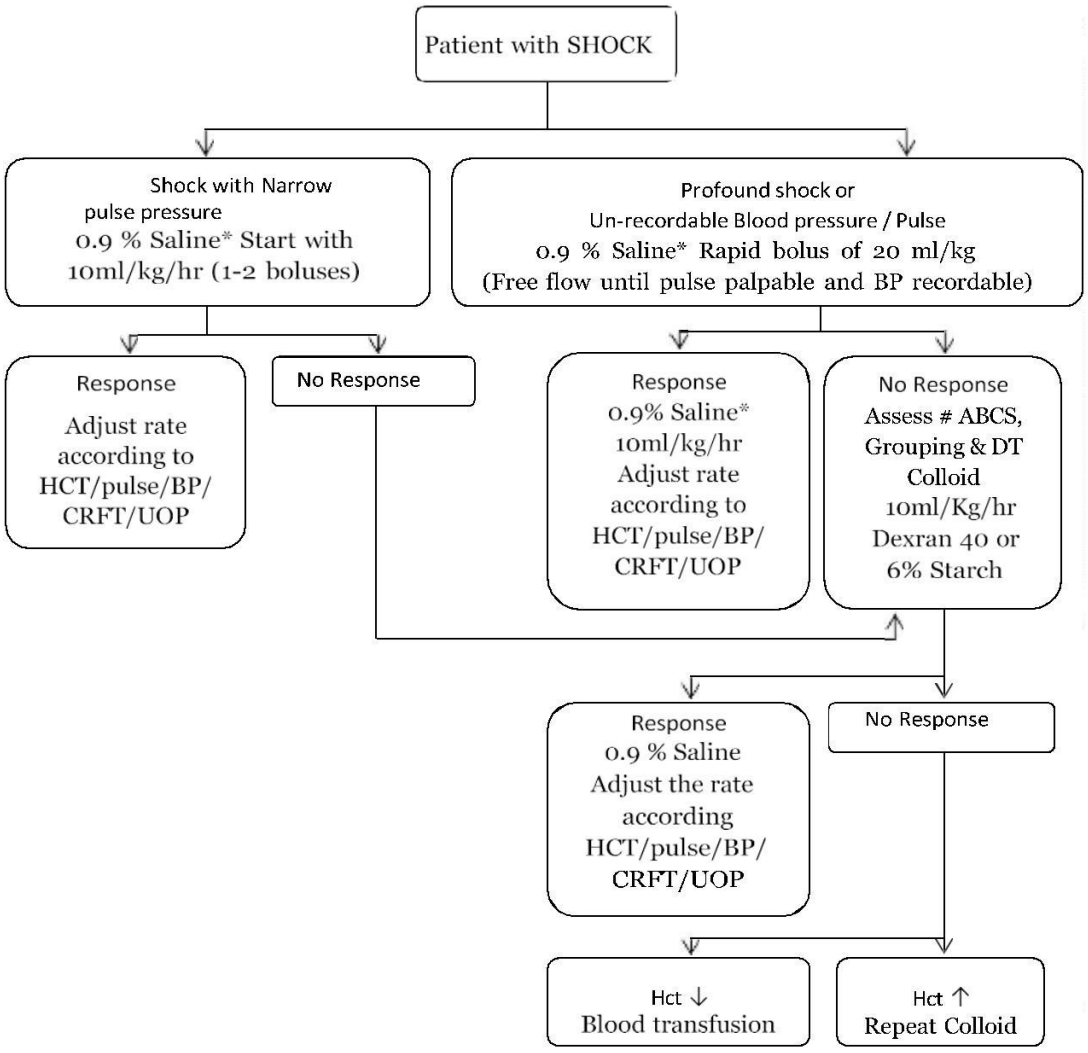
- Sweating
- Abdominal pain
- Persistent vomiting
- Restlessness / altered conscious level
- Postural dizziness
- Decreased urine output (OUP) (<0.5 ml/kg/hour)
- Calculate the urine output in ml/kg/hr., using the same weight used for fluid calculation.

Signs suggestive of Pre-shock/Shock (from 3rd day of illness)

- Cold extremities
- Prolonged capillary refill time >2 seconds
- Unexplained tachycardia
- Increasing diastolic pressure
- Narrowing of pulse pressure ≤20 mmHg
- Postural drop ≥20 mmHg of systolic blood pressure
- Hypotension (< 20% from patient's baseline or SBP<90mmHg if baseline not known or mean BP 60mmHg)
- Increased respiratory rate

▪ Dengue Shock Management– In Child

Figure: Algorithm on management of Shock in DHF



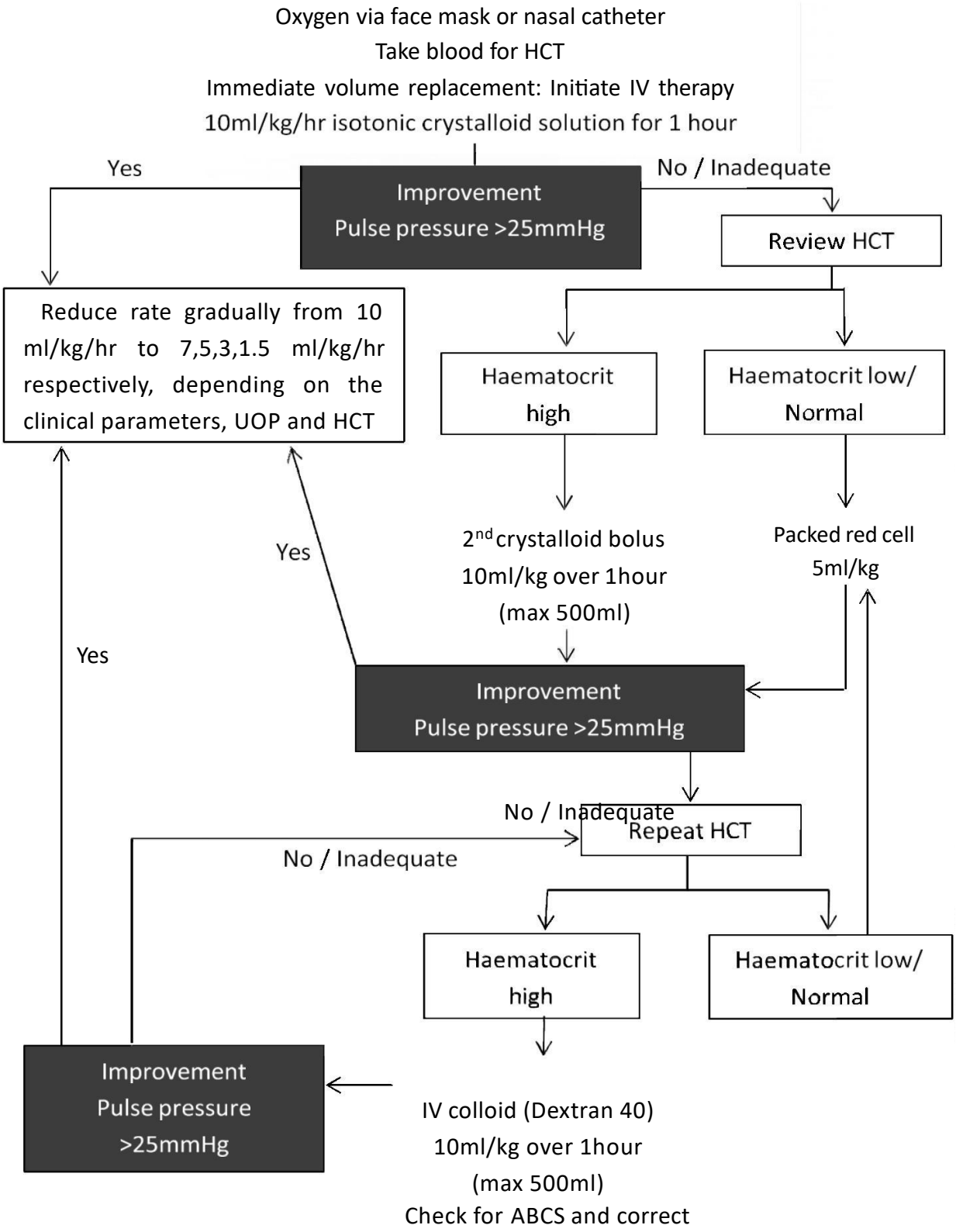
All patients in shock –

Call for help; ensure adequate oxygenation, Keep flat/head low

5 % dextrose in N Saline is a useful alternative to N Saline when available especially in patients who are likely be without any food intake for prolonged periods. In such patients assess blood sugar intermittently.

ABCS A- Acidosis B- Bleeding C- Calcium S- Sugar

SHOCK WITH NARROW PULSE PRESSURE (COMPENSATED SHOCK)

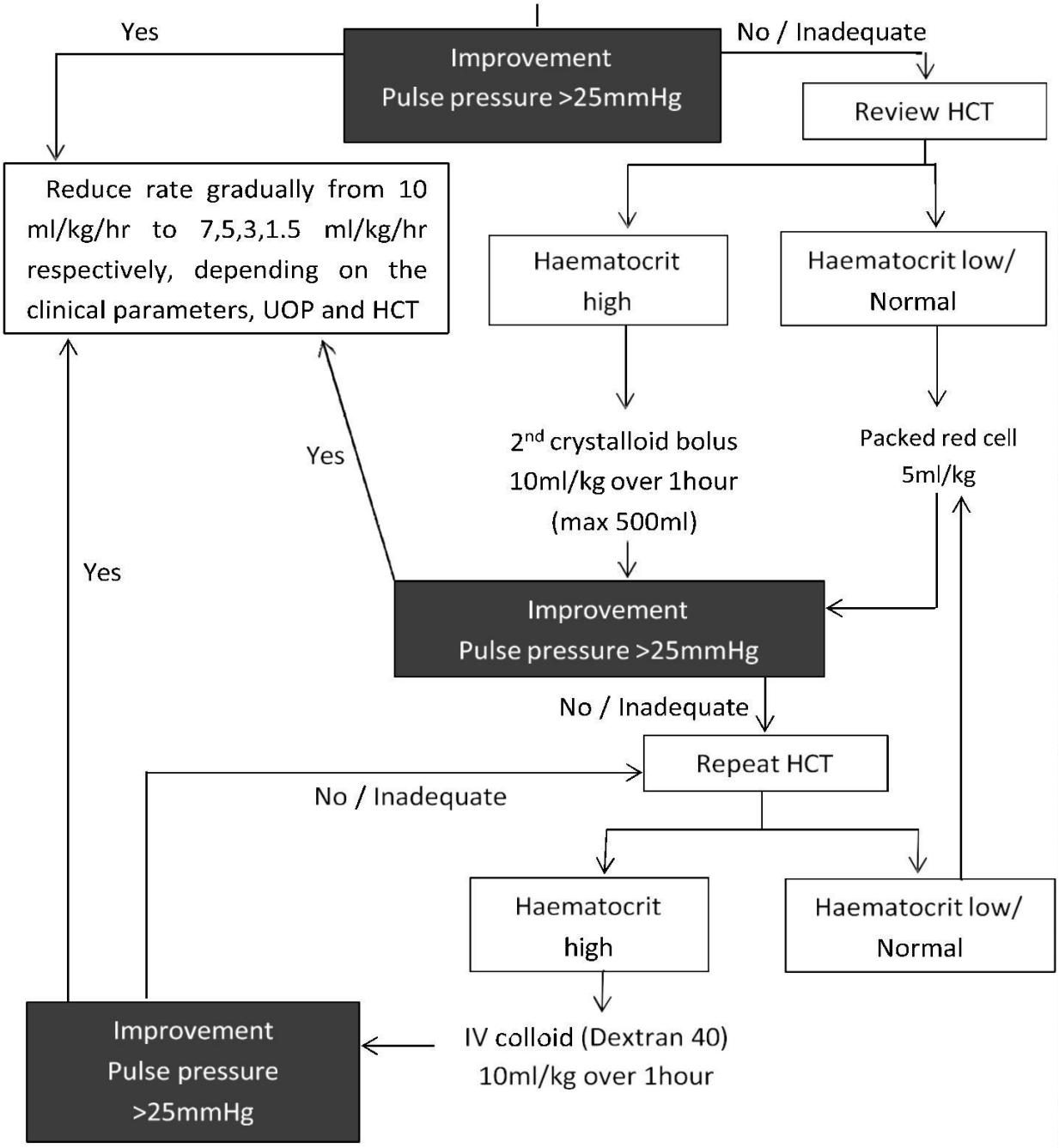


ABCS A- Acidosis B- Bleeding C- Calcium S- Sugar (refer 6.7)
Calculate the urine output in ml/kg/hr, using the same weight used for fluid calculation.

DECOMPENSATED OR PROFOUND SHOCK

Rapid bolus of 10ml/kg crystalloid

(Free flow until pulse palpable and BP recordable)



ABCS A- Acidosis B- Bleeding C- Calcium S- Sugar (refer 6.7)

Calculate the urine output in ml/kg/hr, using the same weight used for fluid calculation.

In all patients with shock –

Call for help; ensure adequate oxygenation, Keep flat/head low

Burns- Fluid Management

In contrast to resuscitation for other types of trauma in which fluid deficit is typically secondary to hemorrhagic losses, burn resuscitation is required to replace the ongoing losses from capillary leak due to inflammation.

- Fluid resuscitation is indicated for deep partial and full thickness burns larger than 20% TBSA.

- Choice of fluid- warmed crystalloid (Ringer's Lactate preferably).

- Calculation of fluid amount for 1st 24 hours- According to Parkland Formula (a modified version)

Adults:	2mL/ kg/ % TBSA
Children:	3mL/ kg/ % TBSA
Electric injury (all ages):	4mL/ kg/ % TBSA

- One half of calculated fluid is infused over 1st 8 hours **from the time of the incident**
- Second half is infused over next 16 hours

- UOP targets: 0.5 mL/kg/hr for adults and 1 mL/kg/hr for children weighing less than 30 kg

Management of the shocked patient

IV 0.9% NaCl rapid bolus (20mL/ kg, maximum 1L) - free flow till pulse is palpable.
Once the patient is haemodynamically stable, continue to manage according to the Parkland Formula.

Fluid amount used for initial resuscitation should be deducted from 1st 8hour fluid quota.

Burn Resuscitation Fluid and Target UOP by age and type of burn

Category of burn	Age and Weight	Adjusted fluid rates	Target UOP
Flame or Scaled	Adults and Older children (≥14 y)	2mL RL/ kg/ %TBSA	0.5mL/ kg/ hour 30-50mL/ hour
	Children (<14 y)	3mL RL/ kg/ %TBSA	1mL/ kg/ hour
	Infants and young children (≤30kg)	3mL RL/ kg/ %TBSA Plus 5% dextrose at maintenance rate	1mL/ kg/ hour
Electric Injury	All Ages	4mL RL/ kg/ %TBSA	1-1.5mL/ kg/ hour

RL- Ringer's Lactate, TBSA- Total Burn Surface Area

Cardiogenic Shock

	Cardiogenic shock (Acute Heart failure)
History	• Central chest pain with radiation • Shortness of breath • Autonomic symptoms • Altered mental status • Reduced UOP
Examination	• Sinus tachycardia, tachypnoea • SBP <90mmhg or Pulse pressure <20mmhg • B/L fine basal crepitations on auscultation • Cool peripheries, sweating • Jugular venous distention/hepatojugular reflex/oedema • Murmurs
Investigation/ Adjuncts	• ECG – ischemia, STEMI, arrhythmias • POCUS-Cardiac- Poor cardiac contractility and low EF In LV failure(common)-Dilated LV In RV failure- Dilated RV, small LV -Lung- Interstitial oedema- B lines

Cardiogenic Shock

Cardiogenic Shock is defined as a state of critical end organ hypoperfusion and hypoxia due to primary cardiac disorders.

Causes of Cardiogenic Shock

Severe depression of cardiac contractility

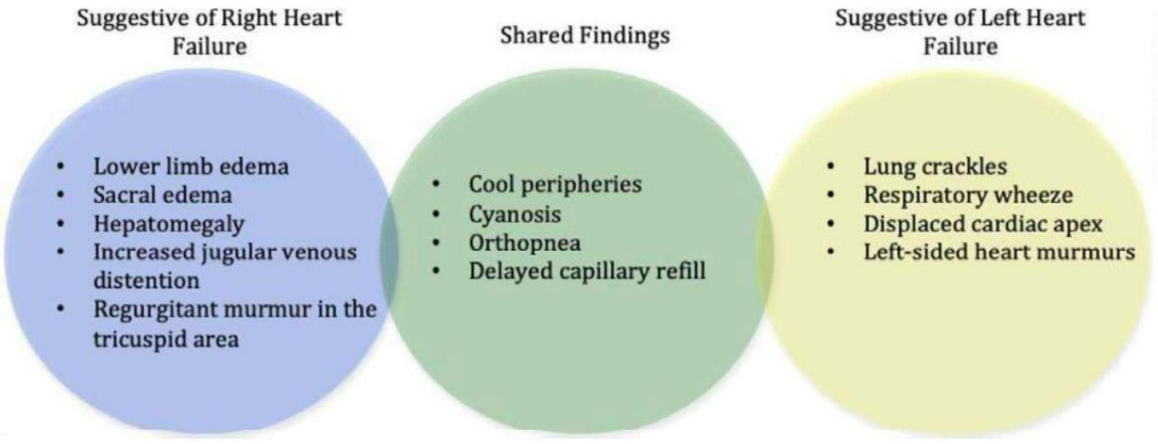
- **Unstable dysrhythmia – Refer Tachycardia algorithm or Bradycardia algorithm.**
- **Acute myocardial infarction (80%) – Acute LVF (anterior, lateral , Posterior , Inferior MI) Acute RVF (Inferior MI with right ventricular involvement)**
- Sepsis
- Myocarditis
- Myocardial contusion
- Cardiomyopathy
- Medication toxicity (e.g., β-blocker overdose, calcium channel–blocker overdose)

Mechanical complications

- Acute MR secondary to papillary muscle dysfunction or chordal rupture
- Ventricular septal defect
- Free wall rupture
- Right ventricular infarction
- Acute aortic insufficiency (aortic dissection)

Mechanical obstruction to forward blood flow

- Aortic stenosis
- Hypertrophic cardiomyopathy
- Mitral stenosis
- Left atrial myxoma
- Pericardial tamponade



JAHA

Management

Check heart rate - Manage unstable Tachyarrhythmias and Bradyarrhythmia If there's no features for unstable Tachyarrhythmias or Bradyarrhythmia - consider Ischemia.

Most important definitive intervention for acute cardiogenic shock due to ischemia is emergency revascularization.

Goals in ED- Airway stabilization
Improvement of myocardial pump function to maintain end-organ perfusion while arranging definitive care.

After stabilization, the patient should be transferred to a Centre with emergency cardiac revascularization facilities.

Air way & Breathing: Apply supplemental oxygen to maintain a SPO2 >90%
Monitor continuously for the need of ventilatory support
NIV may be useful.
(Beware of further deterioration of hypotension following positive pressure ventilation)

Circulation: Give IV crystalloid boluses (250-500mL), if there is RV infarction with hypotension **OR** no evidence of pulmonary congestion

IF there is pulmonary congestion **OR** no improvement with fluid boluses, start vasopressors +/- inotropes.

- 1st line- IV noradrenaline (0.1-1 μg/Kg/min, titrate to response) Can be combined with
- IV Dobutamine (10 μg/kg/ min, titrated up to 20 micrograms/ kg/ min)
  - If acute inferior MI with RV infarct consider fluid boluses (1st line therapy) for shock management reassess the fluid responsiveness. If not responding to fluids, consider IV noradrenaline. (2nd line therapy)

In apex hospital assess peripheral circulation: if it is warm start noradrenaline, if it is cold consider dobutamine equal or more than 10 mic/kg/min. At cluster level Always start Noradrenaline before starting Dobutamine.

Antiplatelets: Aspirin 300mg stat dose unless contraindicated.
Second antiplatelet- Clopidogrel 300-600mg stat dose
Irrespective of reperfusion strategy

Definitive treatment: Emergency coronary intervention (Primary PCI or CABG) is the preferred definitive treatment.
In the absence of facilities for coronary intervention thrombolytics should be considered

Distributive Shock

Distributive shock			
	Anaphylaxis	Sepsis	Neurogenic
History	• History of taking a known allergen • Past history of anaphylaxis • Cough/ wheeze/ difficulty of breathing • Abdominal pain	• Features suggestive of infection	• Trauma to cervical or upper thoracic spine • Spinal anaethesia • Toxins • Transvers myelitis • GBS
Examination	• Urticaria • Ronchi on auscultation • Flushed, Warm peripheries • SBP <90 mmhg	• Temperature >38°C or <36°C • Heart rate >90bpm • RR >20 or PaCO2 <32mmHg • SBP- <90mmHg	• Midline spinal tenderness • Autonomic dysfunction • Bradyarrhythmia • Warm extremities • Temp. dysregulation
Investigation/ Adjuncts	• Send blood for serum tryptase levels	• ABG- metabolic acidosis • Lactate ≥2 mmol/l	• NCCT Spine • POCUS- volume status assessment

Neurogenic Shock

- The joint committee of the American Spinal Injury Association and the International Spinal Cord Society proposed the definition of a neurogenic shock to be-

  General autonomic nervous system dysfunction that also includes symptoms such as orthostatic hypotension, autonomic dysreflexia, temperature dysregulation.

  A focal neurologic deficit is not necessary for the diagnosis of neurogenic shock.

- Neurogenic shock remains a diagnosis of exclusion in the traumatic patient

Causes of neurogenic shock

Trauma to cervical spine / upper thoracic spine
(commonest) Guillain Barre syndrome
Transverse myelitis
Spinal anaesthesia

Management

- Airway with C spine protection with a hard collar or manual in line stabilization
  Supplemental oxygen to maintain SPO2 >94%

- Breathing- may need ventilatory support

- Circulation- Fluid resuscitation with IV crystalloid 500ml- 1000ml
  Vasopressors +/- inotropes if blood pressure is not maintained with fluid
  only 1st line- IV Noradrenaline
  For refractory cases- IV Adrenaline

- IV Methyl prednisolone is not recommended

Definitive surgery for decompression may be required