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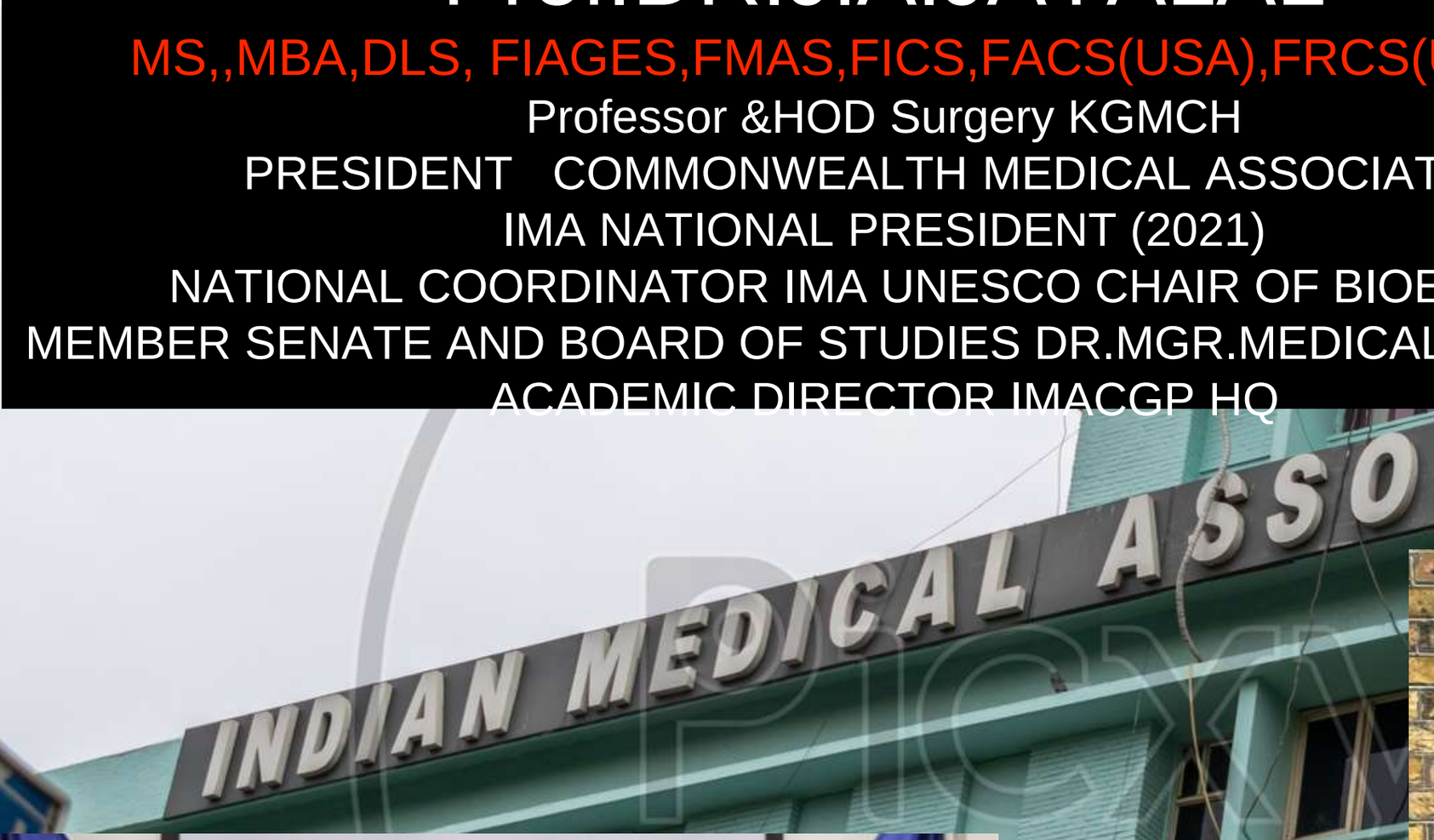
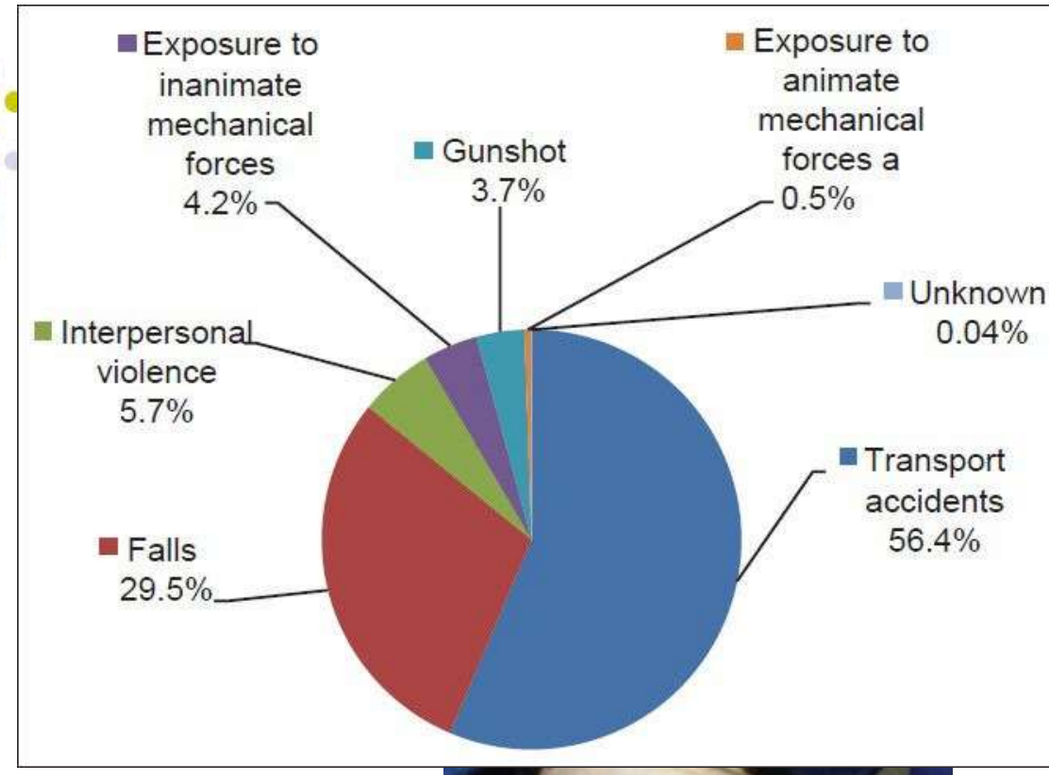


Trauma: Primary Care Management

POLYTRAUMA

- World wide No.1 killer amongst the younger age group (18-44 yrs).
- Third most common cause of death in all age group.
- Great economic & social loss to country.
- Less than 2% of budgets for health services spend on trauma patients.

TRAUMA- Neglected Disease of Modern Society



- Polytrauma is a significant injury in at least two of the following six body regions:
  - Head , neck and cervical spine
  - Face
  - Chest and thoracic spine
  - Abdomen and lumbar spine
  - Limbs and bony pelvis
  - External (skin)

Significant injury in AIS>=3

Etiology of polytrauma

- RTA
- Fall from height (blunt or penetrating injury)
- Assault-اعتداء
- Airplane crashes ,train derailment
- Blast
- Thermal ,chemical injury

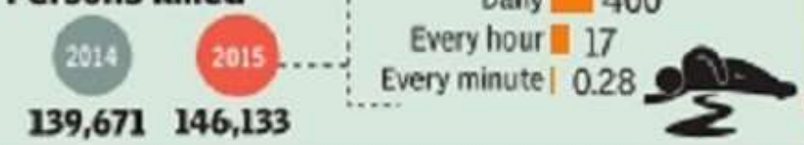
1 ACCIDENT A MINUTE, 1 DEATH IN 4 MINUTES

THE KILLER ROADS OF INDIA

A Every day, nearly 1,400 accidents take place on Indian roads

Total crashes

Persons killed



Persons injured

B Delhi roads recorded the highest no. of deaths in 2015

10 DEADLIEST CITIES	Deaths	Crashes	% of fatal crashes
Delhi	1,622	8,085	20
Chennai	886	7,328	12
Bengaluru	713	8,434	8
Kanpur	665	1,496	44
Mumbai	611	23,486	3
Lucknow	526	1,378	38
Allahabad	479	1,019	47
Jaipur	476	1,894	25
Agra	474	1,143	41
Raipur	448	2,189	20

Has the deadliest roads

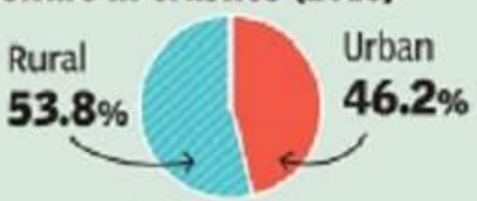
Most crashes but least fatality ratio

C Over half of Uttar Pradesh accidents are fatal

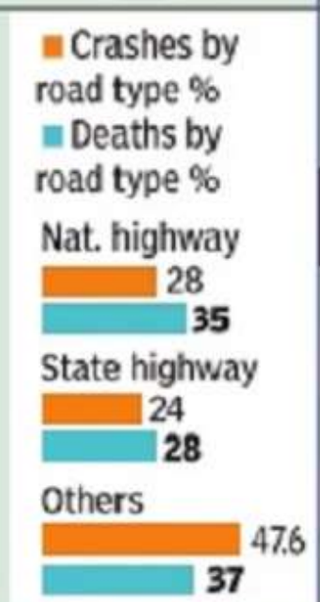
5 DEADLIEST STATES	Deaths	Crashes	% of fatal crashes
UP	17,666	32,385	55
Tamil Nadu	15,642	69,059	23
Maharashtra	13,212	63,805	21
Karnataka	10,856	44,011	25
Rajasthan	10,510	24,072	4

D Rural India is no less dangerous

Share in crashes (2015)



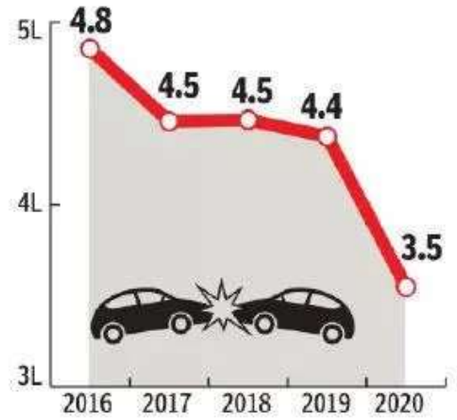
Share in deaths (2015)



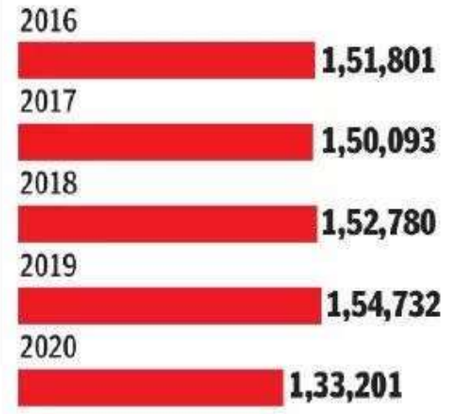
Source: Transport Research Wing, MoRTH; Text: **Dipak Dash** 2015 da

37 DEATHS PER 100 CRASHES

No. of accidents (in lakh)



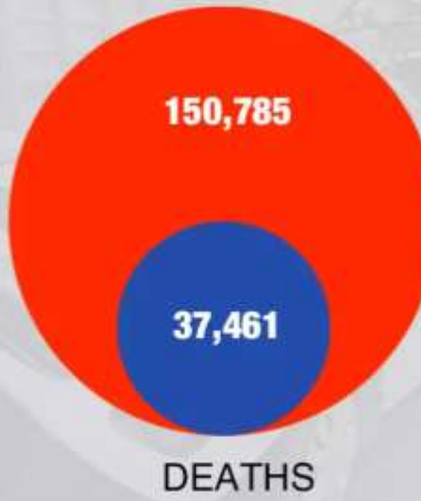
No. of deaths



Deaths per 100 accidents (approx)

Source: National Crime Records Bureau

THIS IS WHAT MAKES INDIAN ROADS DEADLIEST



Abbreviated injury score AIS >=3
injury severity score ISS >=16

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver Complex Rupture Spleen	2 5	25
Extremity	Fractured femur	3	
External	No Injury	0	
		Injury Severity Score:	50

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Survivable

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HEADLINES OF THE DAY

Assam Cabinet approves Rs 115 crore for emergency ambulance service

November 28, 2024

The Assam Cabinet has approved a significant allocation of Rs 115 crore for the 108 Mrityunjoy Emergency Ambulance Service, a vital part of the state's healthcare system. This allocation aims to enhance the operational capabilities of the service and improve its reach, ensuring that emergency medical assistance is available across the state, especially in rural and remote areas. The move reflects the state gov Screenshot ommitment to

Boat Ambulance

With a view to transporting patients from riverine and char areas to better health care facilities, boat ambulances service has been provided by the Government of Assam and it is an integral part of 108 Emergency Response Service. This service at present is provided by 5 boat ambulances in Assam. The Mrityunjoy boat ambulances are located in

- North Guwahati: 1 boat
- Majuli: 2 boats
- Bogibeel (Dibrugarh): 1 boat
- Dhubri Sukchor ghat: 1 boat

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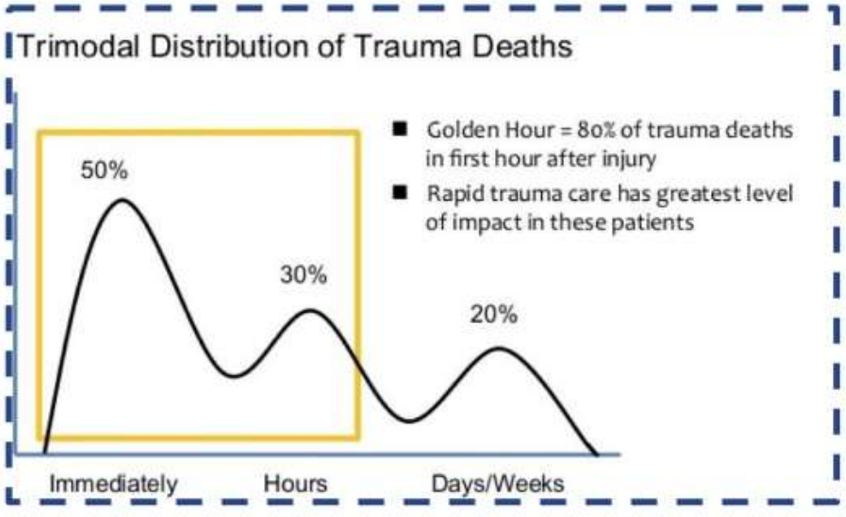
❖ Trimodal Death Distribution:

1st peak **Immediate death** (0 to 1 hour)	2nd peak **Early death** (1 to 3 hours)	3rd peak **Late death** (1 to 6 weeks)
• Accounts for **50%** of deaths. • Occurs **within minutes** of injury. • Due to **major neurological or vascular injury** (unsurvivable injuries). • Medical treatment can rarely improve outcome **(die on scene)**	• Accounts for **30%** of deaths. • **Occurs during the golden hour**[1]. • Due to **intracranial haematoma, major thoracic or abdominal injury.** • Primary focus of intervention for the **ATLS** methodology.	• Accounts for **20%** of deaths. • Occurs after **days** or **weeks.** • Due to complications (**sepsis and multiple organ failure**).



First 1 to 2 hours is the golden hours

- Why is it called "the golden hour"? Hence death in this peak is mostly due to hypoxia and loss of blood (hypovolemic shock) which is **potentially preventable**. (80% of deaths happen here.)

1st peak causes immediate death in minutes due to vascular damage like Aortic rupture.
2nd peak happens within 1-3 hrs after the trauma and this is where if ATLS is performed right would save a life.
3rd peak happens in days and is due to infections and sepsis

1. Here's the thing, patients who die in the first peak often die from severe traumas, (like decapitation for example) which means most of the time you cannot save those patients. However, patients who die in the second or third peaks CAN be saved you manage them correctly IN THE GOLDEN HOUR. It's called the golden hour cause it gives you a chance to save the patient.

First peak of death/Immediate trauma de

- Severe head injury
- Brain stem injury
- High cord injury
- Heart and major vessel injury
- Massive blood loss

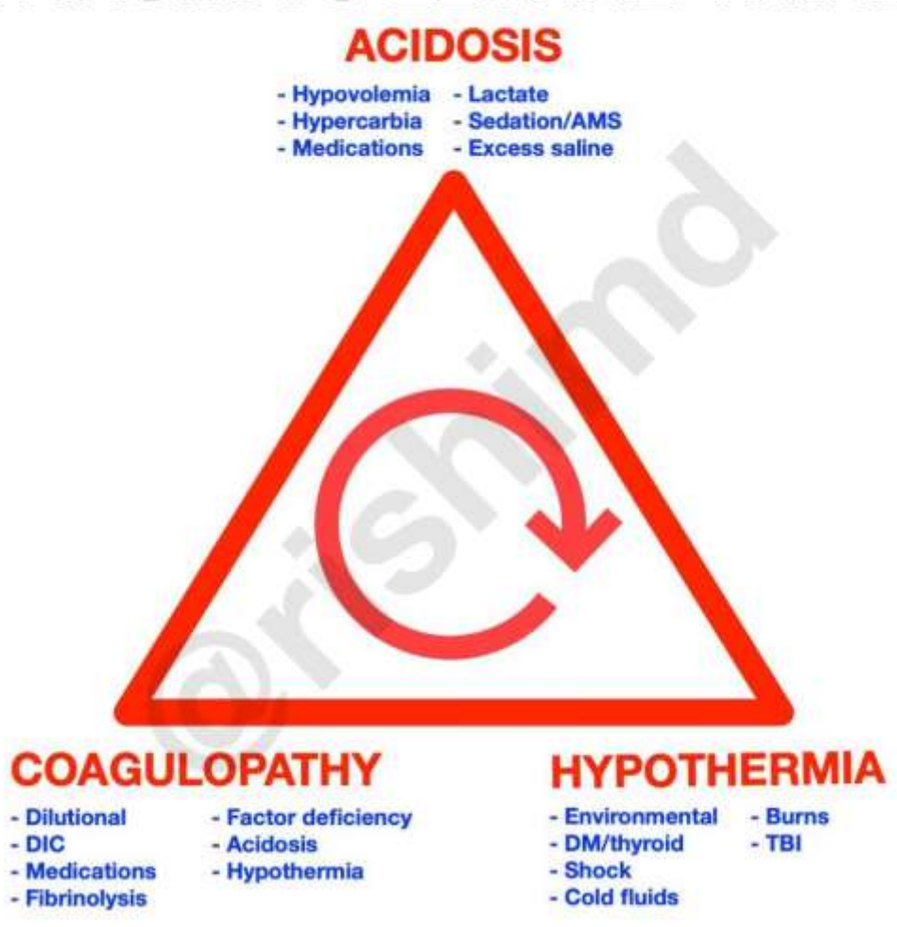
Second peak of death / Early trauma death

- Intracranial bleed
- Chest injury
- Abdominal bleeding
- Pelvic bleeding
- Multiple limb injury

Third peak of death / Late death

- It occurs after several days or weeks due to
  - Sepsis
  - Organ failure

TRAUMA'S LETHAL TRIAD



The Golden Hour

- "There is a golden hour between life and death. If you are critically injured you have less than 60 minutes to survive. You might not die right then; it may be three days or two weeks later -- but something has happened in your body that is irreparable."

- R Adams Cowley

PLATINUM 10 MINUTES : ONLY 10 MINUTES MAY BE USED FOR ACTIVITIESONSITE

AIMS IN MANAGEMENT

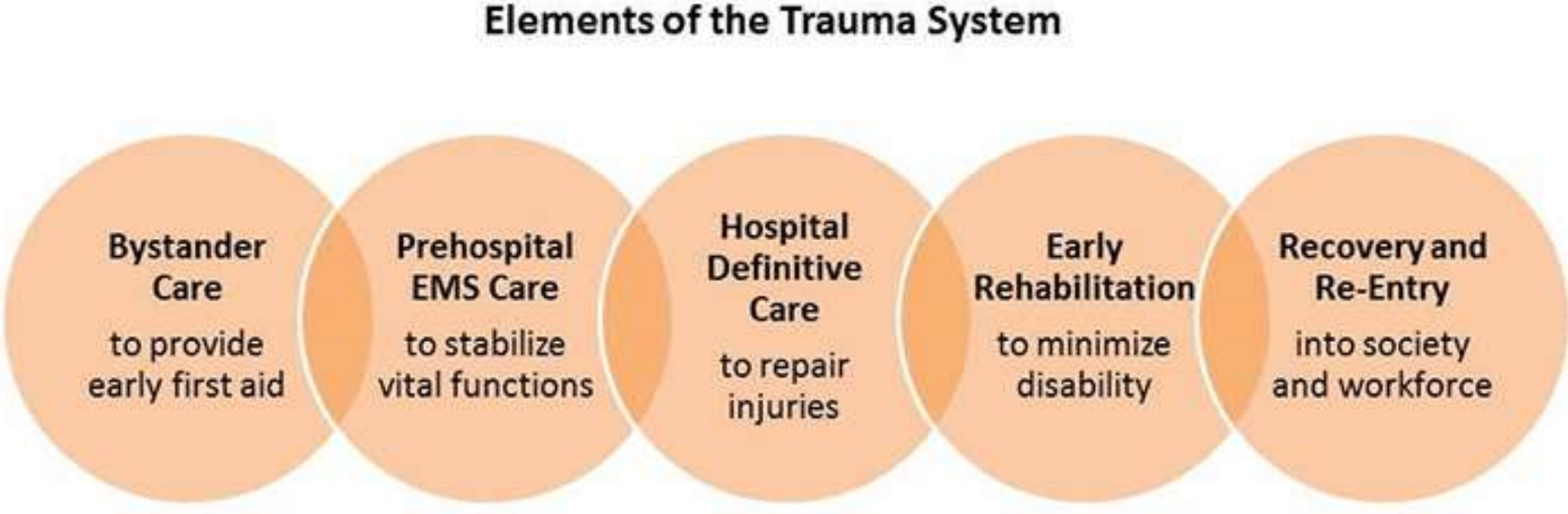
"TO RESTORE THE PATIENT BACK TO HIS PREINJURY STATUS"

HAVING FOLLOWING PRIORTIES:

- ***LIFE SALVAGE***
- ***LIMB SALVAGE***
- ***SALVAGE OF TOTAL FUNCTION IF POSSIBLE***

TRAUMA CARE SYSTEM

A trauma system is a holistic approach that encompasses the prevention, access to care, prehospital care, hospital care which includes trauma centers of different categories, rehabilitation, education, and disaster care



Source: Adapted from National Academies of Science, Engineering and Medicine (NASEM). "A National Trauma Care System: Integrating Military and Civilian Trauma Systems to Achieve Zero Preventable Deaths," 2016. http://www.nationalacademies.org/hmd/Reports/2016/A-National-Trauma-Care-System-Integrating-Military-and-Civilian-Trauma-Systems.aspx

Prehospital Management:

- **The goal of prehospital management:**
  - Gain access to the patient.
  - Smooth transfer.
- **Approaches:** a balance between these two approaches is better.
  1. "Scoop & Run policy" (Take patient to the hospital ASAP, you can give him oxygen mask but we don't do any major intervention here until patient reaches the hospital).
  2. ''Stay & Play policy" (Needs expert EMS to do this, full management on scene like intubation etc….).

Pre-Hospital Phase:

->deals by Paramedics + in ambulance management

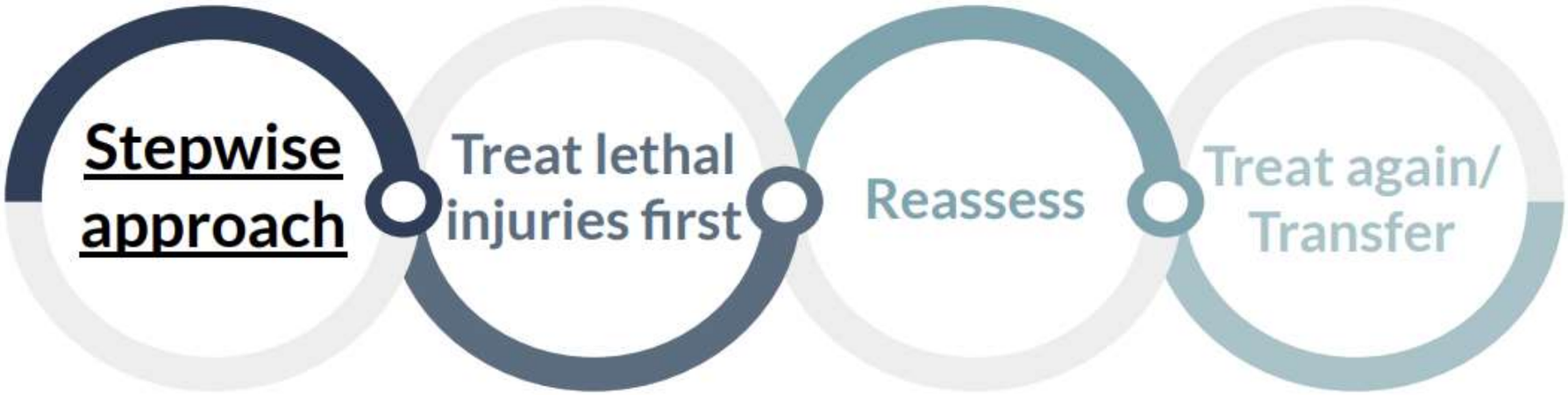
->Main role is to inform the hospital (which has stroke unit) about the status and number of causalities.

->IV cannulation and start of IV fluids

->C-spine stabilization

->Pneumatic anti-shock garments to deal with Hypovolemic shock

❖ ATLS Algorithm - Assessment Approach to Trauma Patient in Hospital Settings



1 Primary survey & resuscitation (ABCDE):

1. **A**irway and securing cervical spine
2. **B**reathing
3. **C**irculation and haemorrhage control
4. **D**ysfunction of the central nervous system
5. **E**xposure.

Adjunct to primary survey (Only imaging permitted during this phase is):

- **X-ray:** AP supine chest, AP plain pelvic, Cross table lateral C- spine X-ray (outdated).
- **Ultrasound:** FAST has replaced peritoneal lavage for detecting intraperitoneal fluid of blood.

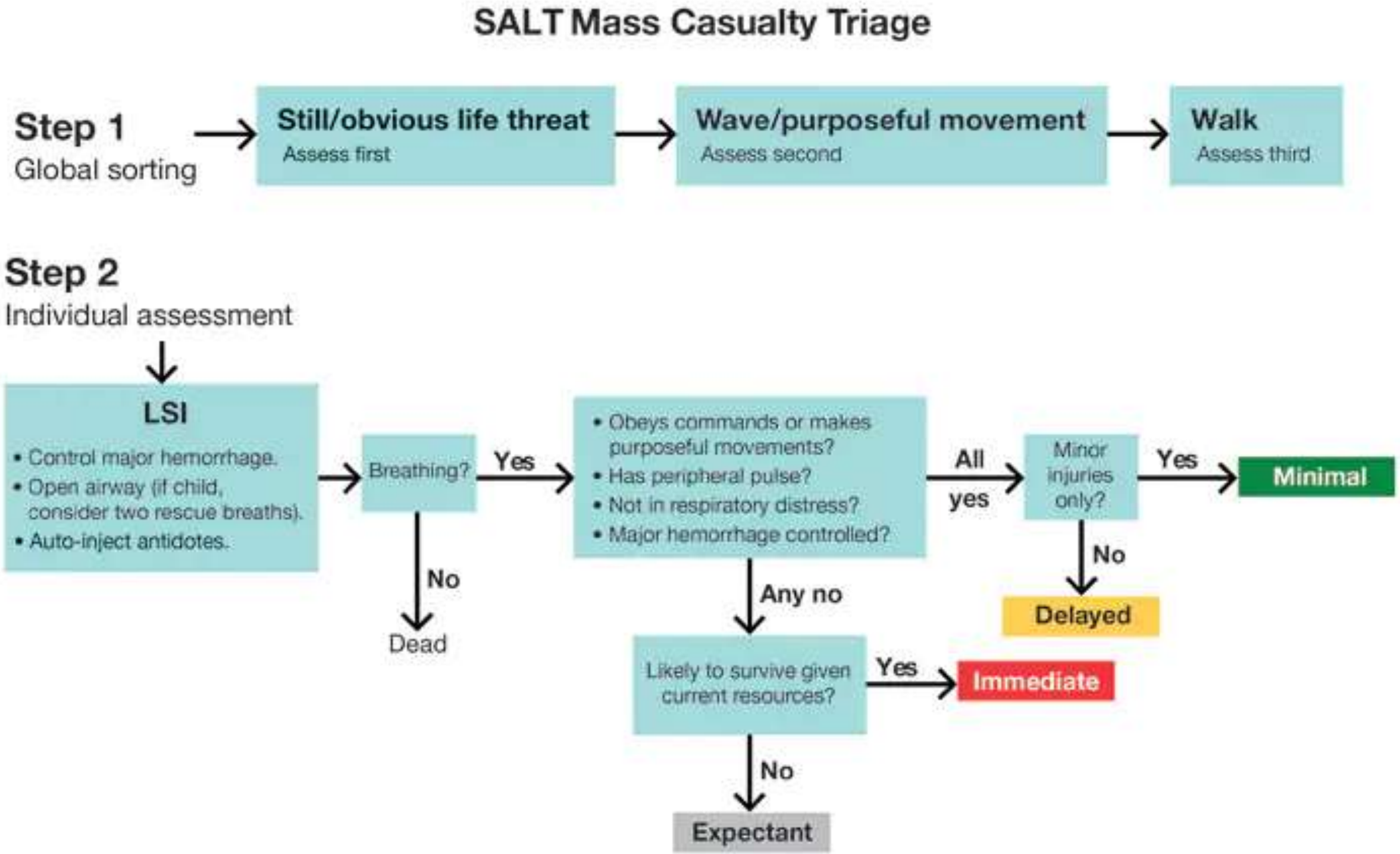
2 Secondary survey
(Full physical examination to identify any missed injuries)

3 Definitive treatment
(In most cases surgical management)

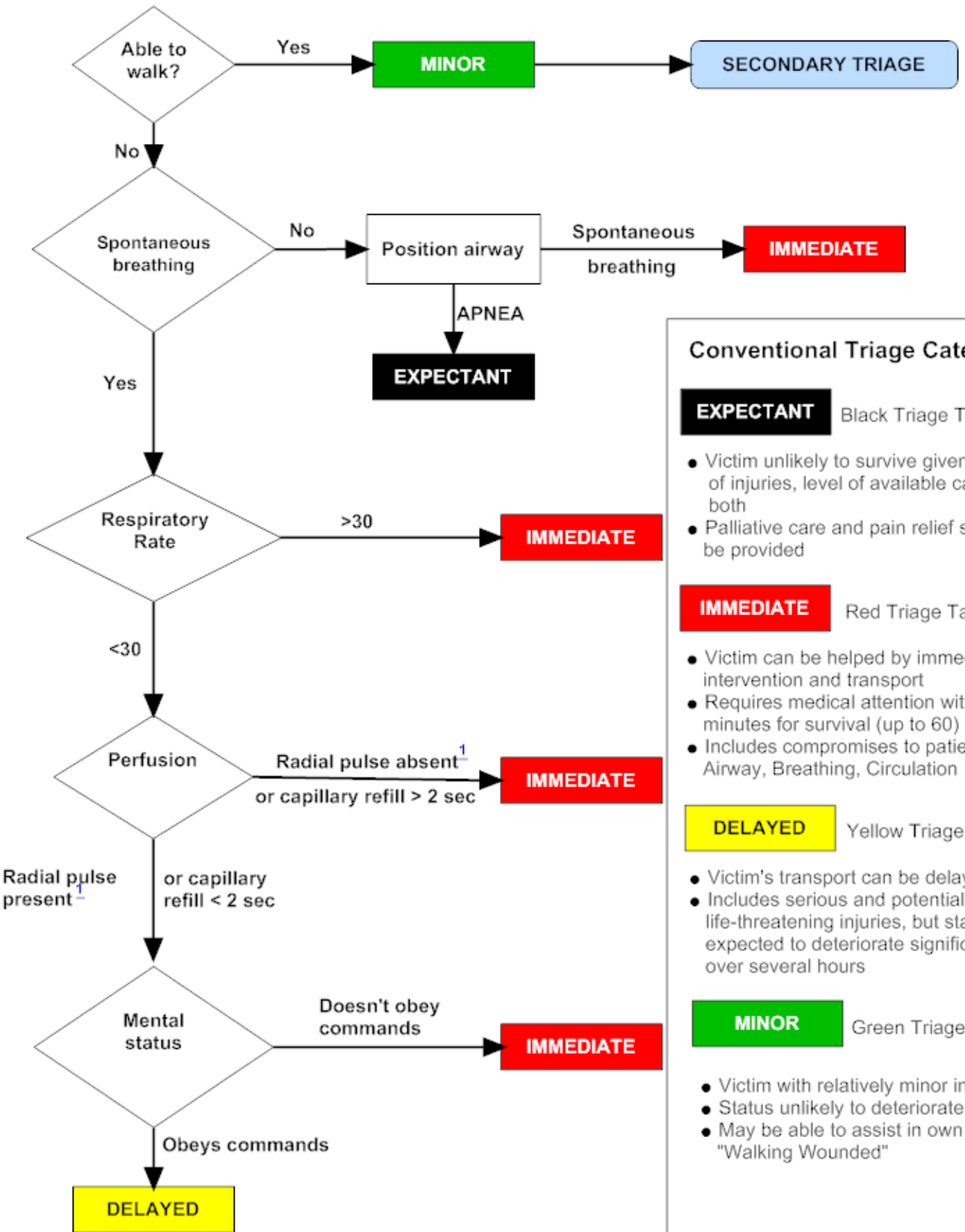
4 Tertiary survey
(Another full examination just to be safe)

5 Consider Early Transfer

SSESS,LIFESAVING INTERVENTION,TREATMENT/TRANSPO



SIMPLE TRIAGE AND RAPID TREATMENT -START



Conventional Triage Categories

EXPECTANT Black Triage Tag Color

- Victim unlikely to survive given severity of injuries, level of available care, or both
- Palliative care and pain relief should be provided

IMMEDIATE Red Triage Tag Color

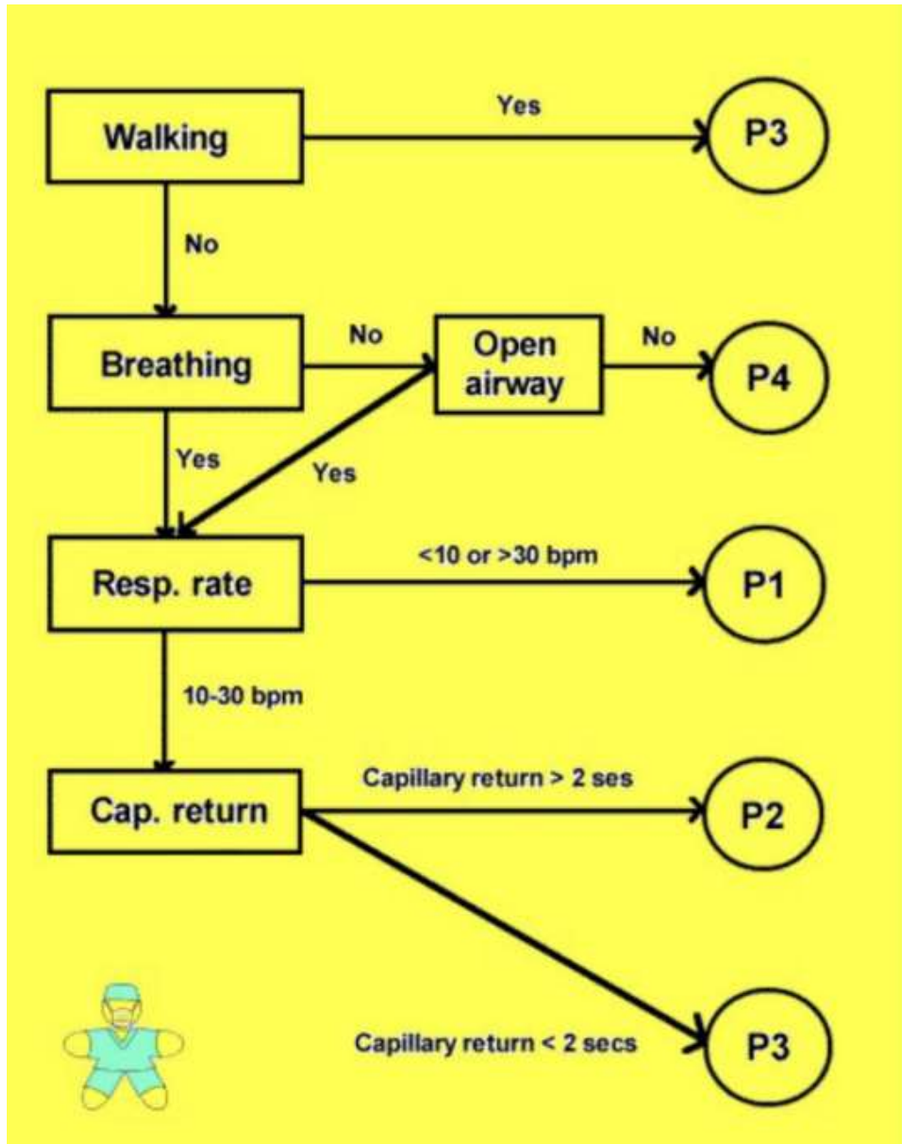
- Victim can be helped by immediate intervention and transport
- Requires medical attention within minutes for survival (up to 60)
- Includes compromises to patient's Airway, Breathing, Circulation

DELAYED Yellow Triage Tag Color

- Victim's transport can be delayed
- Includes serious and potentially life-threatening injuries, but status not expected to deteriorate significantly over several hours

MINOR Green Triage Tag Color

- Victim with relatively minor injuries
- Status unlikely to deteriorate over days
- May be able to assist in own care: "Walking Wounded"



PRIMARY SURVEY - cABCDE

Recognise	Assess for	Manage
C – Catastrophic bleeding	• Life-threatening haemorrhage	• Apply direct pressure/compression bandage/tourniquet
A – Airway compromise	• Patency/ position	• Airway protection with adjuncts/jaw thrust to open with cervical spinal protection
B – Breathing difficulty	• Poor respiratory effort • Pneumothorax	• Administer oxygen supplementation • Chest decompression (chest tube)
C – Circulation (haemorrhagic shock)	• Cool skin • Tachycardia • Bleeding sites	• Apply pelvic binder/compression bandage • Administer tranexamic acid • Give blood transfusion if available
D – Disability (head injury)	• Reduced consciousness	• Protect airway • Transfer as soon as possible
E – Exposure (everything else)	• Hypoglycaemia • Hypothermia	• Maintain normothermia

Source: Mercer (2018)

Emergency resucitation procedures that should be done immediately with the primary survey

- If inadequate circulation or suspected major blood loss:
  - Start at least one large bore iv (16-14 gauge)
  - Run lactated Ringer or normal saline
    - Run very slow if only isolated closed head injury
    - Run wide open (very fast) if patient hypotensive
    - Rapidly infuse 0-negative bloode 2 or more units if obvious ongoing blood loss and severely hypotensive

- With the I.v. stick,draw tubes of blood:
- -Type and cross-most important
- -CBC,amylase,glucose,electrolytes,BUN, platelet count, PT, PTT,creatinine,CPK, medication levels,pregnancy test
- -drug(especially alcohol)or toxin levels may also be needed

ADJUNCT TO PRIMARY SURVEY & RESUSCITATION

A. Electro-cardiographic Monitoring

B. Urinary & Gastric Catheter

C. X-Ray & Diagnostic Studies

C-spine lateral , CXR, Pelvic film (*TRAUMA SERIES*)

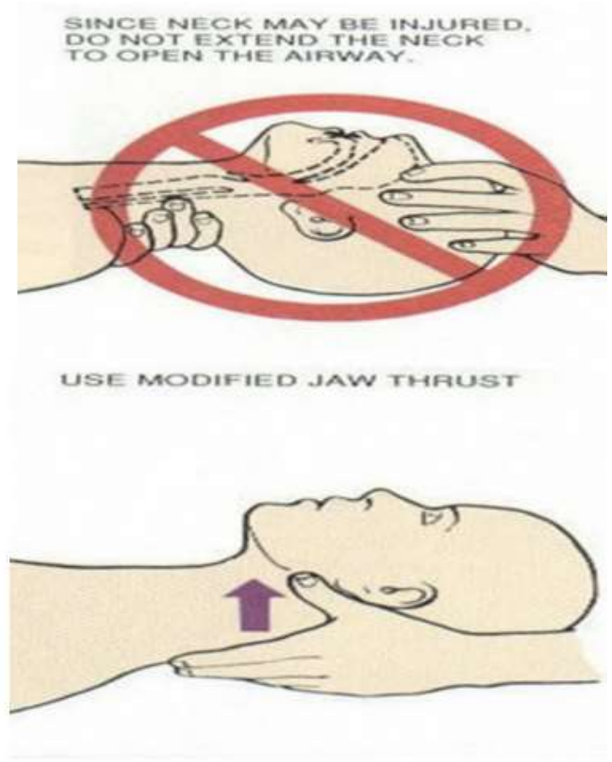
Essential x-ray should NOT be avoid in pregnant pt.

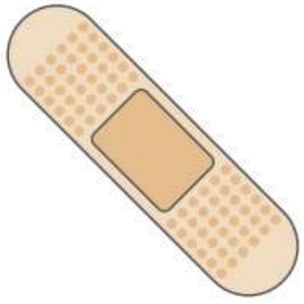
e-FAST SCAN

(Extended Focused Assessment with Sonography for Trauma)

A. Airway:

- **Always assume that patient has cervical spine injury**
- **If patient can talk** then he is able to maintain own airway
- If airway compromised initially attempt a jaw thrust and clear airway of foreign bodies, suction, adjuncts to open airways.
  - Remember to avoid causing harm eg NP tube, nasopharyngeal airway in base skull fracture
- **Give 100% Oxygen** (face mask, bag valve)
- Assist airway & breathing including "definitive airways" (endotracheal tube/cricothyroidotomy)





- A – Airway maintenance & Control of C-Spine (By Applying cervical collar).
- If conscious - Ask the pt's name
- If unconscious - **Look for added sounds** (stridor,cyanosis etc)
- If the pt does not respond to any questions- resuscitate.

Airway maintenance steps:

AIRWAY WITH CERVICAL SPINE IMMOBILIZATION

The first step in managing potentially life threatening airway compromise is to identify that there is airway compromise

(A) At risk airways

Obstructed Airway:

Look for objective signs of airway obstruction and manage accordingly

Look for	Listen for	Feel for
Patient is agitated	Noisy breathing	Location of the trachea In midline Shifted to right Shifted to left
Retractions of Intercostal Muscles	Snoring/gurgling	
Use of Accessory Muscles	Stridor	
Cyanosis	Hoarseness	

EMERGENCY SURGICAL AIRWAY

- If cannot intubate or Ventilate in time
- Cricothyroidotomy
- Primary Sx Airway
- Needle
- Surgical

Cricothyrodotomy Set

Procedure

- Do not apply traction to cervical spine
- Only stabilization to minimize movement
- Place a cervical collar, if available

B. Breathing and ventilation:

Assessment

- Exposure
- Inspection:
- Palpation
- Movement
- Auscultation

❖ **The aim is to hunt out & treat the life threatening thoracic conditions which include :**

Life threatening conditions that requires rapid intervention

Massive Pneumothorax/ Hemothorax

Flail segment

Tension Pneumothorax

Open Pneumothorax

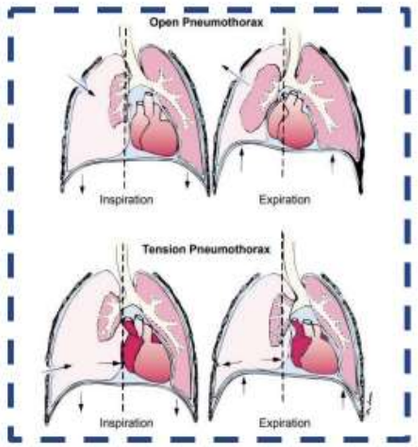
Cardiac Tamponade

Breathing Problem in Chest Injury

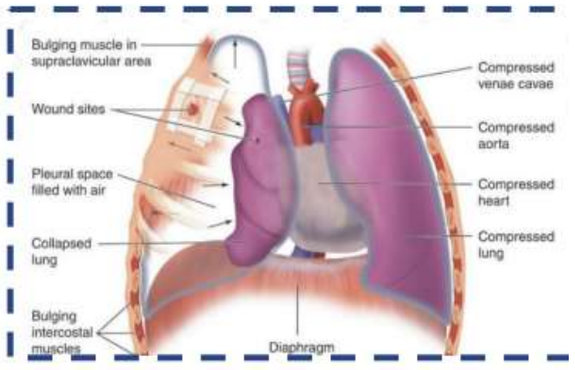
Respiratory distress, Tachypnea, Low O2 sat.

- Change in Voice
  - LTB Injury
- Absent Breath Sounds
  - Hyper-resonant
    - Tension Pneumo-Thorax
  - Dull percussion
    - Massive Haemo-thorax
- Chest Wall Defect – Sucking Wound
  - Open Pneumo-thorax
- Paradoxical Movements
  - Flail Chest with Contusion
- Muffled Hr. Sounds
  - Cardiac Temponade

1 Pneumothorax



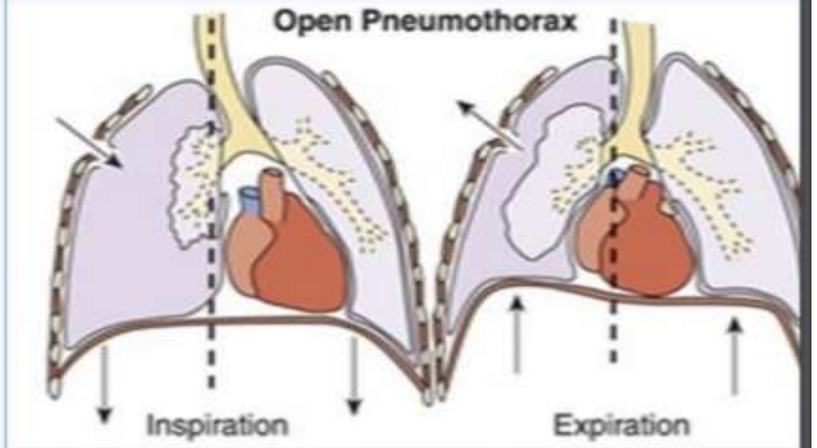
- **Tension Pneumothorax:**
  - Presence of air or gas in the pleural cavity.
  - Can impair oxygenation and/or ventilation.
  - Clinical results are dependent on the degree of collapse in the lung.
  - Pneumothorax is called tension if it was severe enough to shift the mediastinum & compromise hemodynamic stability.
  - Air can enter the intrapleural space through a communication from the chest wall (ie, trauma) or through the lung parenchyma across the visceral pleura.
  - **Clinical Features:**
    - Diminished breath sound (with hyperresonance)
    - Distended neck veins.
    - Hypotension.
    - Tracheal deviation.
    - Respiratory distress.

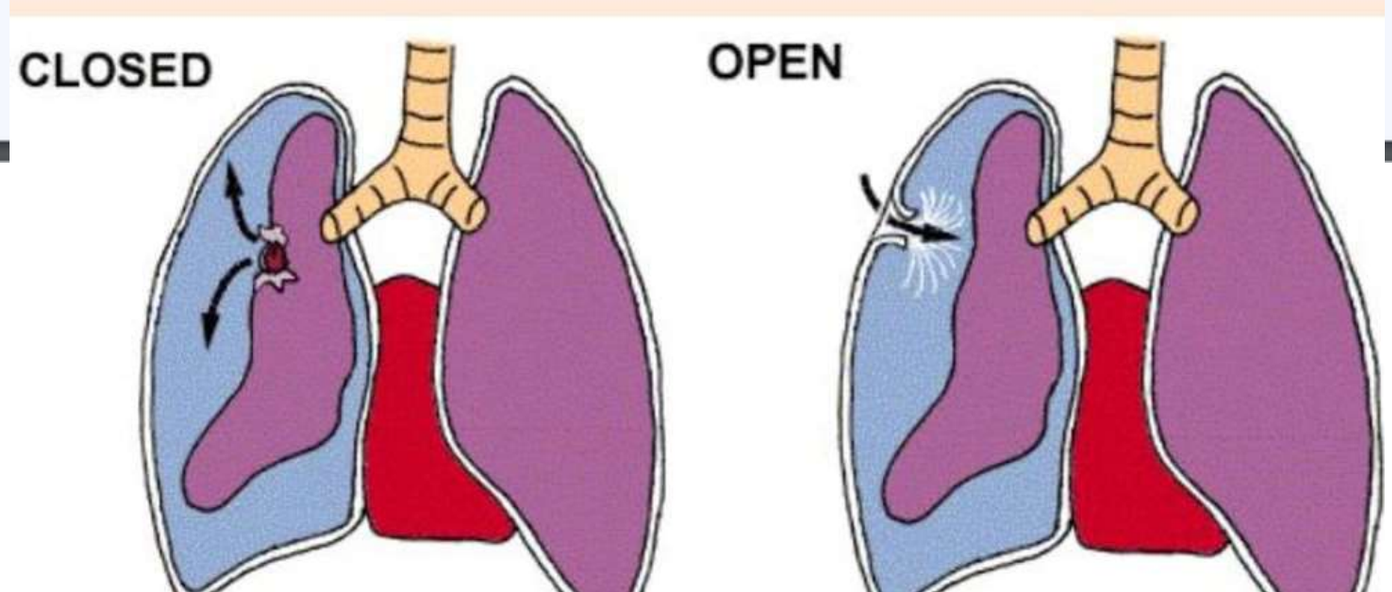


  - **Management:**
    - **Needle decompression:** Immediate needle thoracocentesis in 2nd intercostal space in mid clavicular line, followed by chest tube (definitive) in 5th intercostal space anterior axillary line.
    - Supportive management:
      - analgesia, ventilators support, CXR monitoring, Chest physiotherapy.
- **Open Pneumothorax:**
  - Treated by sealing the wound with occlusive dressing and tube thoracostomy.
- **Suction Pneumothorax:**
  - Sealing of the wound (3 sided occlusive dressing to create one way valve) and Tube thoracostomy

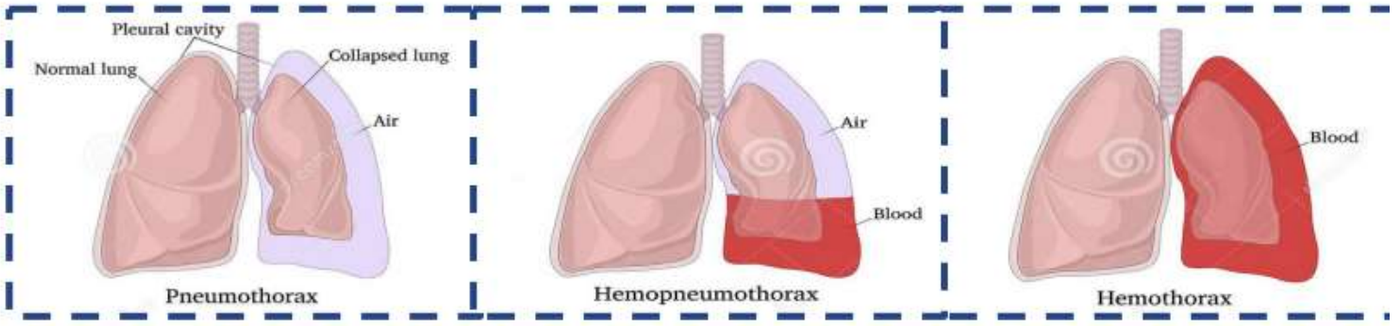
OPEN PNEUMOTHORAX

- Open defect in chest wall
- Decreased ventilation if air preferentially enters through defect, rather then via trachea
- **Clinical signs**: Air bubbles through the defect in the chest
- **Treatment**:
  - Seal chest wound with occlusive dressing
  - Tube thoracostomy – (ICD)

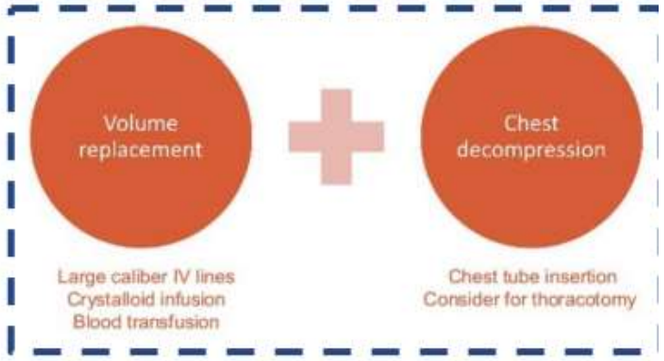




2 Massive Pneumothorax/ Hemothorax



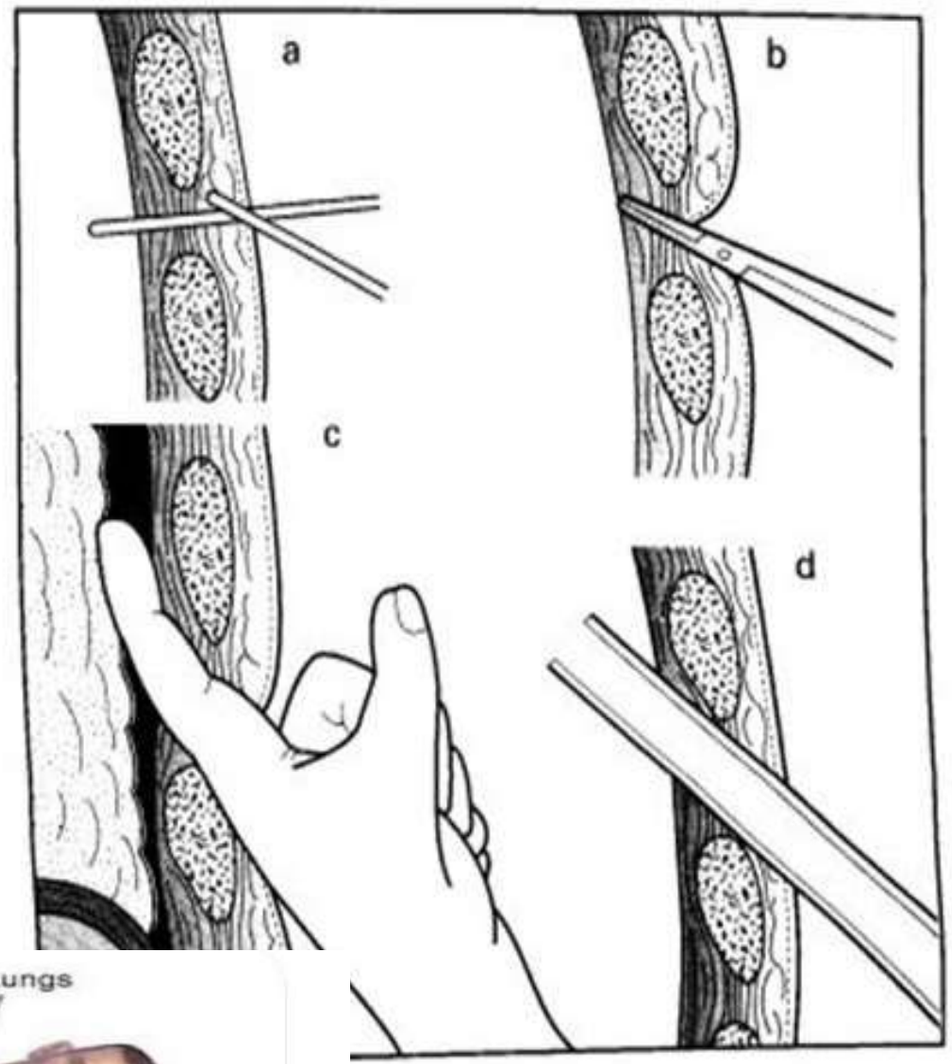
- Massive hemothorax is defined by the need for thoracotomy in OR the indications are:
  - Blood loss > 1,500 mL or 1/3rd of blood volume or
  - Blood loss >200 mL/h (3 mL/kg/h) for 2-4 hours.
- Recognition:
  - Hemorrhagic shock:
    - pallor, tachycardia, hypotension, cool peripheries pleural space.
  - Decreased chest movement, dullness and decreased breath sounds ipsilaterally.
  - External evidence of thoracic injury.
  - Persistent blood loss following intercostal cath.
- Management:
  - 2 large bore IVs with crystalloid infusion and blood transfusion + Chest decompression with chest tube insertion

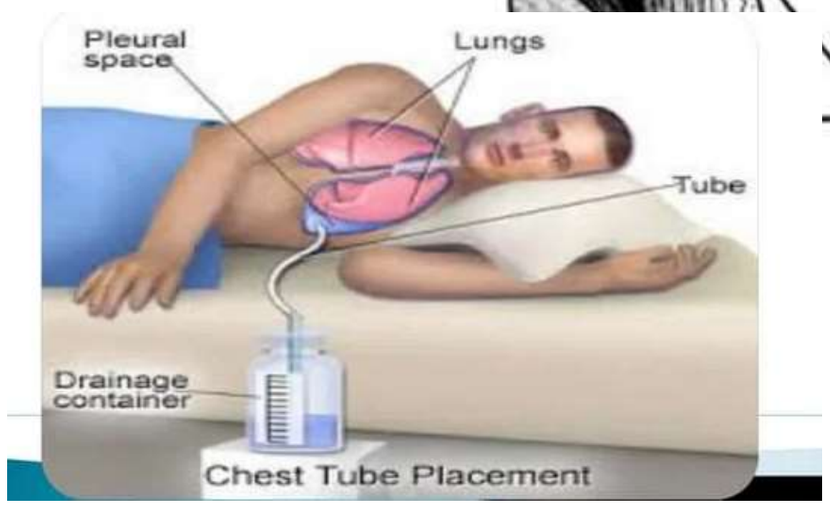


RESCUE MEASURES TO MAINTAIN ADEQUATE AIRWAY AND BRE

A and B

- **Intercostal drain**
- 4th or 5th intercostal space, mid-axillary line
- local anaesthetic down to pleura
- 'above the rib below'
- blunt dissection. finger exploration
- pass large drain on forceps superior & posterior.
- underwater drain
- pursestring suture



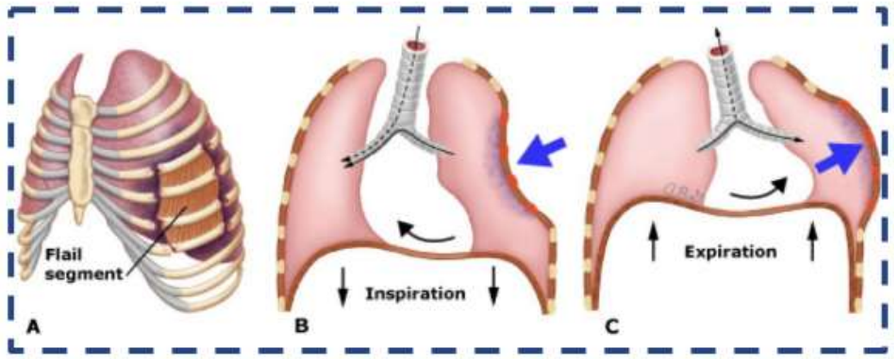


3 Cardiac tamponade

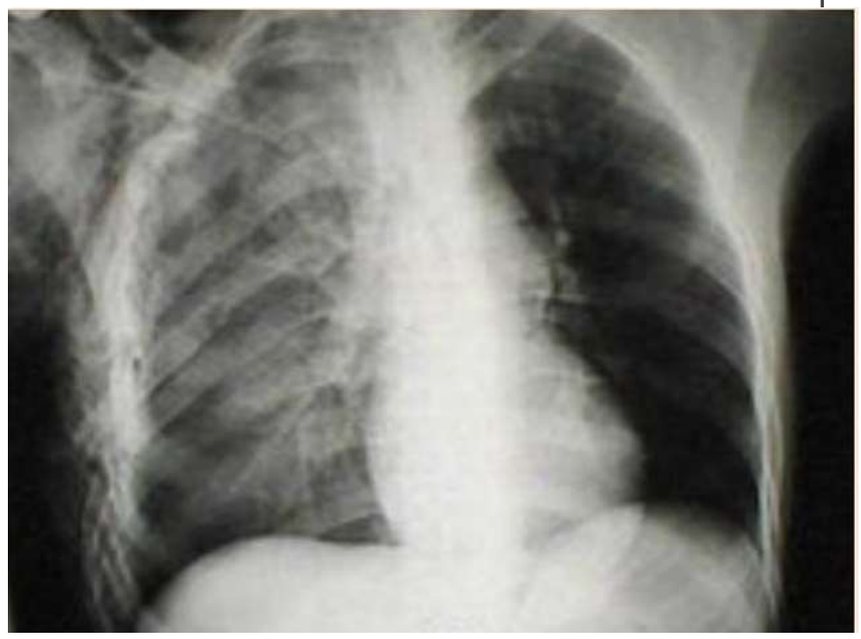
- Almost always seen with a penetrating wound
- **Clinical Signs and Symptoms:**
  - **Beck's triad :**
    - Hypotension tamponade.
    - Distended neck veins.
    - Muffled heart sounds
- **Management:**
  - Needle pericardiocentesis then thoracotomy & repair as definitive management.

4 Flail segment

- Fractures of 3 or more consecutive ribs in 2 or more locations.
- Paradoxical movement:
- **Recognition:**
  - Chest pain
  - Respiratory distress
  - Bony crepitus
  - Paradoxical chest wall movement
    - the segment moves inwards on inspiration as the rest of the chest expands and outwards on expiration as the rest of the chest deflates.



- **Management**
  - Requires an endotracheal intubation and mechanical ventilation[1]
  - Supportive care, O2
  - Stabilization of the segment with manual or object pressure
  - Postpositive pressure ventilation



Crucial 1° Survey Differential Dx: Cardiac Tamponade vs. Tension Pneumothorax

Clinical Sign	Cardiac Tamponade	Tension Pneumothorax
Blood Pressure	Low (PEA)	Low
Cardiac Tones	Muffled	Normal
✓ **Breath Sounds**	Normal	Absent - collapsed side
✓ **Neck Veins**	Distended (flat in hypovolemia)	Flat
✓ **Respirations**	± Normal	Tachypnea
Treatment	Needle/drain pericardium	Needle/tube chest

Sumber:.Management of Chest Trauma , J Thorac Dis 2017;9(Suppl 3):S172-S177

C. Circulation and haemorrhage control:

Assessment

- Pulse rate
- Capillary refill
- ECG monitor
- State of neck veins
- LOOK FOR BLEEDING and apply direct pressure
- Place two large calibre intravenous cannulas Give intrave fluids (crystalloid or colloid)

Assessment of Blood loss

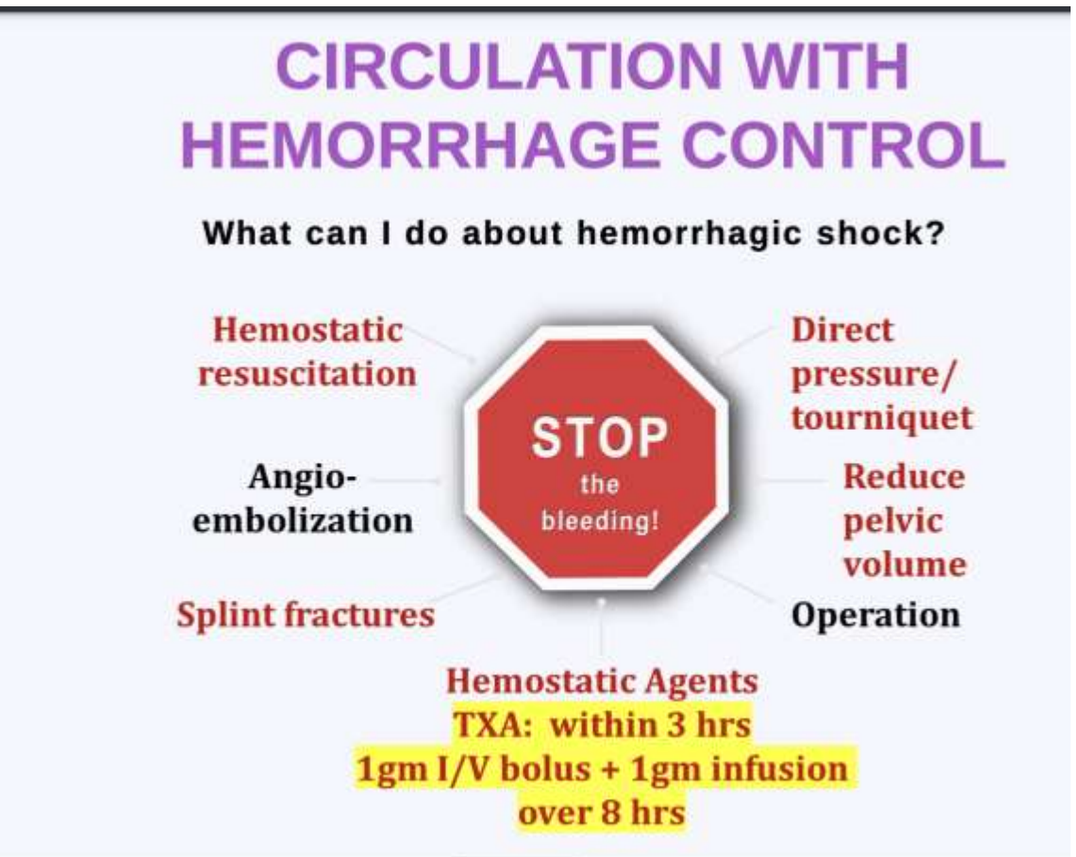
There are 6 keys area to look for evidence of bleeding:

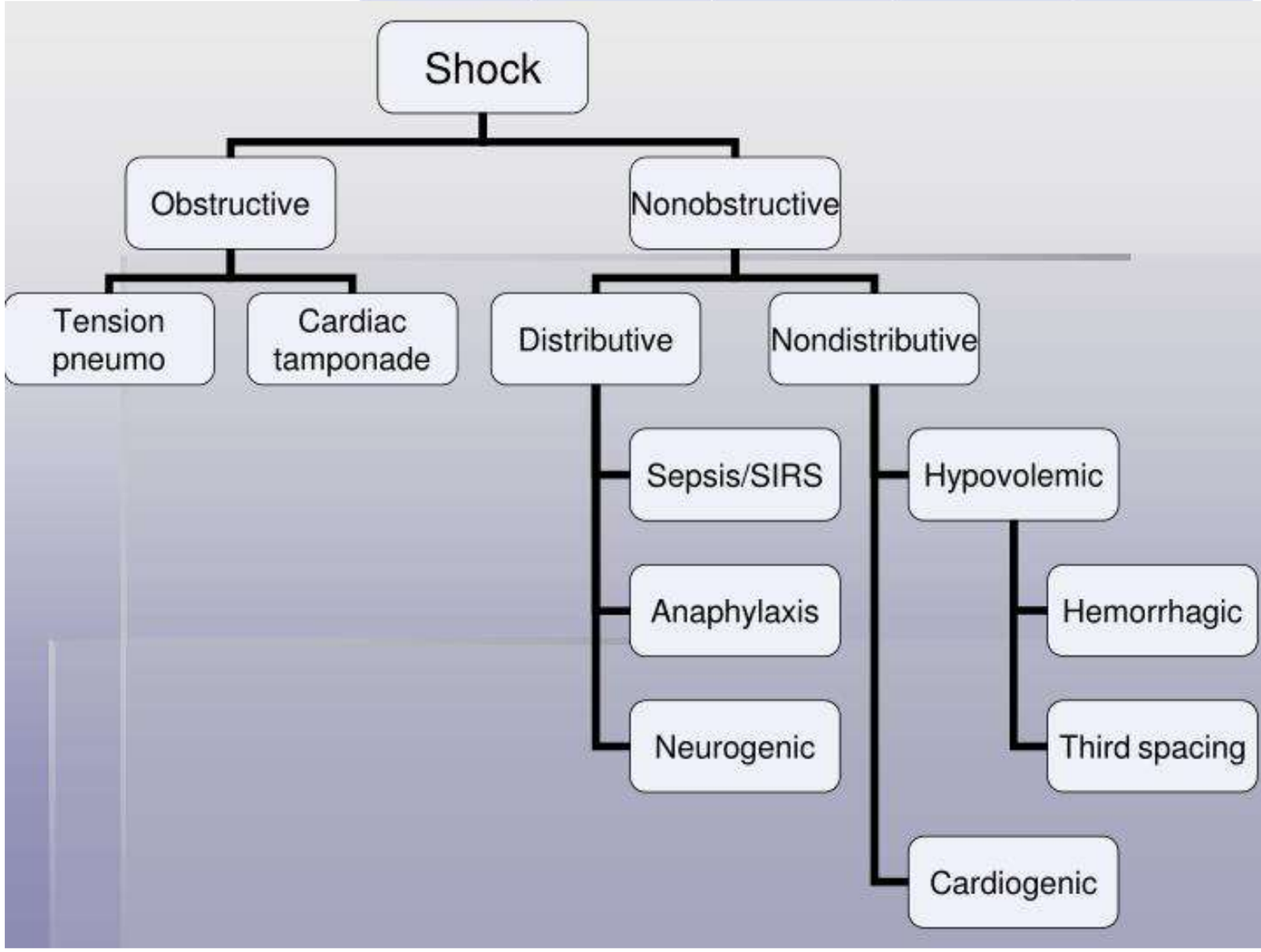
- External or obvious
- Internal or covert
- Chest
- Abdomen
- Pelvis
- Limbs

- **Resuscitation :**
  - Arrest bleeding
  - Obtain vascular access

Classes of hemorrhagic shock

	Class I	Class II	Class III	Class IV
Blood loss (ml)	Up to 750	750- 1500	1500- 2000	> 2000
Pulse	<100	>100	>120	>140
BP	Normal	Normal	Decreased	Decreased





❖ Tachycardia in a cold patient indicates SHOCK

Types Of Shock Following Injury :

Hypovolemic (Resuscitate) | Obstructive (Relieve obstruction) | Cardiogenic (Resus + inotropes) | Neurogenic (Resus + vasopressors) | Septic

Adults

Consider up to 2 litres of fluids if patient is hypotensive , cardiac arrest (until blood available)

Children

20 ml/kg of body weight

Response to initial fluid challenge :

- Immediate & sustained return of vital signs
- Transient response with later deterioration
- No improvement

Immediate Responders

- <20% blood loss
- Bleeding ceases spontaneously

Transient Responders

- Bleeding within body cavities
- Surgical intervention required

Non Responders

- >40% of blood loss
- Require immediate surgery
- Maybe not enough fluids

- Continued IV fluids in detrimental

PERMISSIVE HYPOTENSION

- **In the adult trauma patient, the goal is to prevent/reverse shock, NOT to achieve a normal blood pressure**
- Target BP: SBP 90 or greater (intact radial pulse)
- Problems with excess fluid:
  - Increases bleeding and mortality
  - Dilution of clotting factors
  - Hypothermia and coagulopathy
  - “Pops the clot”

- **Exceptions:**
  - **If head injury is present: target BP is SBP 110 – 120**
  - **Pediatric patients: target BP is normal BP for age**

PEDIATRIC TRAUMA PATIENT IV FLUID PROTOCOL

- Age 14 and less
- **Goal: normal blood pressure for age**
- Must prevent shock in children
- IV fluid: 20 cc/kg bolus
- Colloid: 10 cc/kg
- Reassess
- Repeat boluses until SBP is normal for age
- Administer blood (10 cc/kg) when available

Normal Pediatric Systolic BP =

(2 x age) + 70

Simple Estimates:

Newborn	60 mmHg
< 1 year	70 mmHg
1 – 10 years	80 mmHg
> 10 years	90 mmHg

PRIMARY SURVEY: ABCDE
D: Disability (Neurologic Status)

- Determine basic neurologic status
- Recheck level of consciousness – AVPU
- Calculate GCS
- Pupillary exam: equal/reactive?
- Gross motor exam
  - Does he move all 4 extremities?

Score	Eye Opening	Best Verbal Response	Best Motor Response
6			Obeys Commands
5		Oriented	Localizes Pain
4	Spontaneous	Confused	Flexed to Pain
3	To Speech	Inappropriate Words	Flexion of arms with ext of legs(decorticate)
2	To Pain	Incomprehensible sounds	Extension
1	None	No Verbalization	None

D: DISABILITY
(NEUROLOGICAL EVALUATION)

50% of trauma death are due to head injuries

Simple Mnemonic to describe level of consciousness

A : Alert

V : Responds to Vocal stimuli

P : Responds to Painful stimuli

U : Unresponsive to all stimuli

Not forget to use also Glasgow Coma Scale.

E. EXPOSURE / ENVIRONMENTAL CONTROL

- Patient should be undressed to facilitate thorough examination.
- Warm environment (room temp) should be maintained
- Intravenous fluid should be warm.
- Early control of hemorrhage.

SECONDARY SURVEY

- Does not begin until the primary survey (ABCDEs) is completed, resuscitative effort are well established & the pt is demonstrating normalization of vital sign.

- Head to Toe evaluation & reassessment of all vital signs.

- A complete neurological exam is performed including a GCS score.

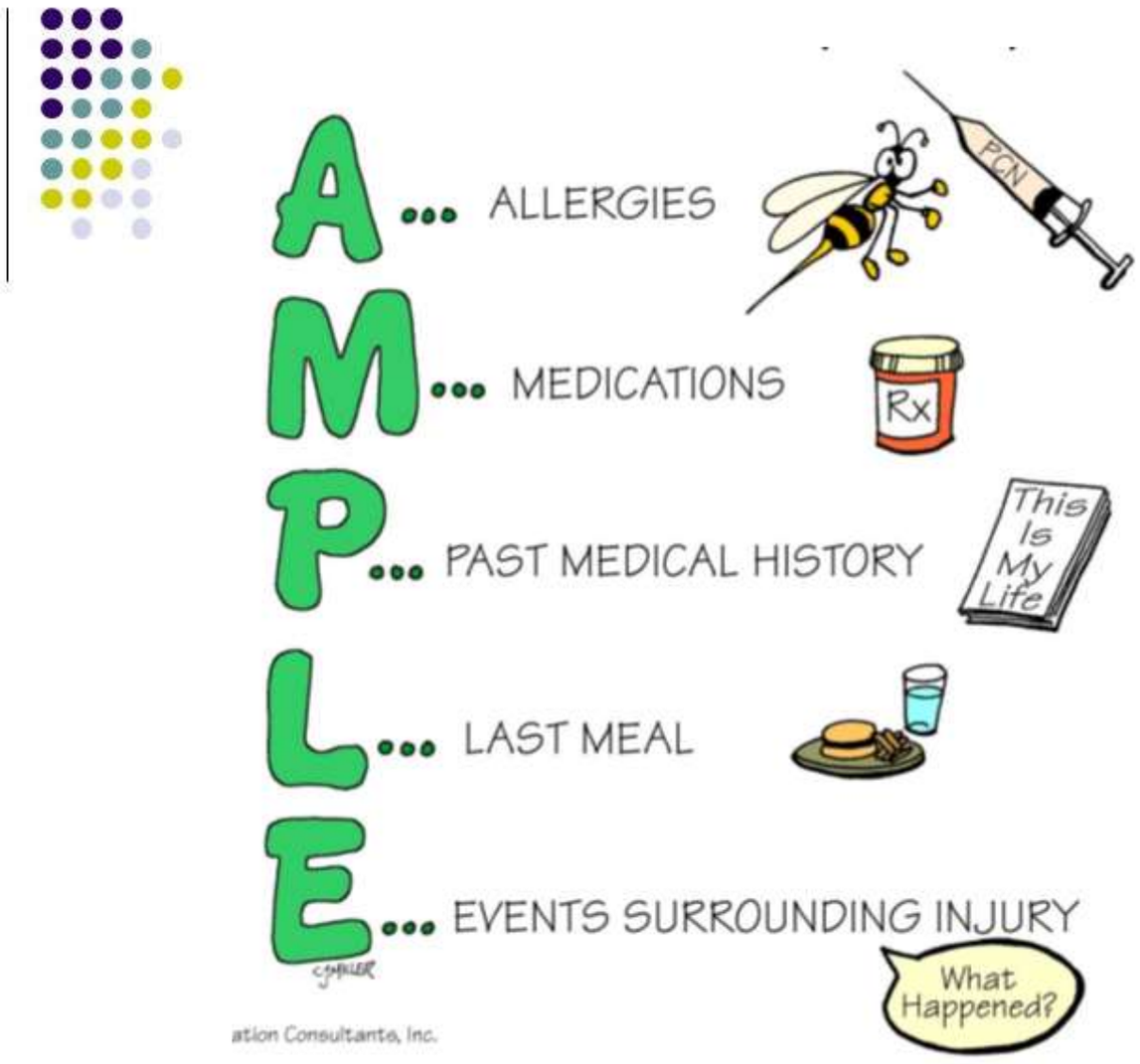
- Special procedure is order.

SECONDARY SURVEY

Focused History and Physical

AMPLE History

- A – allergies
- M – medications
- P – past medical history
- L – last oral intake
- E – events leading up to the incident

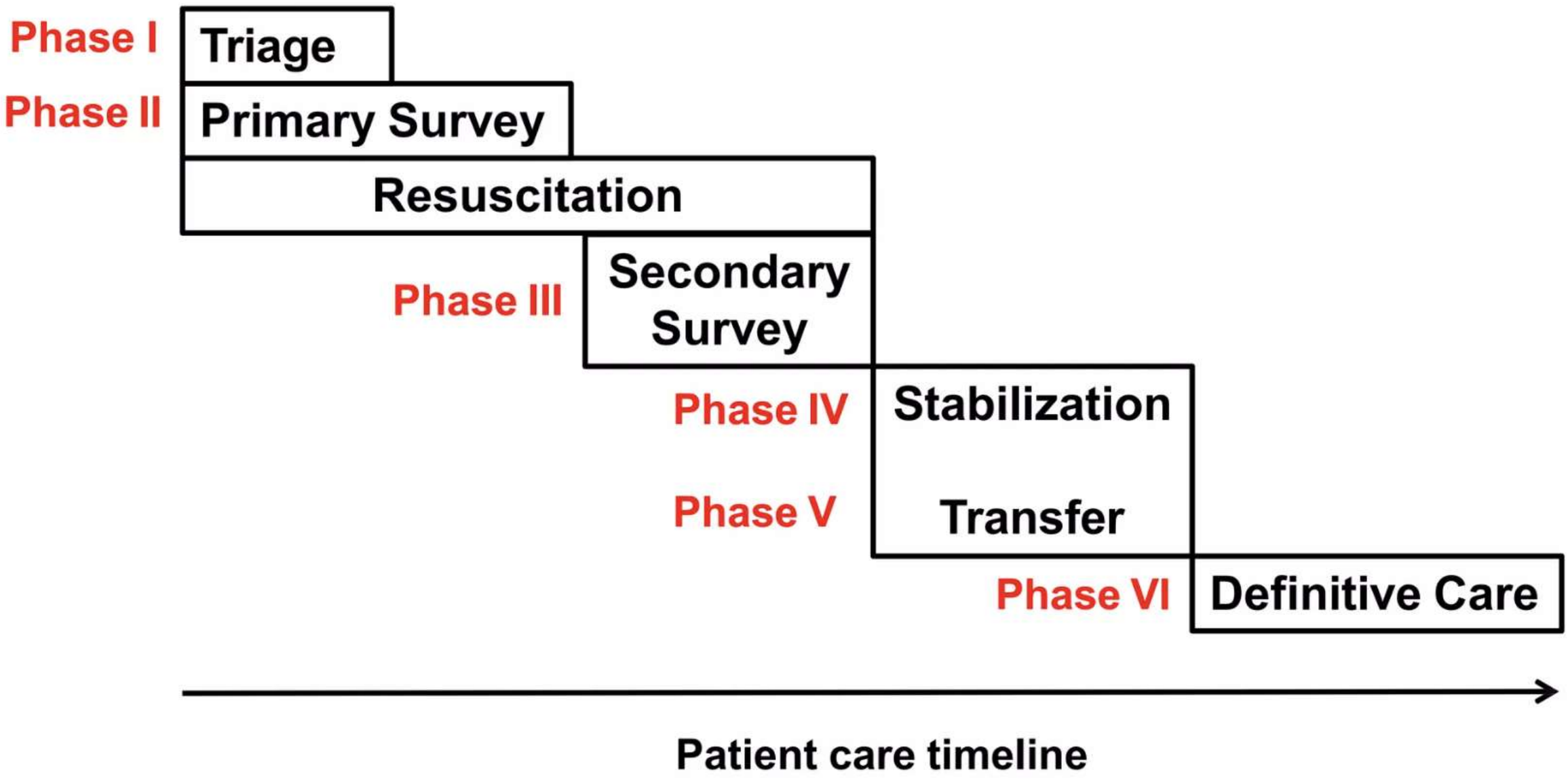


RE-EVALUATION / TRANSFER PHASE

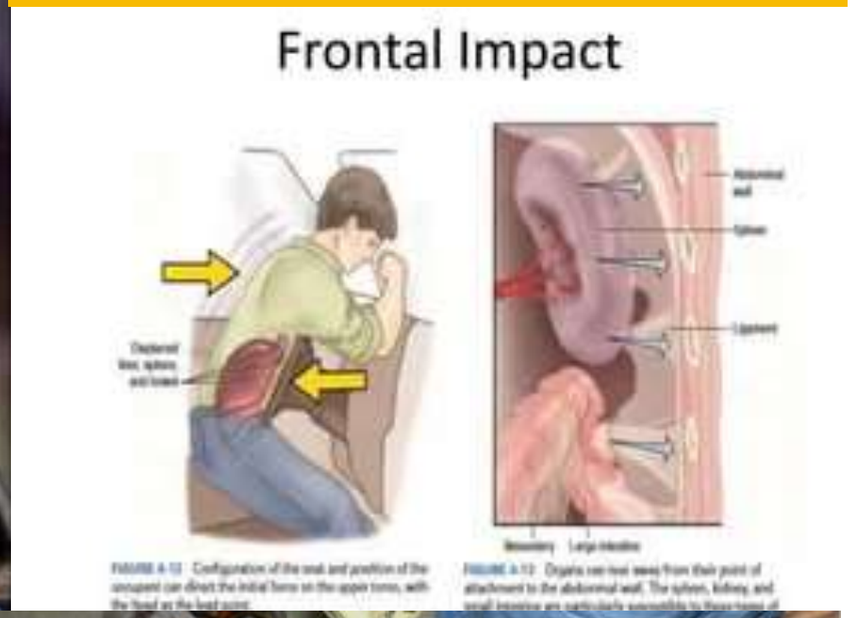
1. Re-check ABC's
2. Begin the transfer process
    a. Call receiving physician and give a verbal report
    b. Complete a brief written report of the patient's injuries and care
3. Place Foley catheter
    a. Do not place if pelvic fracture is suspected, there is blood at the urethral meatus, or a prostate exam is abnormal
4. Check the two large-bore IV catheters (18 gauge or larger)
5. Consider tetanus immunization
6. Antibiotics for open or contaminated wounds

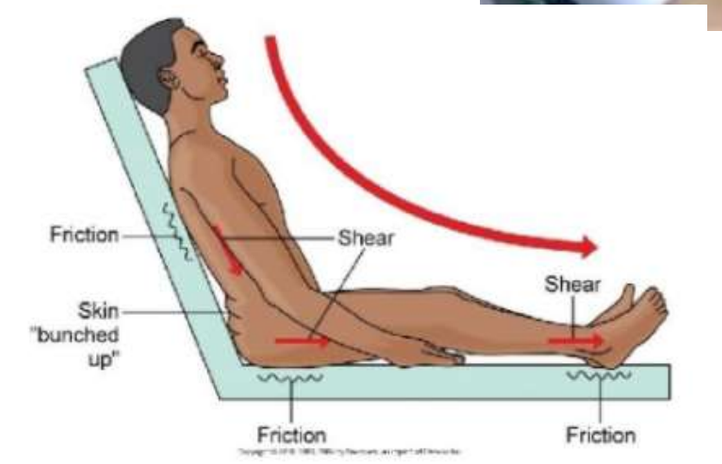
Give instructions to ambulance/attendance for care during transfer

SIX PHASES OF TRAUMA CARE MANAGEMENT



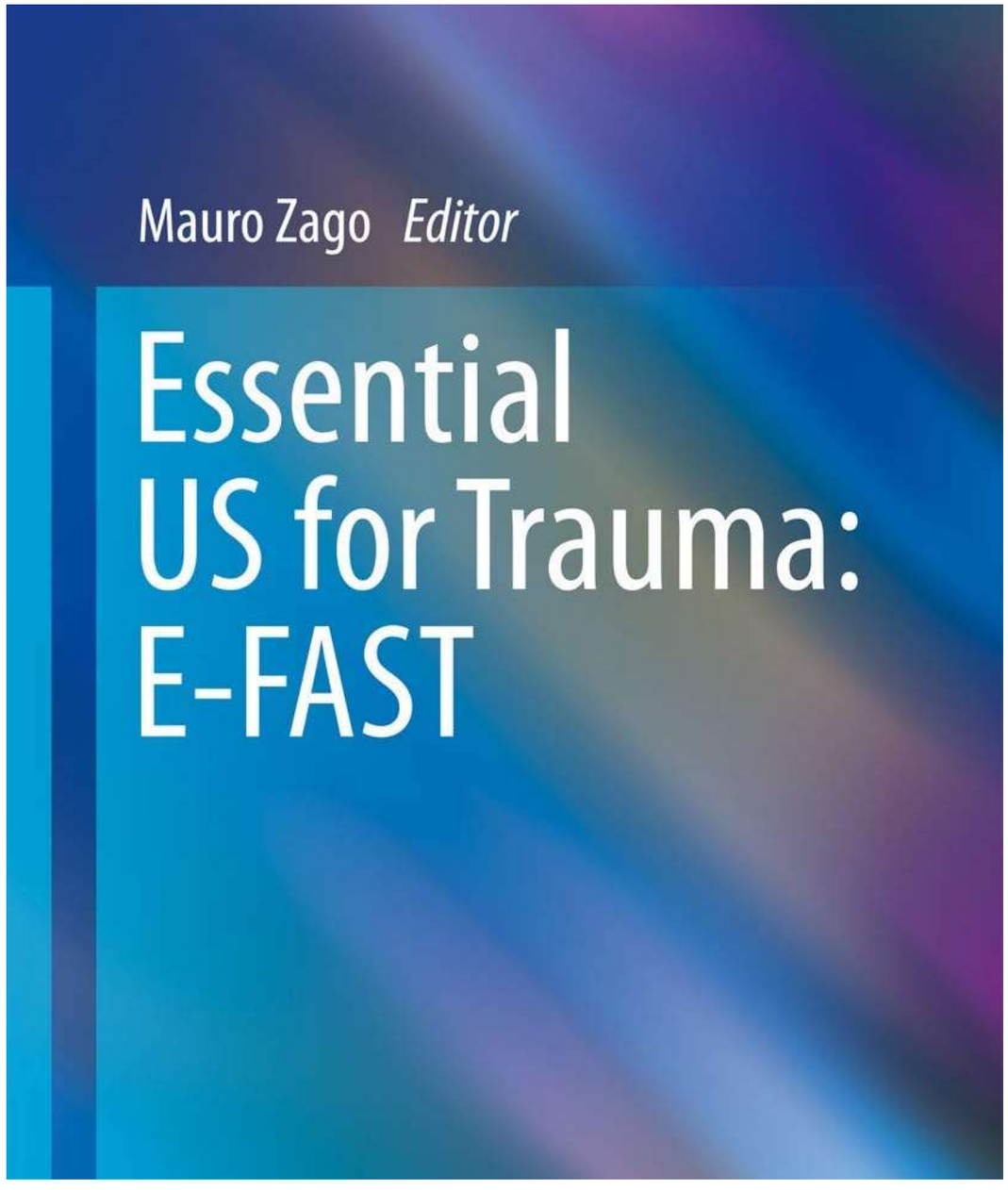
Abdominal trauma





E FAST

- **E XTENDED**
- **F OCUSSED**
- **A SSESMENT WITH**
- **S ONOGRAPHY IN**
- **T RAUMA**



EFAST exam is a point-of-care ultrasound protocol designed to rapidly assess trauma patients with shock/hemodynamic instability

FAST and eFAST

•***Focused Abdominal Sonogram for Trauma*** (Rozycki 1996) consisted of 3 views:

•***the right upper quadrant,***

•the left upper quadrant

•the pelvis

to rule out bleeding in the abdomen from trauma

•2004, Kirkpatrick et al - proposed the current nomenclature and protocol of **“eFAST Exam”** or **Extended Focused Assessment with Sonography in Trauma**

•The eFAST exam incorporates the evaluation of the *lungs* and *heart* in addition to the abdomen.

•pneumothorax -Lichenstein et al,

•hemoperitoneum-Kimura et al,

•pericardial effusions -Plummer et al

within the emergency department.

E FAST

INDICATION

- Hemodynamically unstable trauma patient
- Abdominal and Thoracic Trauma: Blunt or Penetrating
- Previously stable trauma patient with acute worsening in clinical status

LIMITATION

- Does not localize the injured abdominal organ
- Views may be limited in patients with subcutaneous emphysema
- Views may be limited in patients who have a hollow-viscus injury with free air in the abdomen

Subcutaneous Emphysema

Abdominal Free air

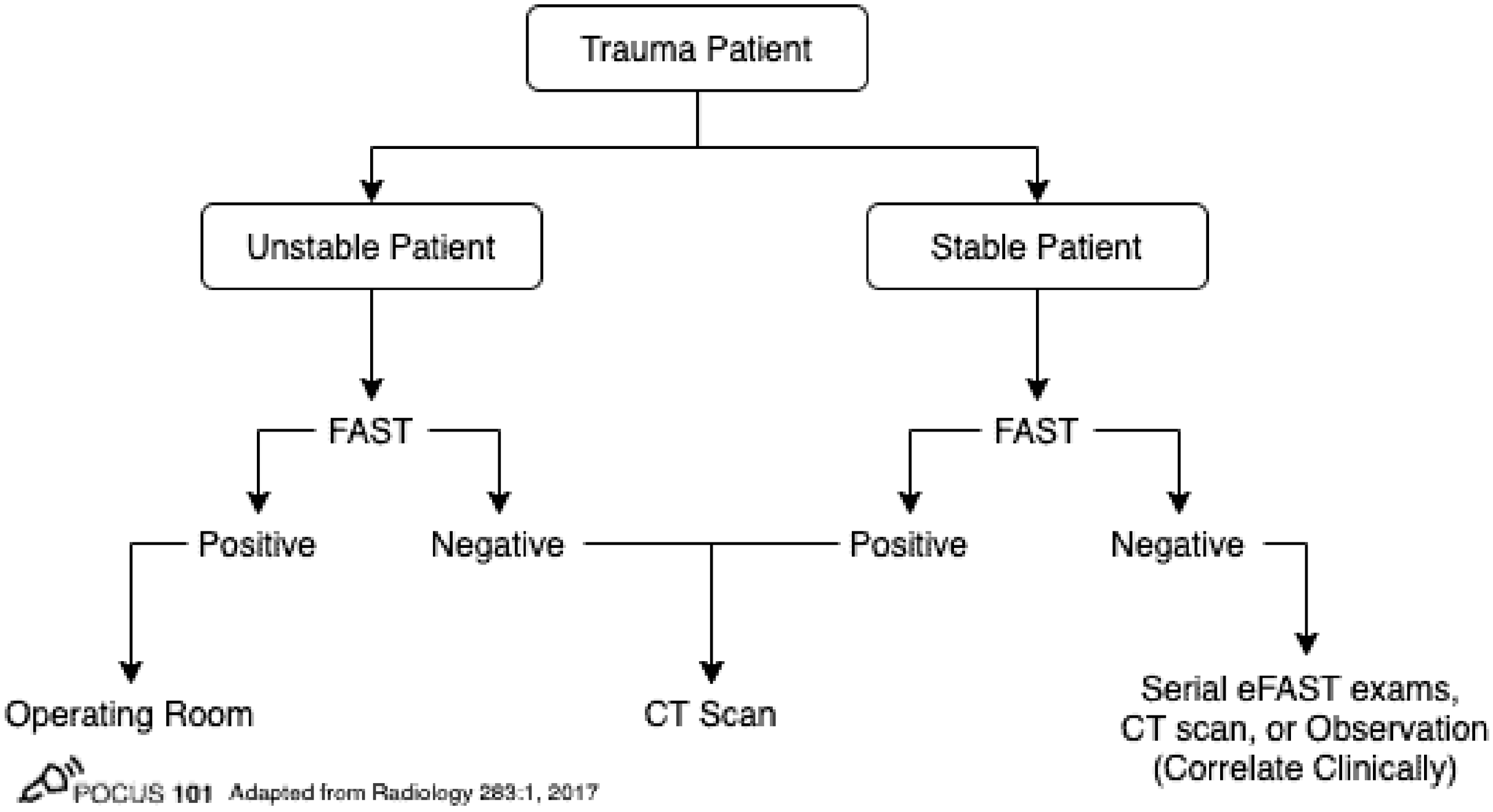
Obese Patients

Ascites

The eFAST Exam serves to answer 4 questions:

- Does my patient have free fluid in the **Abdomen**?
- Does my patient have free fluid in the **Thorax**?
- Does my patient have fluid in the **Pericardium**?
- Does my patient have a **Pneumothorax**?

EFAST EXAM ALGORITHM



Scanning Techniques

1. Intra-peritoneal hemorrhage?
2. Hemothorax?

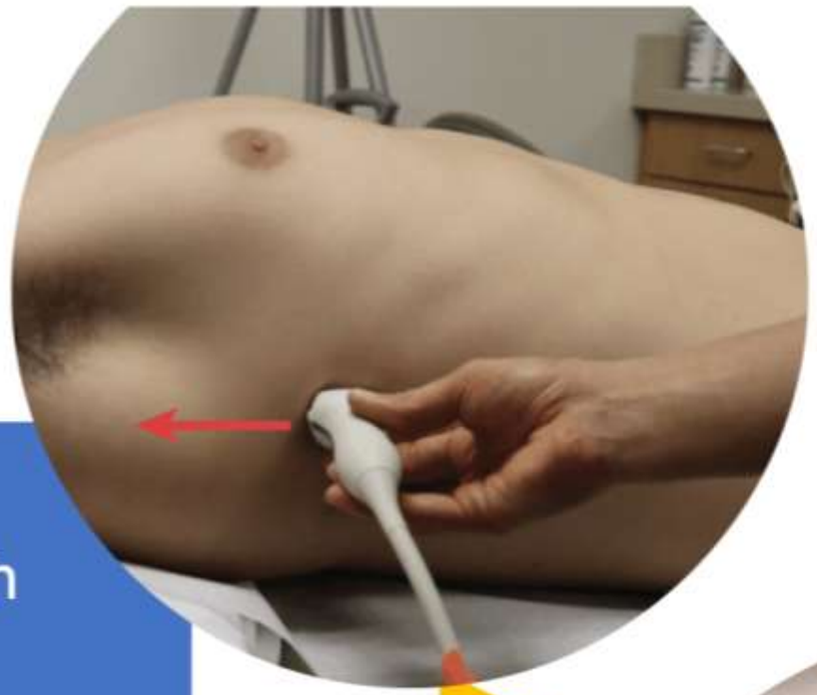
3 VIEWS	9 Zones			
RUQ	Above diaphragm	Below diaphragm	Morrison's	Inferior pole kidney
LUQ	Above diaphragm	Below diaphragm	Splenorenal	Caudal Spleen tip
Pelvic	Rectovesicular/Recto-uterine space			

Sequence

The sequence in which each view is obtained can vary based on the **mechanism of injury**. As a general guide:

- **Blunt** abdominal trauma: begin with a right upper quadrant view
- **Penetrating** abdominal trauma: begin with a cardiac view
- **Respiratory distress**:

Step 1: eFAST Right Upper Quadrant View (RUQ)



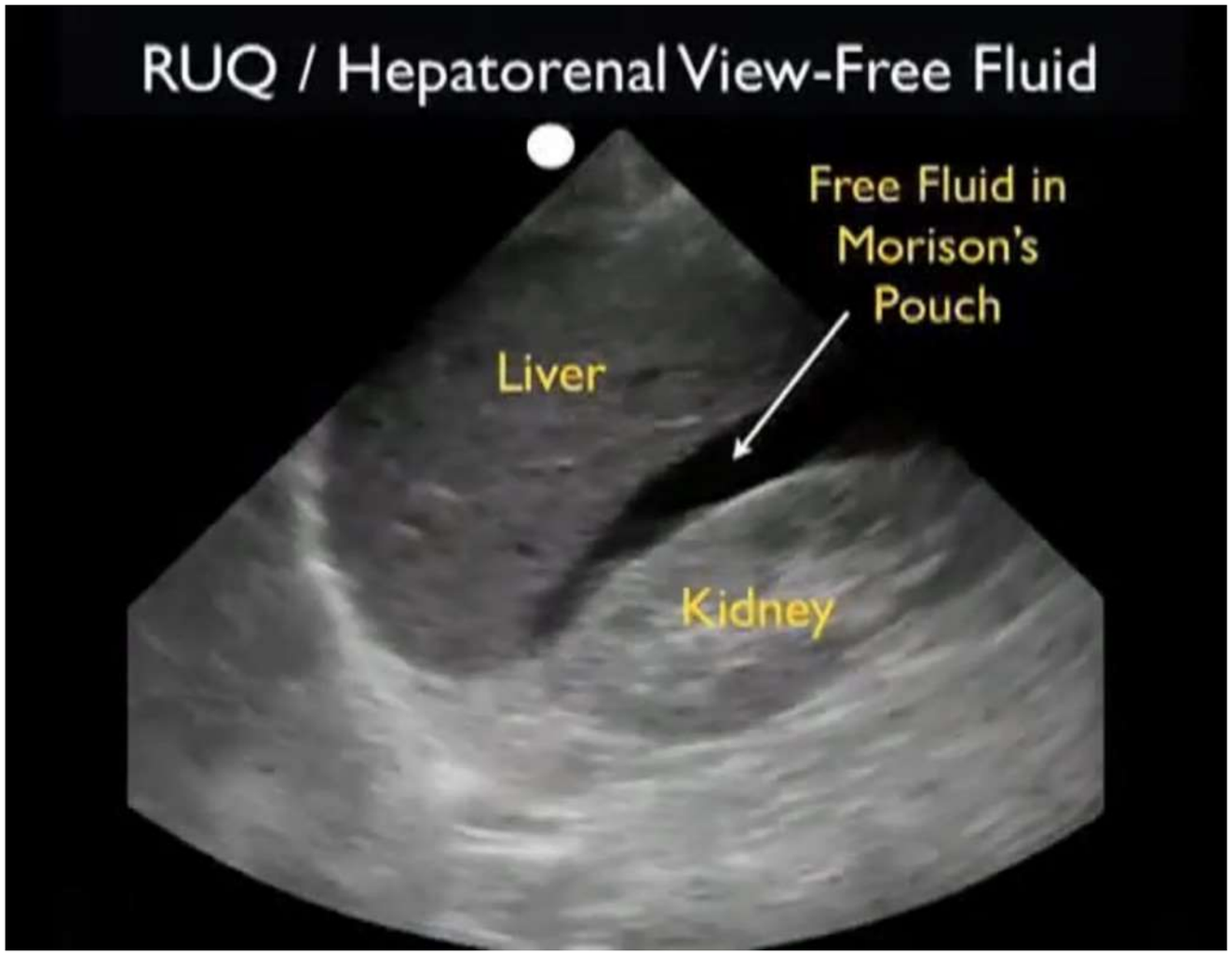
RUQ Probe Position and Hand Placement

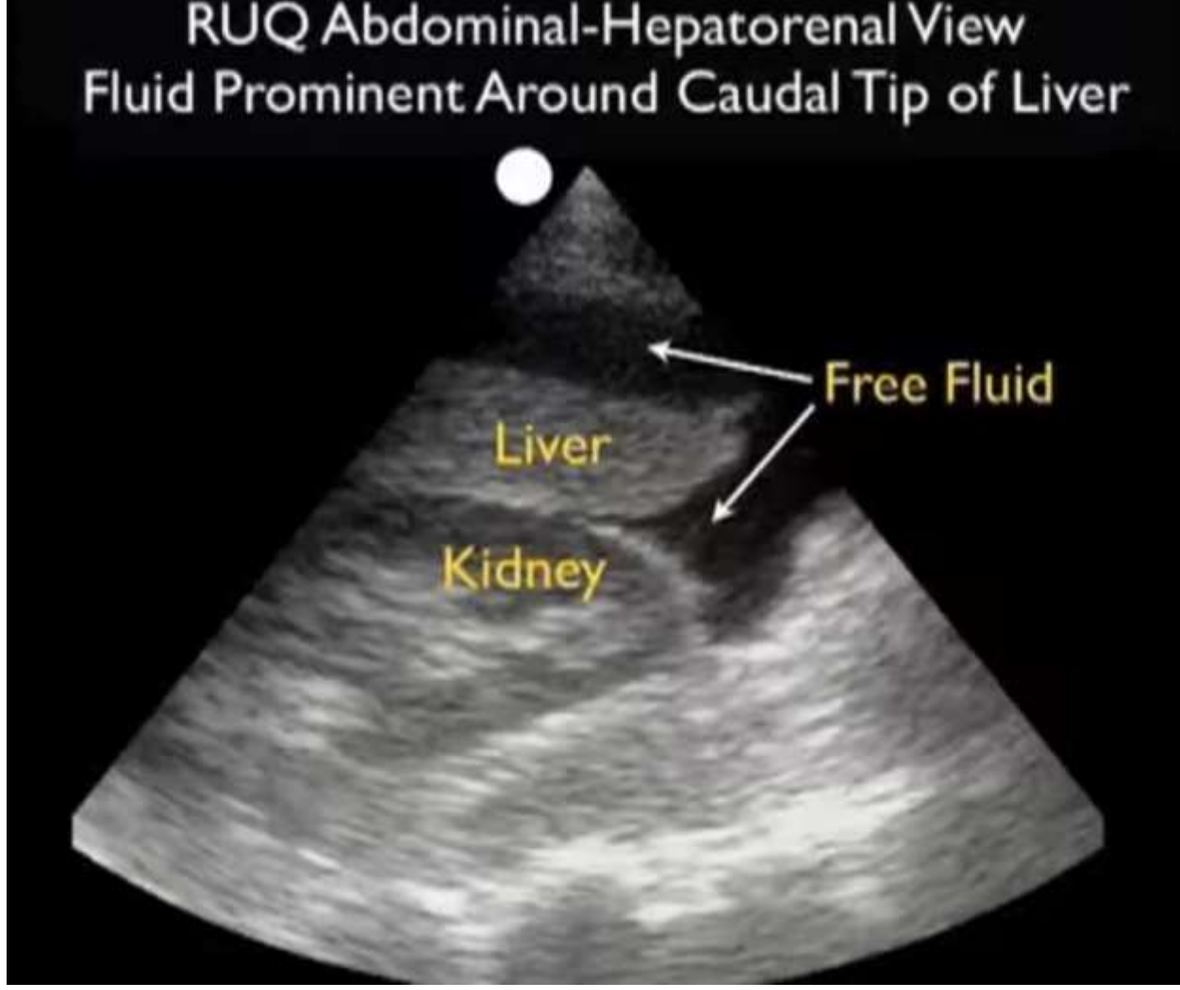
Orientate the **probe indicator** towards the **patient's head**.

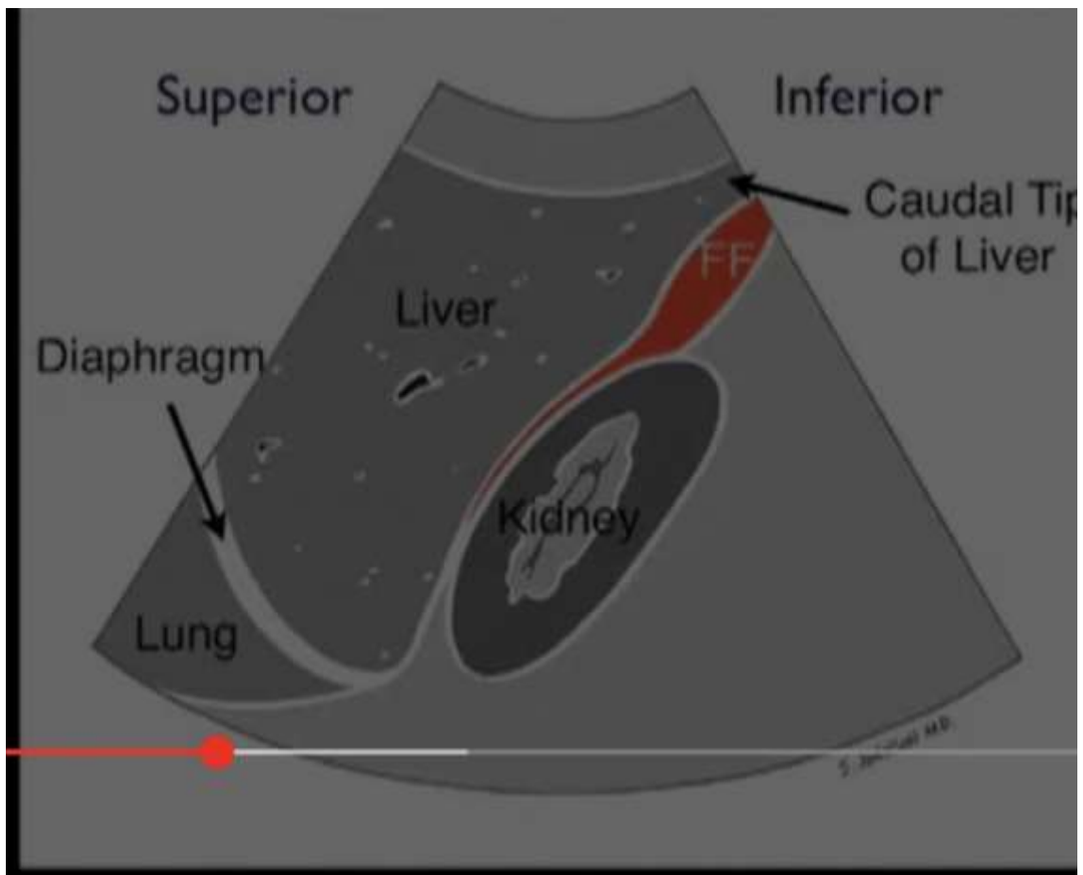
Anchor your probe in the **midaxillary line** at the **10th intercostal space**.

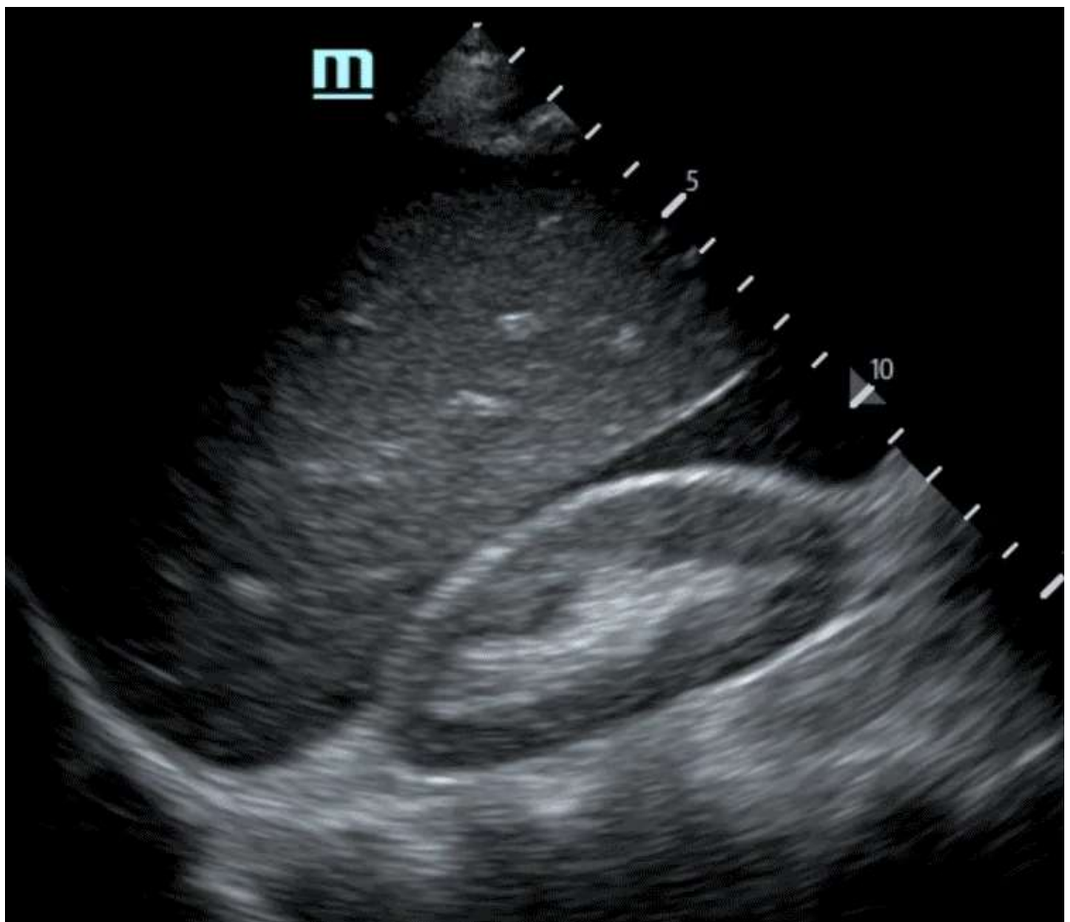
Remember to look free fluid both above (hemothorax) and below (hemoperitoneum) the diaphragm.

Liver is the most commonly injured organ in blunt abdominal trauma, the right upper quadrant is usually the most sensitive view of the eFAST exam.

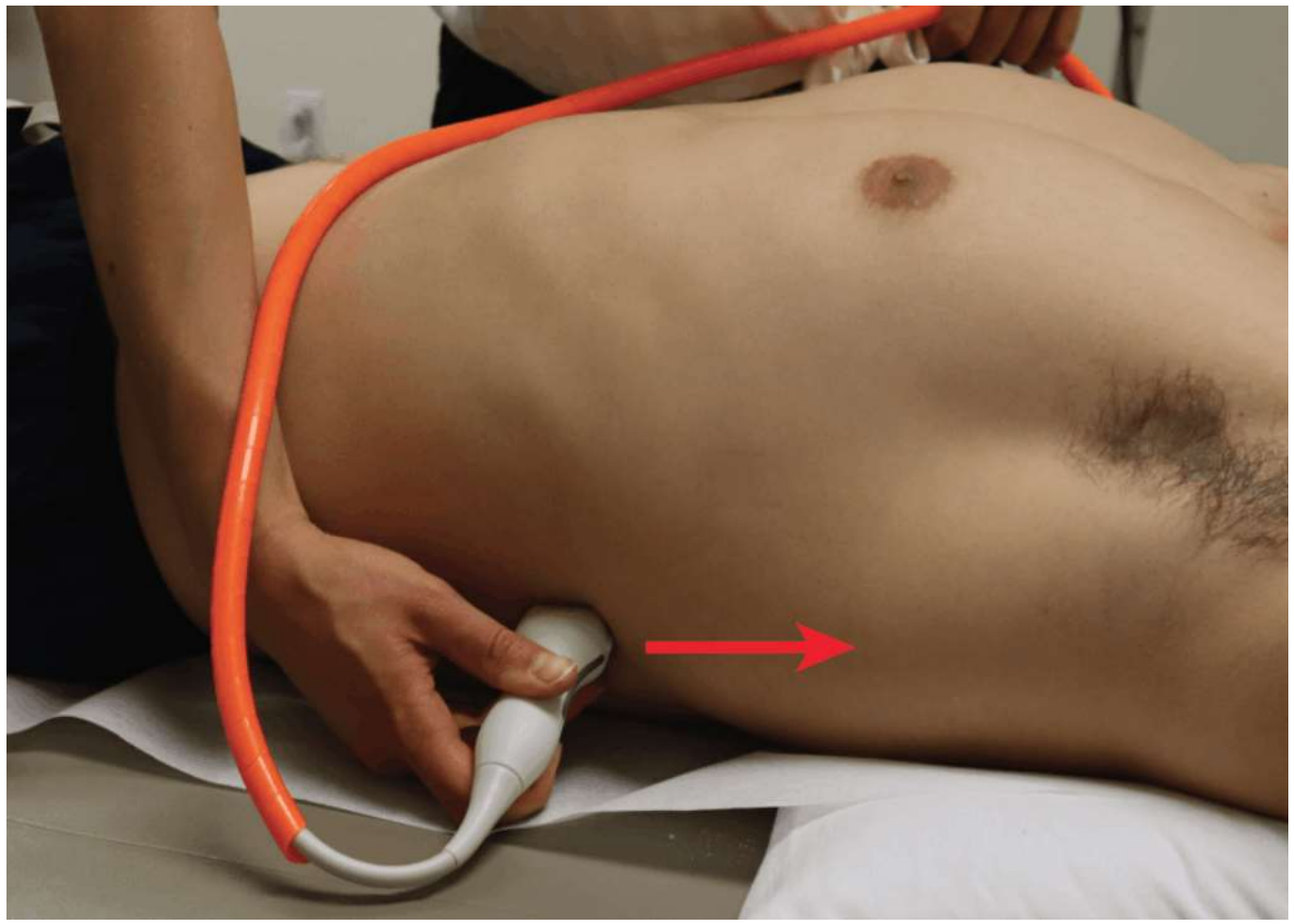

RUQ / Hepatorenal View-Free Fluid
Free Fluid in Morison's Pouch
Liver
Kidney


RUQ Abdominal-Hepatorenal View
Fluid Prominent Around Caudal Tip of Liver
Free Fluid
Liver
Kidney


Superior
Inferior
Caudal Tip of Liver
FF
Liver
Diaphragm
Kidney
Lung


5
10

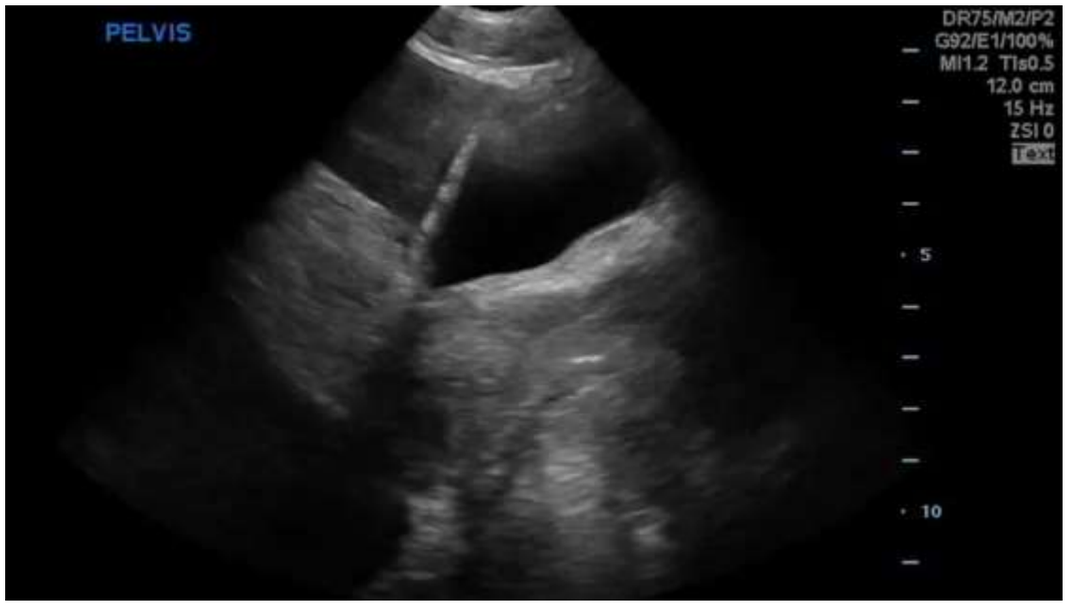
STEP 2: EFAST LEFT UPPER QUADRANT VIEW (LUQ)



•Grasp the linear probe between your **thumb** and **first finger**, *like holding a pencil*.

•**Orientate the probe indicator towards the patient's head.**

Anchor your probe in the **posterior axillary line** around the **8th intercostal space**



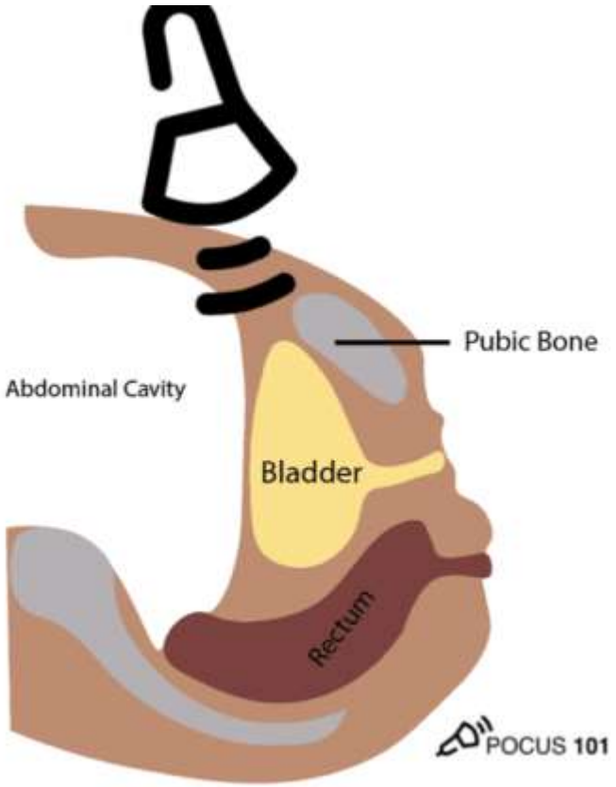
FAST Exam in a Blunt Trauma patient with Shattered Spleen

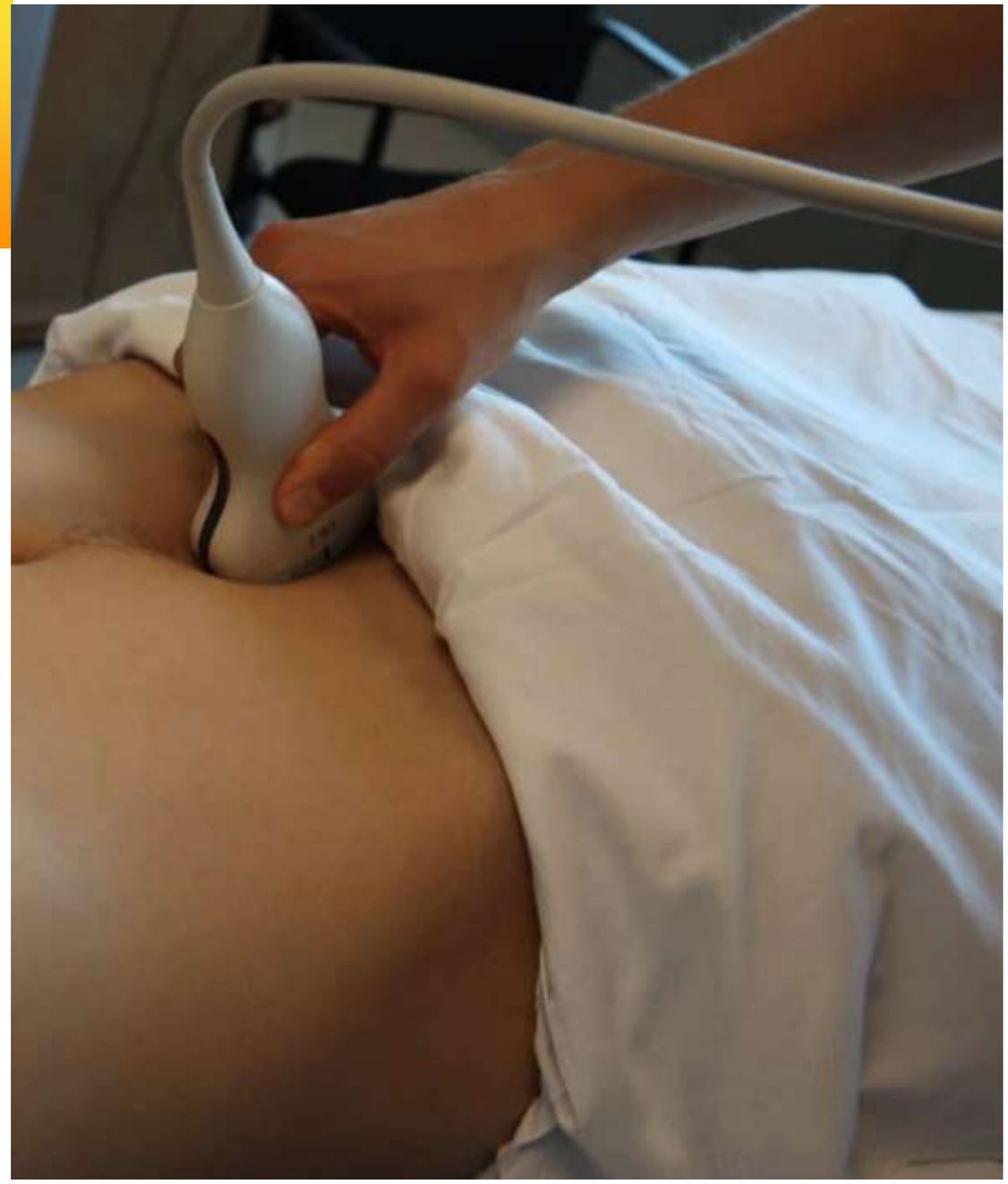
1. Know your US anatomy

2. Beware of "clotted blood camouflage" !

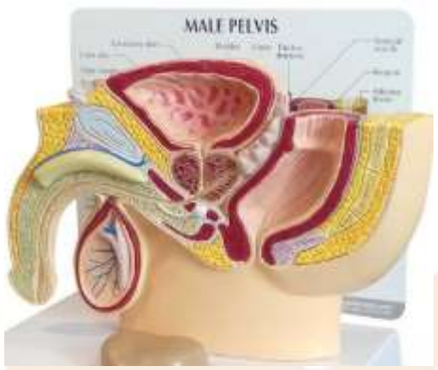
Step 3: eFAST Pelvic View

Does my patient have free fluid in the abdomen or pelvis?

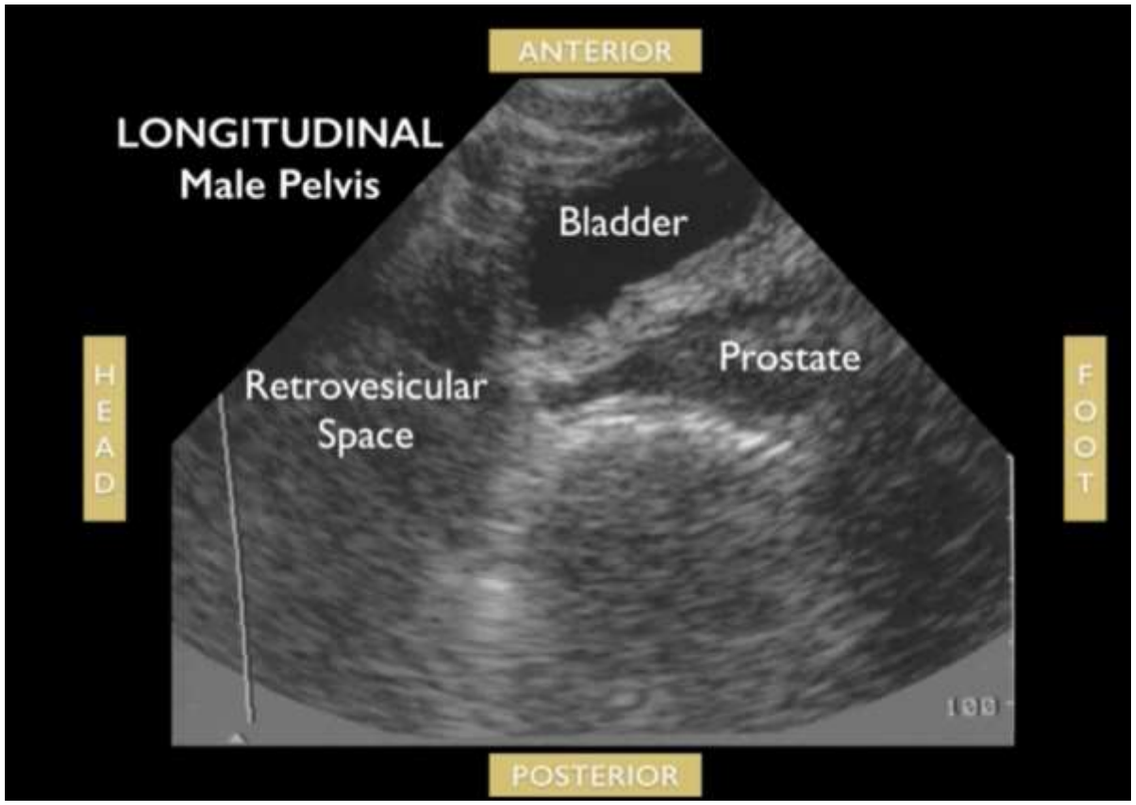


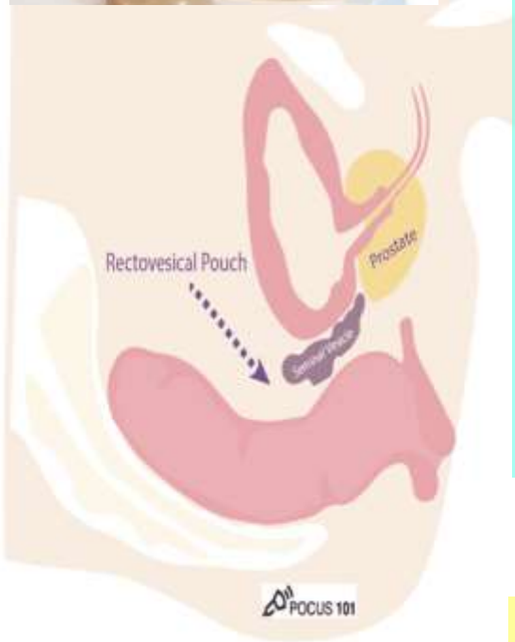


- Free fluid has a tendency to accumulate in different locations depending on the patient's gender.
- Pelvic Ultrasound – Longitudinal View Place the transducer with the indicator pointing towards the patient's head in the patient's midline, right above the pubic symphysis.
- Rock the probe so that it points down towards the pelvic cavity.



•**bladder** (*immediately posterior to the symphysis*), **prostate/seminal vesicle**, and **rectovesical pouch** in the longitudinal view.



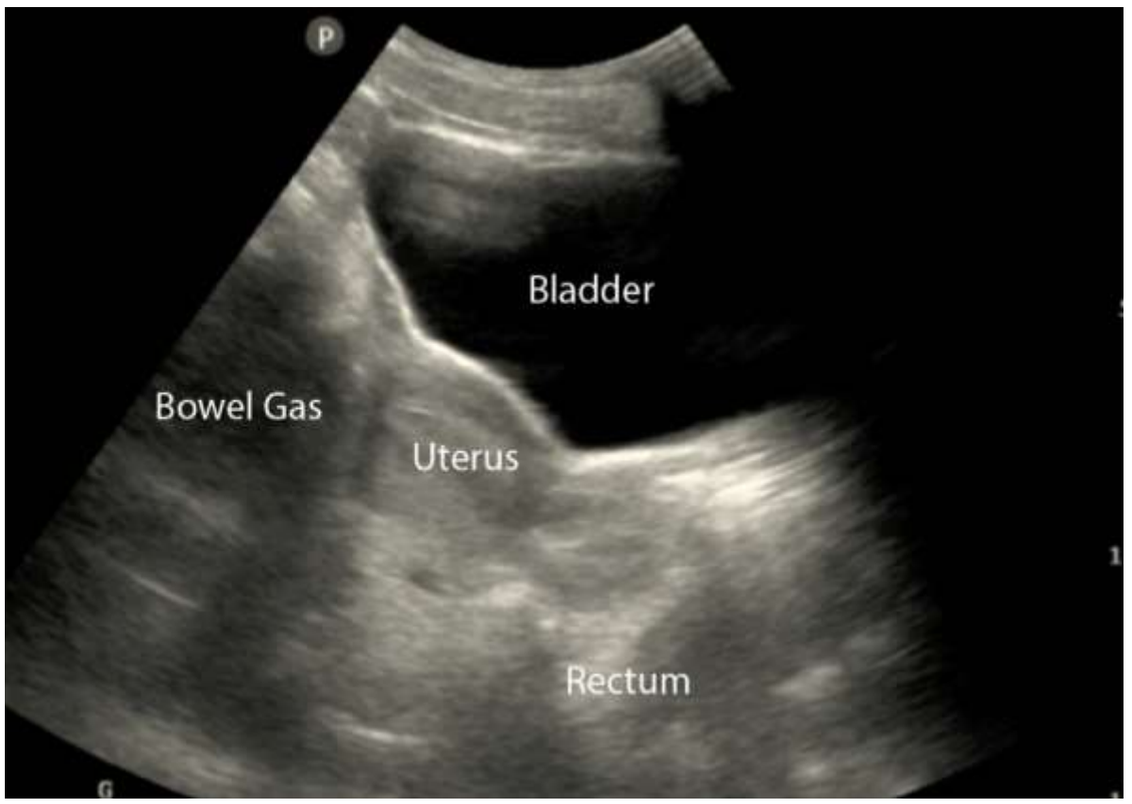


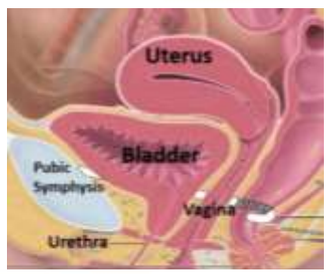
•**The rectovesical pouch-**

male:

●**bladder**, **uterus,** and **Rectouterine Pouch** (also called the *Pouch of Douglas)*.

●**The Pouch of Douglas -Female**

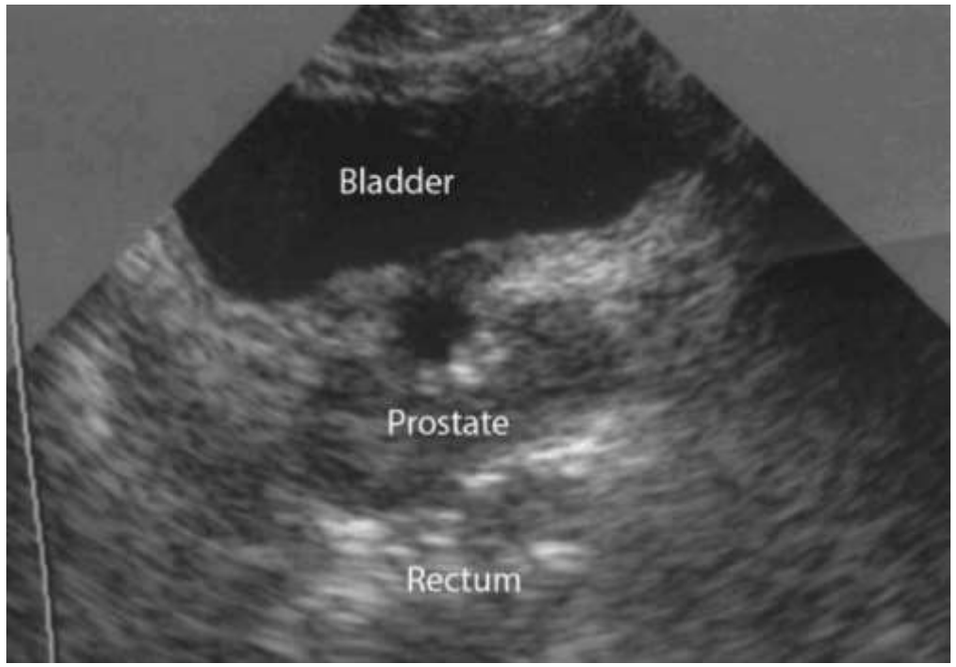


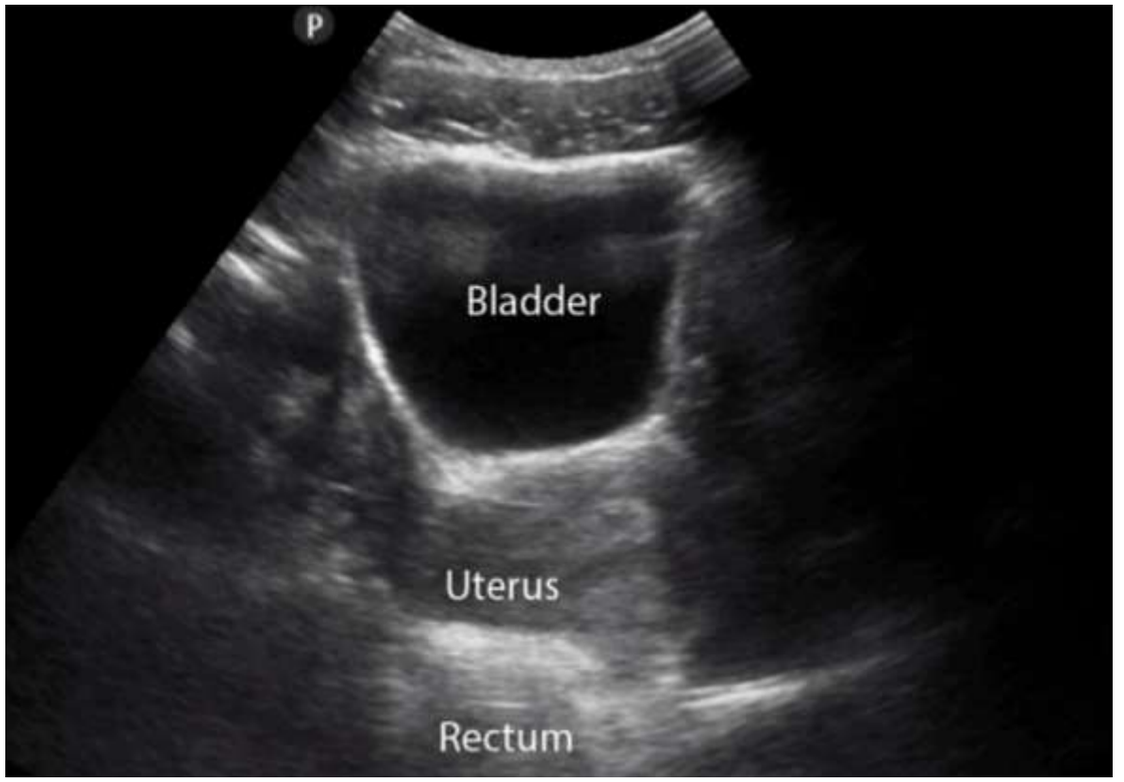


- **In all patients (male or female), observe the lateral borders of the bladder to identify free fluid**

ANTERIOR, bottom of the screen POSTERIOR. L of screen (where i

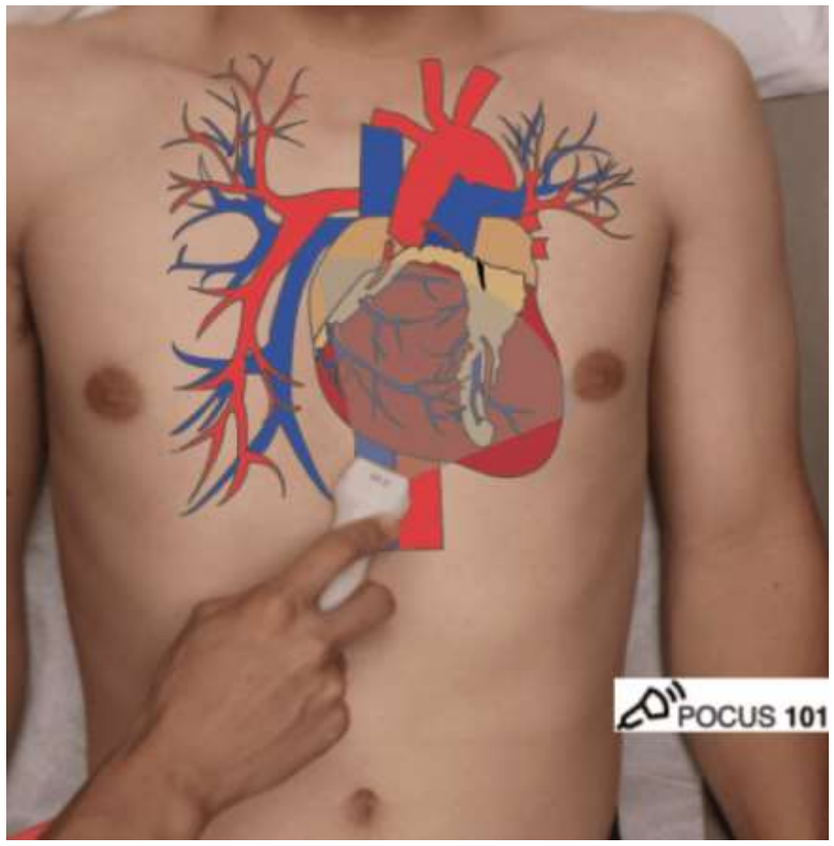
PELVIC ULTRASOUND – TRANSVERSE VIEW

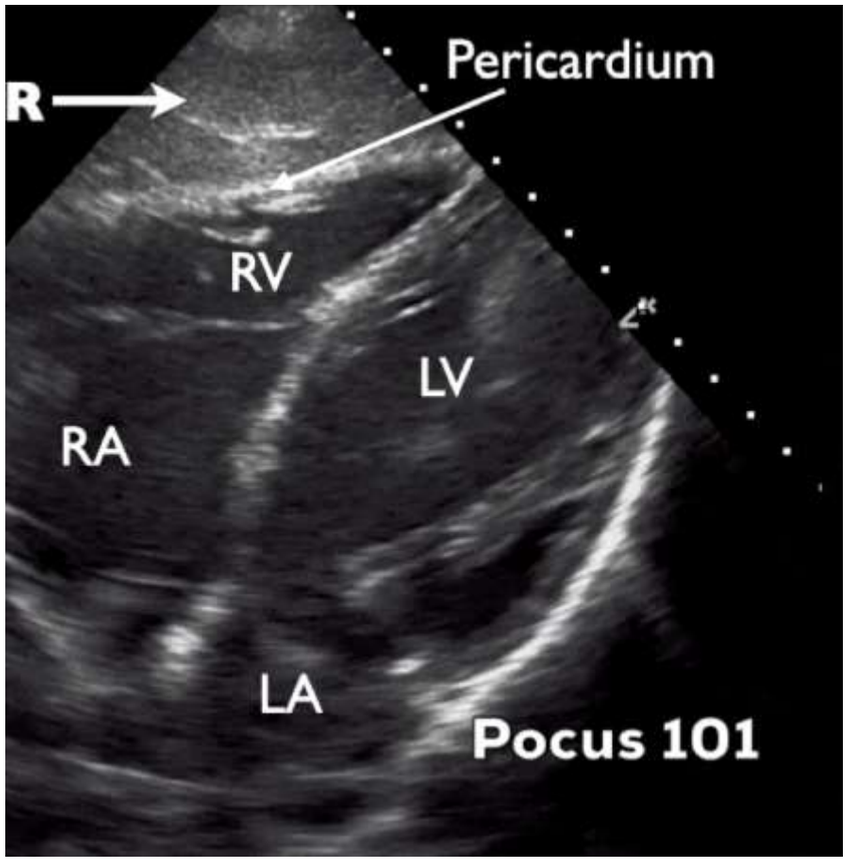


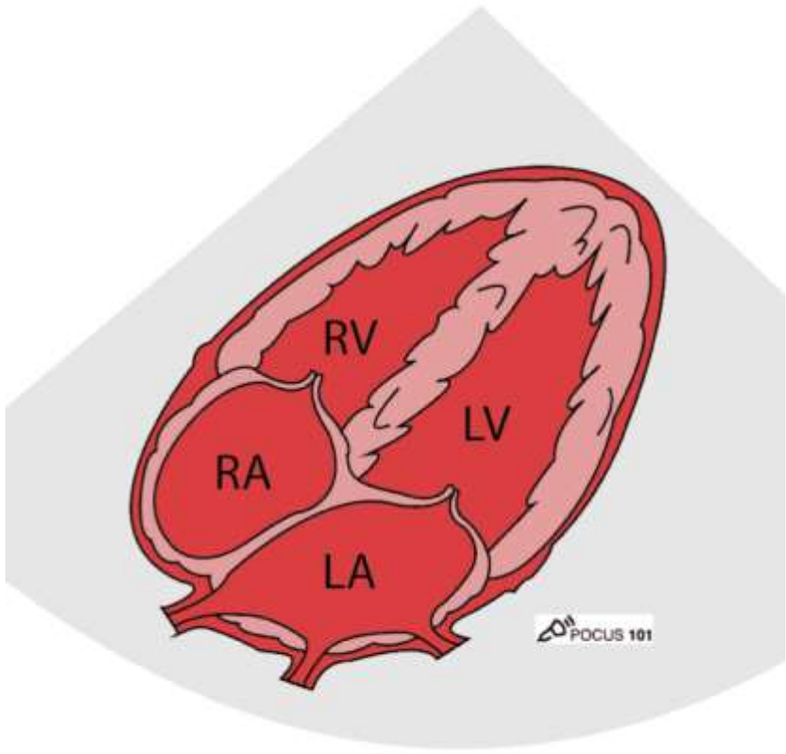


- •Center the bladder and then rotate the transducer 90 degrees counter clockwise.
- The indicator should now point to the patient’s Right side.
- •Make sure to tilt the ultrasound probe so it scans into the pelvic cavity.

Step 4: eFAST Cardiac View
my patient have a pericardial effusion with cardiac tampon



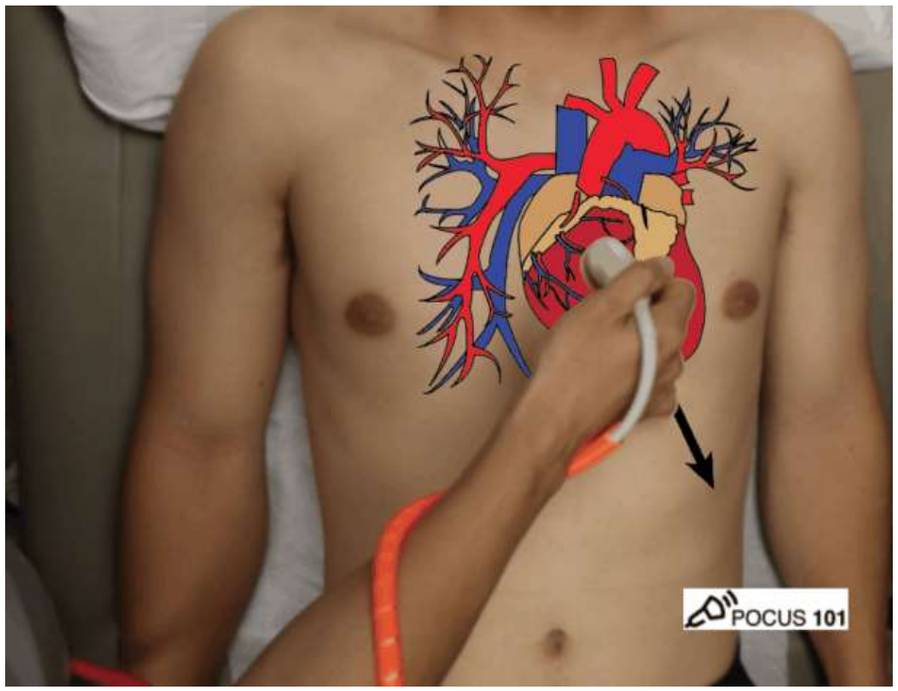


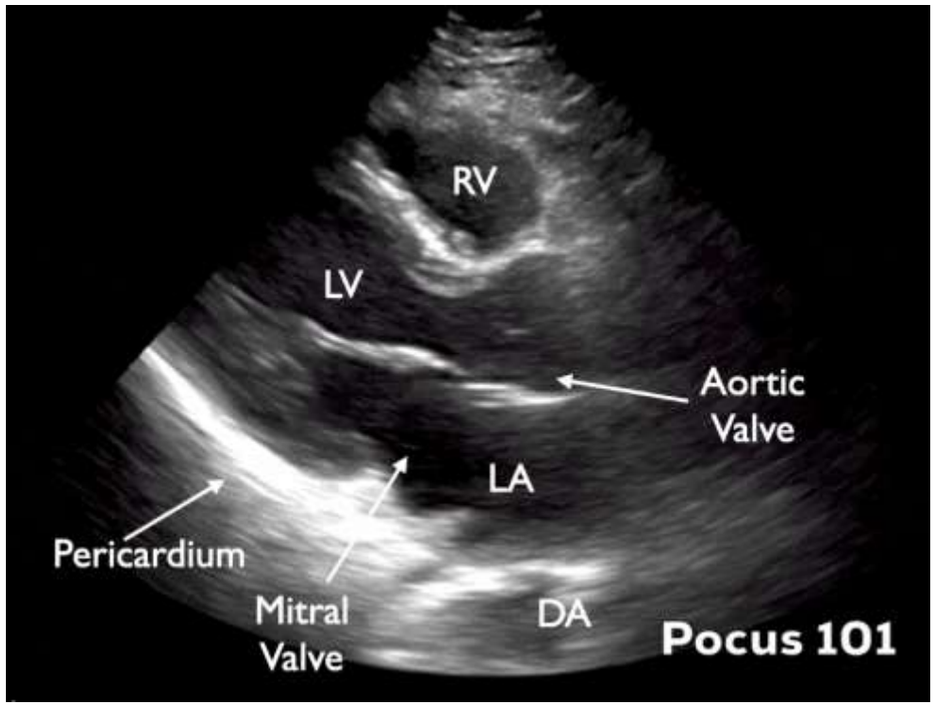


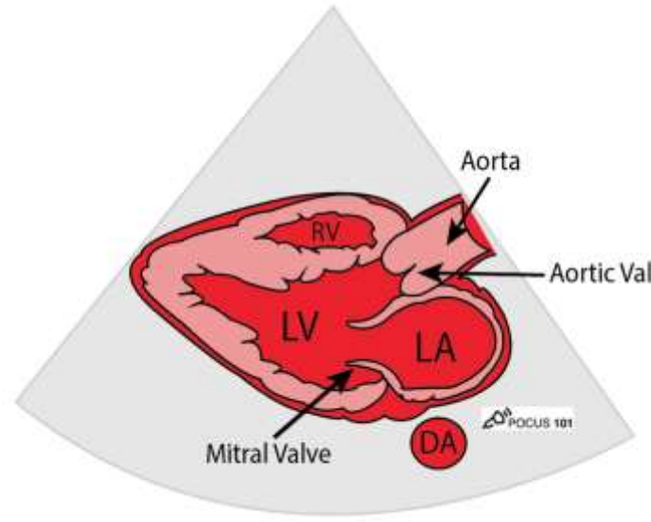
•CARDIAC SUBXIPHOID VIEW

- Hold the probe in the palm of your hand and use an overhand grip.
- Point the probe indicator towards the patient's right with the ultrasound machine depth set to around 15-20 cm.
- Using the *liver as the acoustic window*, *simultaneously* press the probe into the patient's abdomen while tilting the tail of the probe *towards the patient's feet*
- Aim the ultrasound beam towards the patient's left shoulder.

Step 4: eFAST Cardiac View
my patient have a pericardial effusion with cardiac tampon







CARDIAC PARASTERNAL LONG AXIS

PROCEED TO SCANNING THE LUNGS.

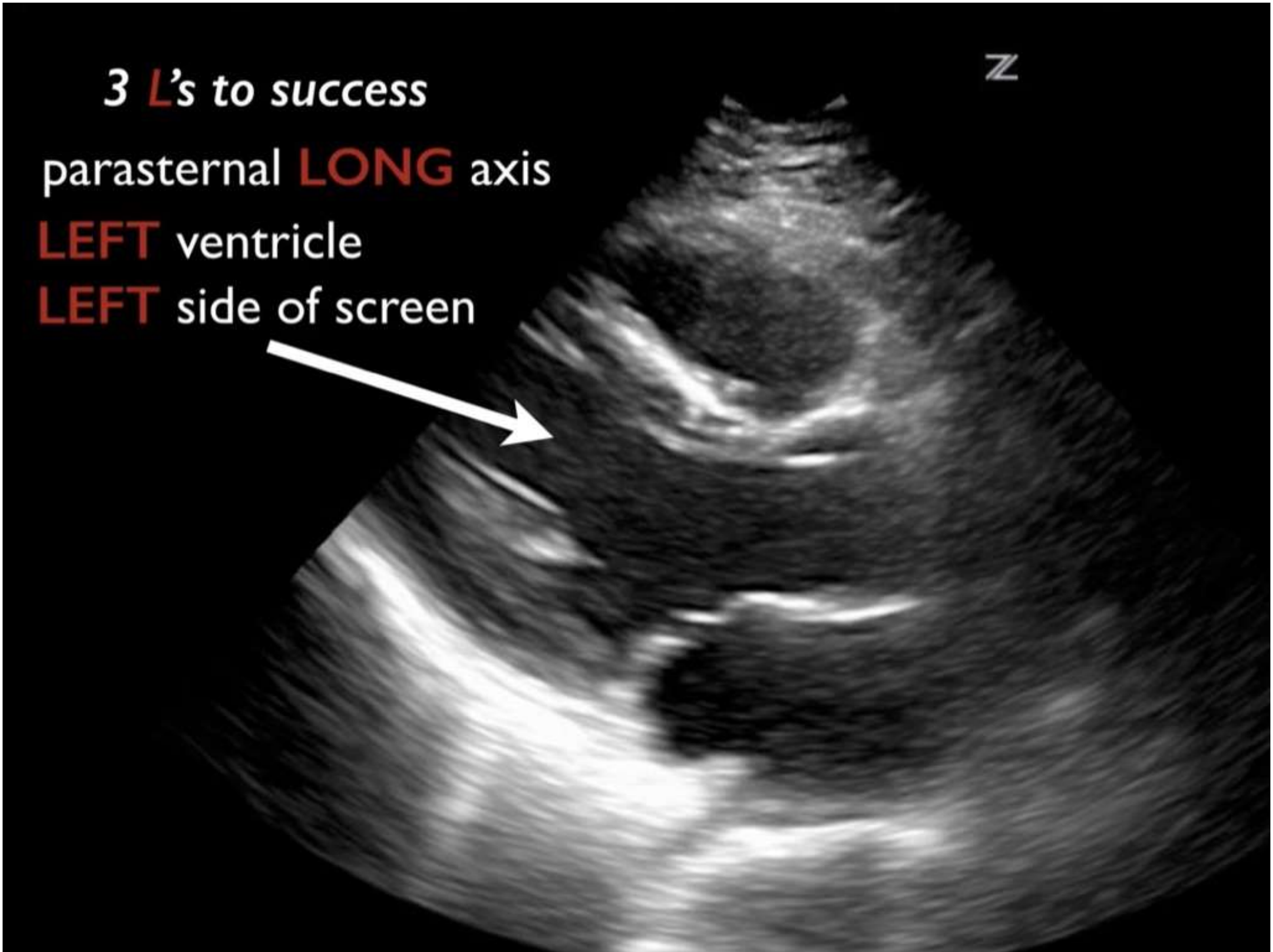
- Grasp the linear probe between your **thumb** and **first finger**, like *holding a pencil*.
- **Anchor** your third and/or fourth finger(s) in the **2nd or 3rd left intercostal space**, just **lateral** to the **sternum**.
- **Probe indicator** towards the patient's **left hip** with the machine **depth** set approximately **10-15 cm**
- Identify the **pericardium, mitral valve, aortic valve, right ventricle, descending aorta**

3 L's to success

parasternal **LONG** axis

LEFT ventricle

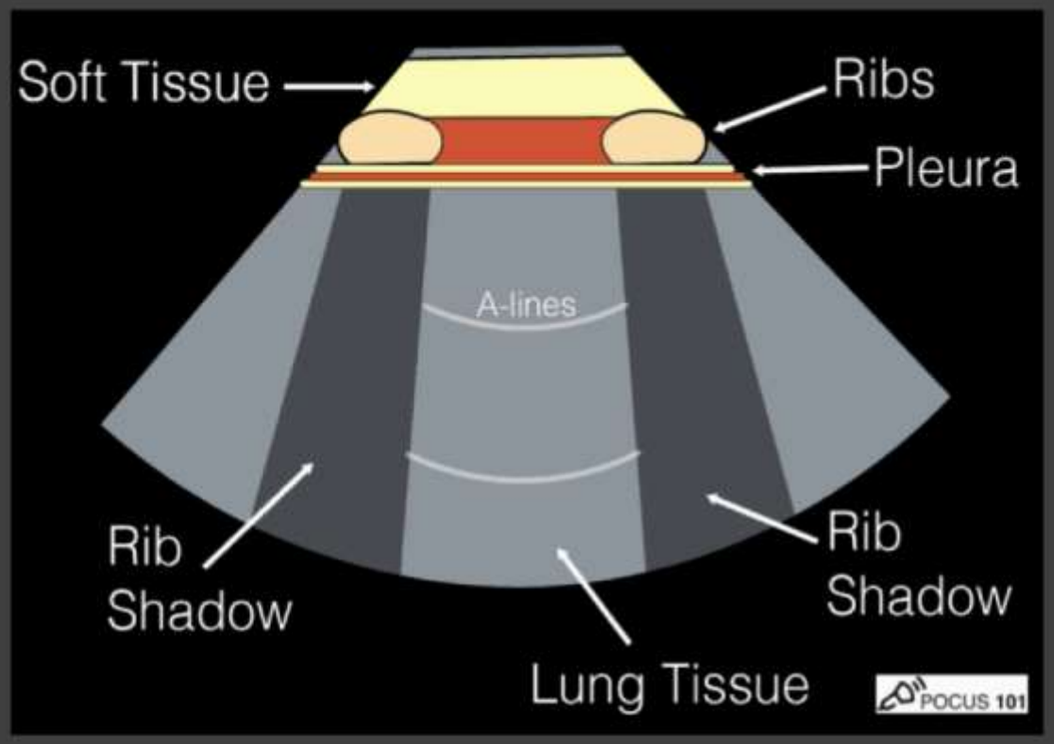
LEFT side of screen



STEP 5: EFAST LUNG VIEWS
DOES MY PATIENT HAVE A PNEUMOTHORAX?

eFAST Scan of the Right Lung

eFAST Scan of theLeft Lung

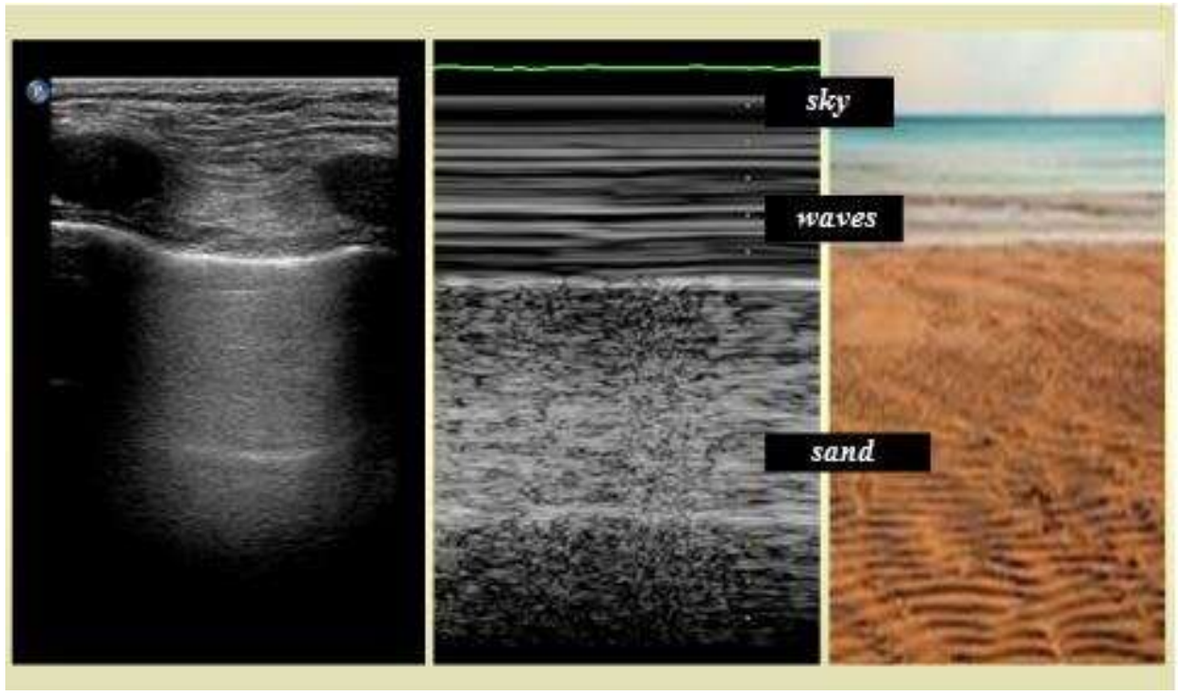


Two Rib Shadows
(Batwing Sign)

- **The first lung ultrasound finding to confirm you are in the correct position is to look for the two rib shadows or the "Batwing Sign." This ensures that your probe is in between two ribs.**

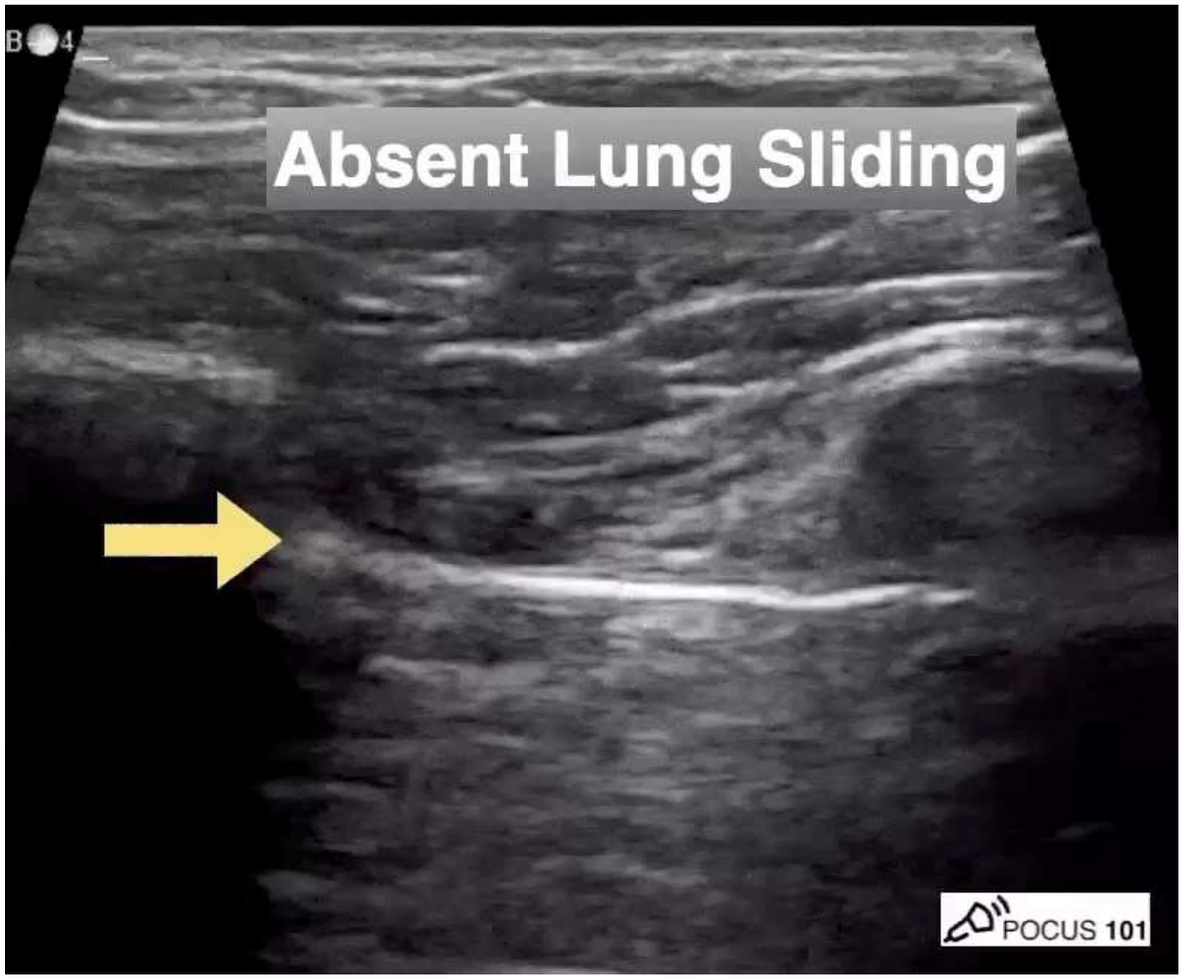
LUNG SLIDING

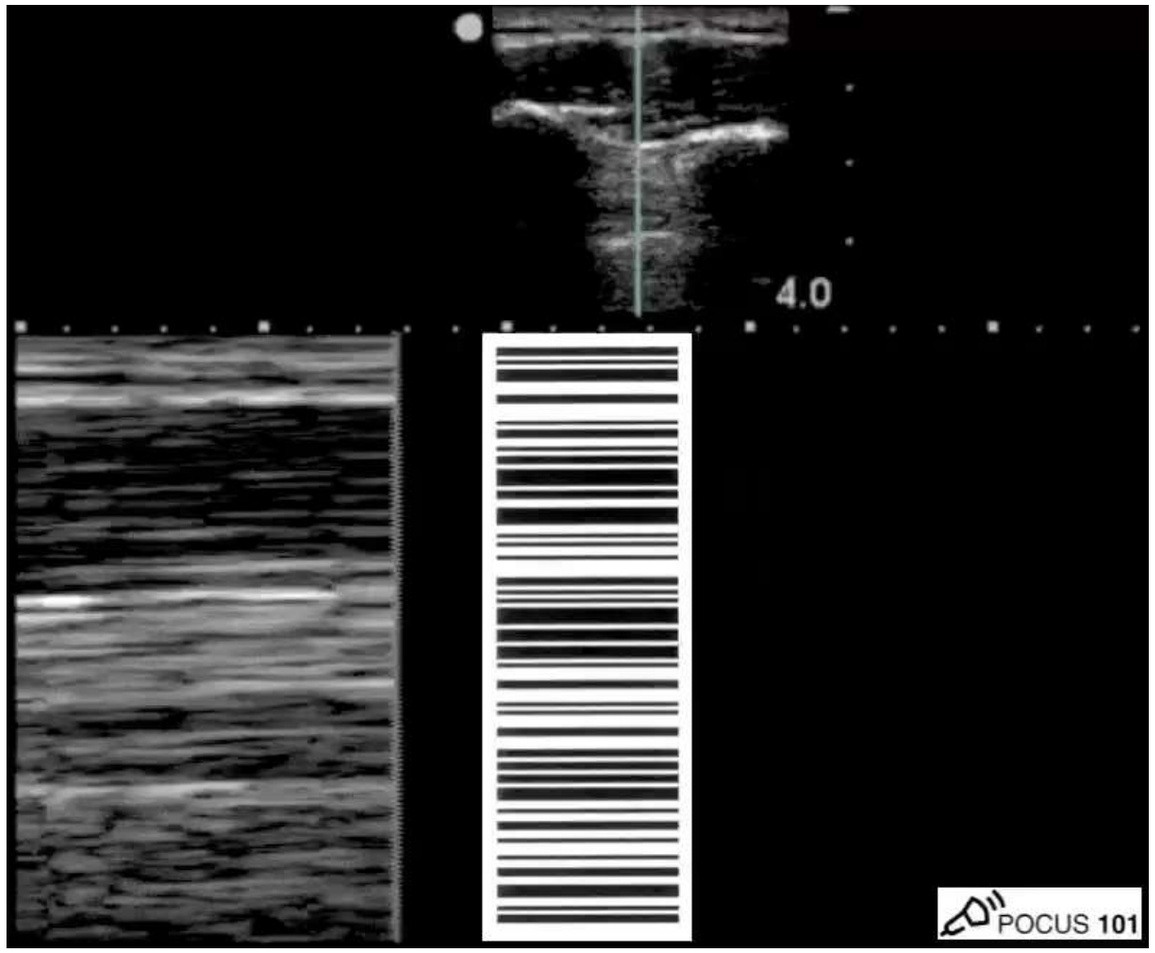
B- MODE ANTS MARCHING SIGN



M - MODE SEA SHORE SHINE

- The next finding you will want to look for is **lung sliding** during respiration.
- Lung sliding is a normal finding where the visceral and parietal pleura slide back and forth on one another as the patient breathes. Some say this looks like tiny “**ants marching on a line**.”
- **“Ants Marching” sign** is produced from the visceral and parietal pleura





Pneumothorax – eFAST

Here are three important steps to evaluating for pneumothorax when performing the eFAST scan:

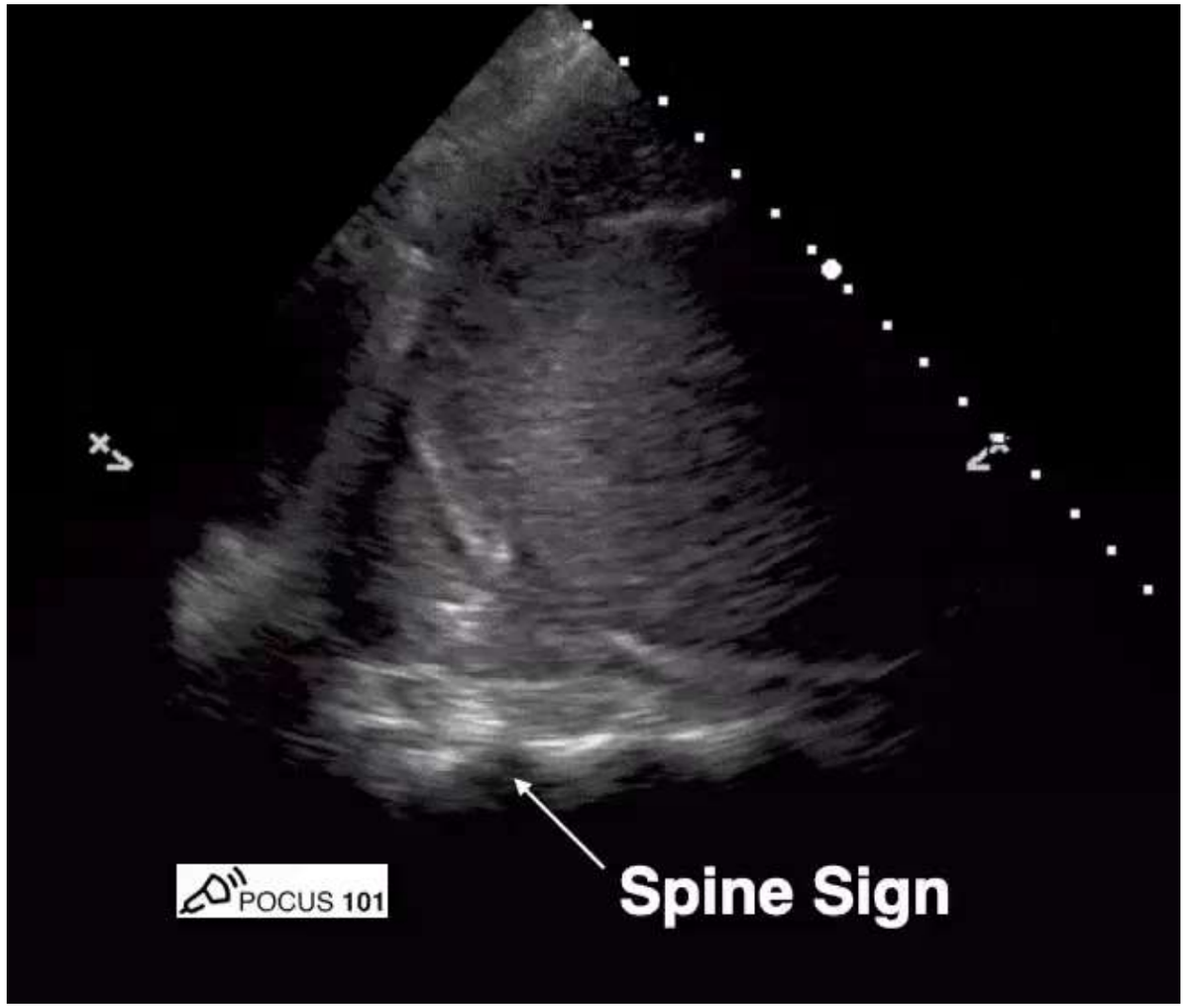
First, if lung sliding is present, you can rule *out* pneumothorax with 100% accuracy at that ultrasound point (Husain LF).

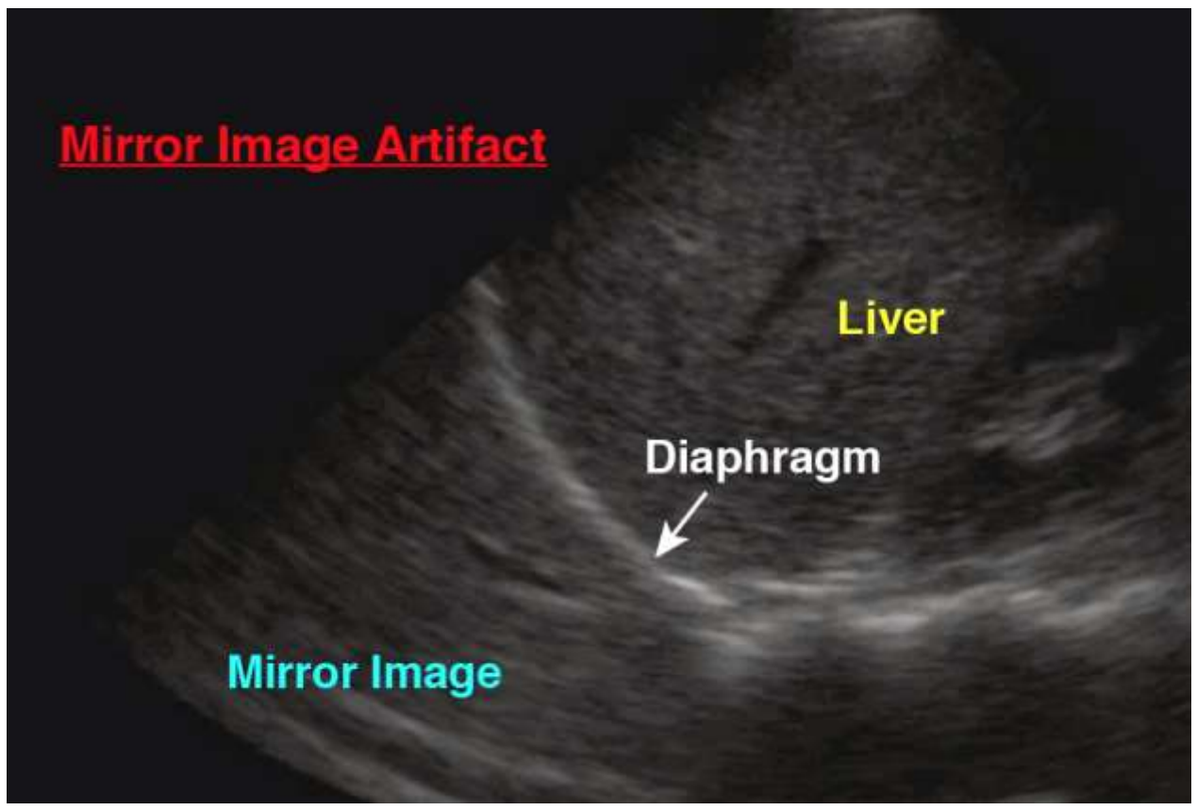
You can look for lung sliding with B-mode or M-mode:

HEMOTHORAX – EFAST

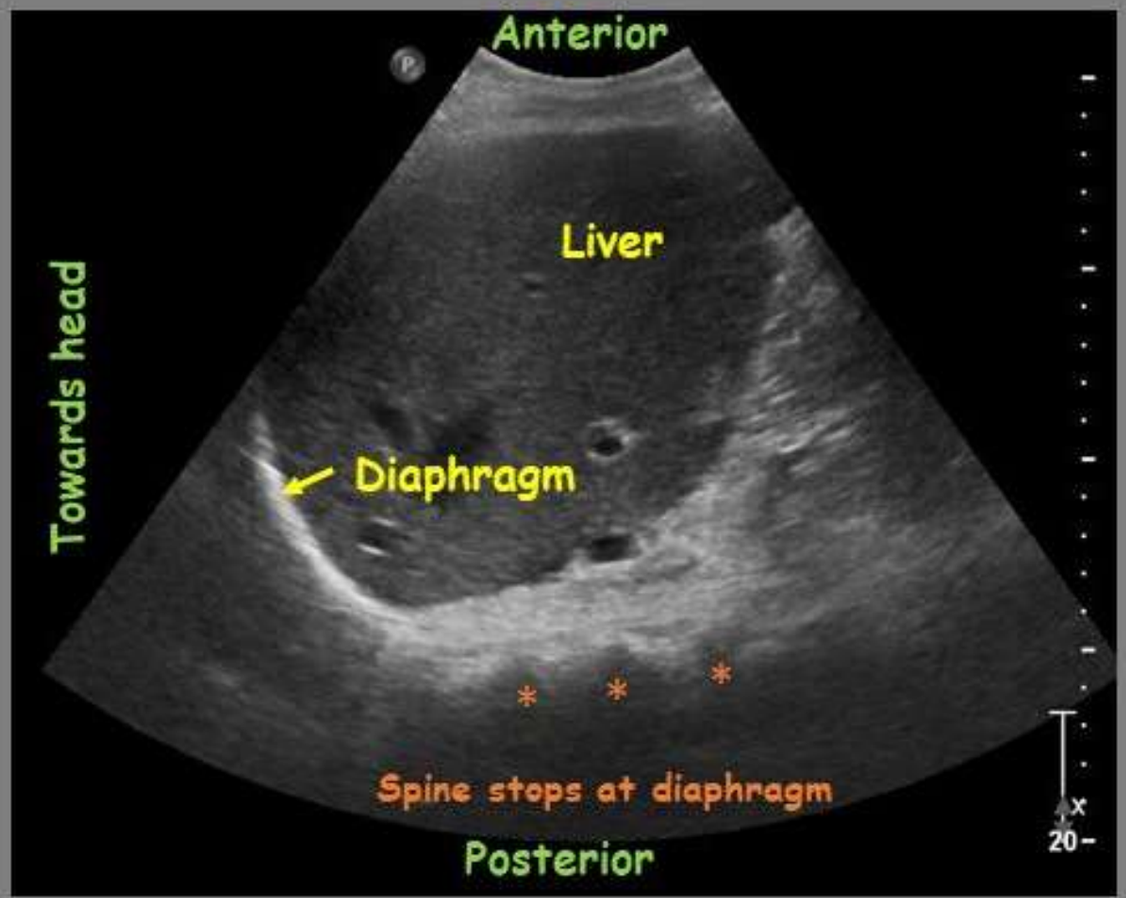
Visualizing the patient's

spine above the diaphragm implies that there is free fluid (e.g. blood) in the thorax since ultrasound waves can easily pass through the free fluid in the chest cavity, allowing you to see the spine. This is re





Spine sign or Thoracic spine sign



No Pleural effusion

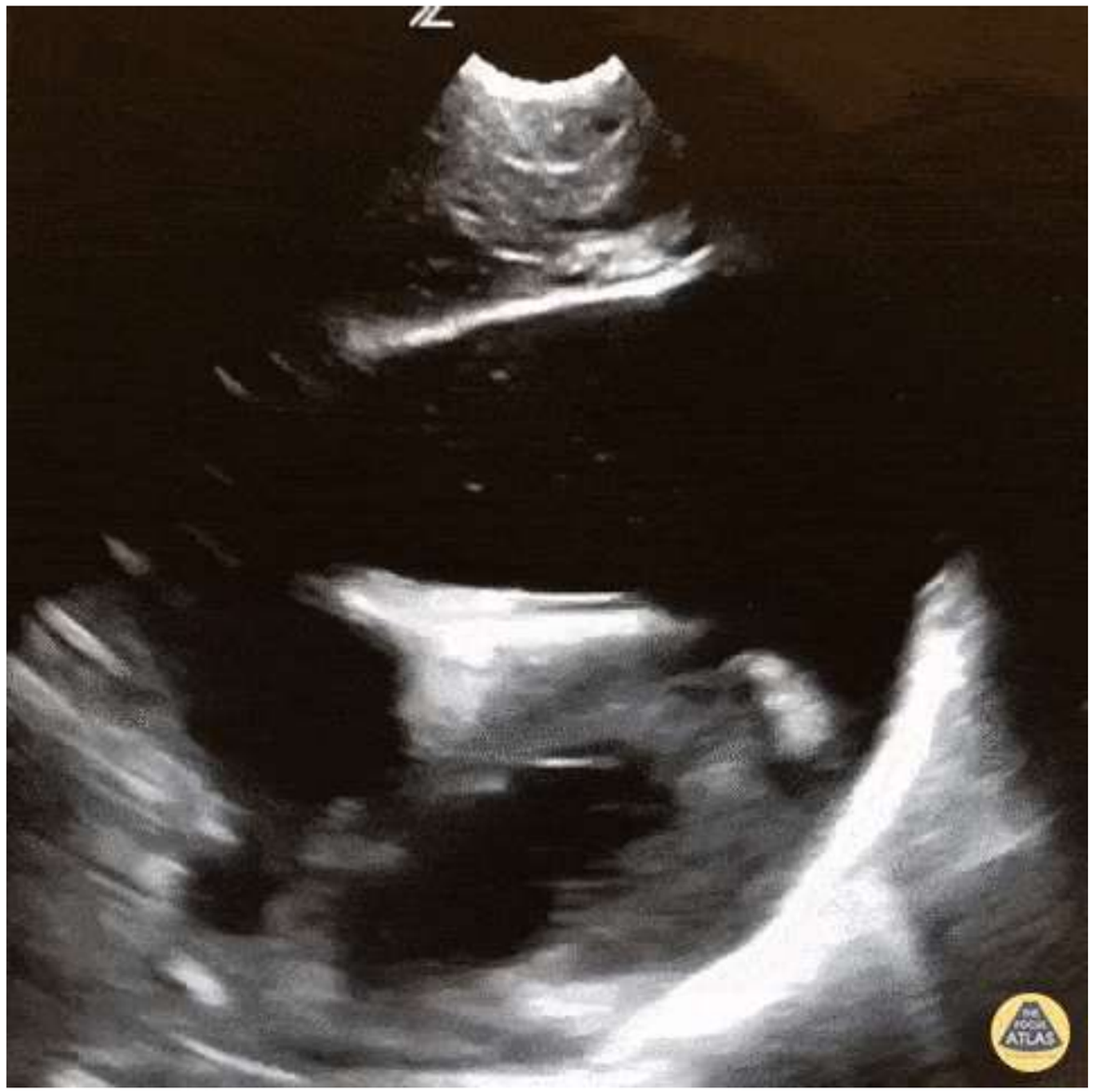
Pleural effusion

* Shadowing from vertebral bodies

Pericardial Effusion and Tamponade – eFAST

- **Anechoic** free fluid can accumulate in the pericardial sac causing a **pericardial effusion**.
- Simply seeing a pericardial effusion not mean the patient has cardiac tamponade. Rather, the **fluid must be impairing cardia filling for it to be considered tamponade**.
- Consider tamponade when the following is observed:
  - **RIGHT ATRIAL SYSTOLIC COLLAPSE** – the **most sensitive** *(and earliest)* echocardiographic finding of tamponade (Perez-Casares, A., et al). Also referred to as the ***Trampoline Sign.***
  - **RIGHT VENTRICLE DIASTOLIC**

HAEMOPERICARDIUM



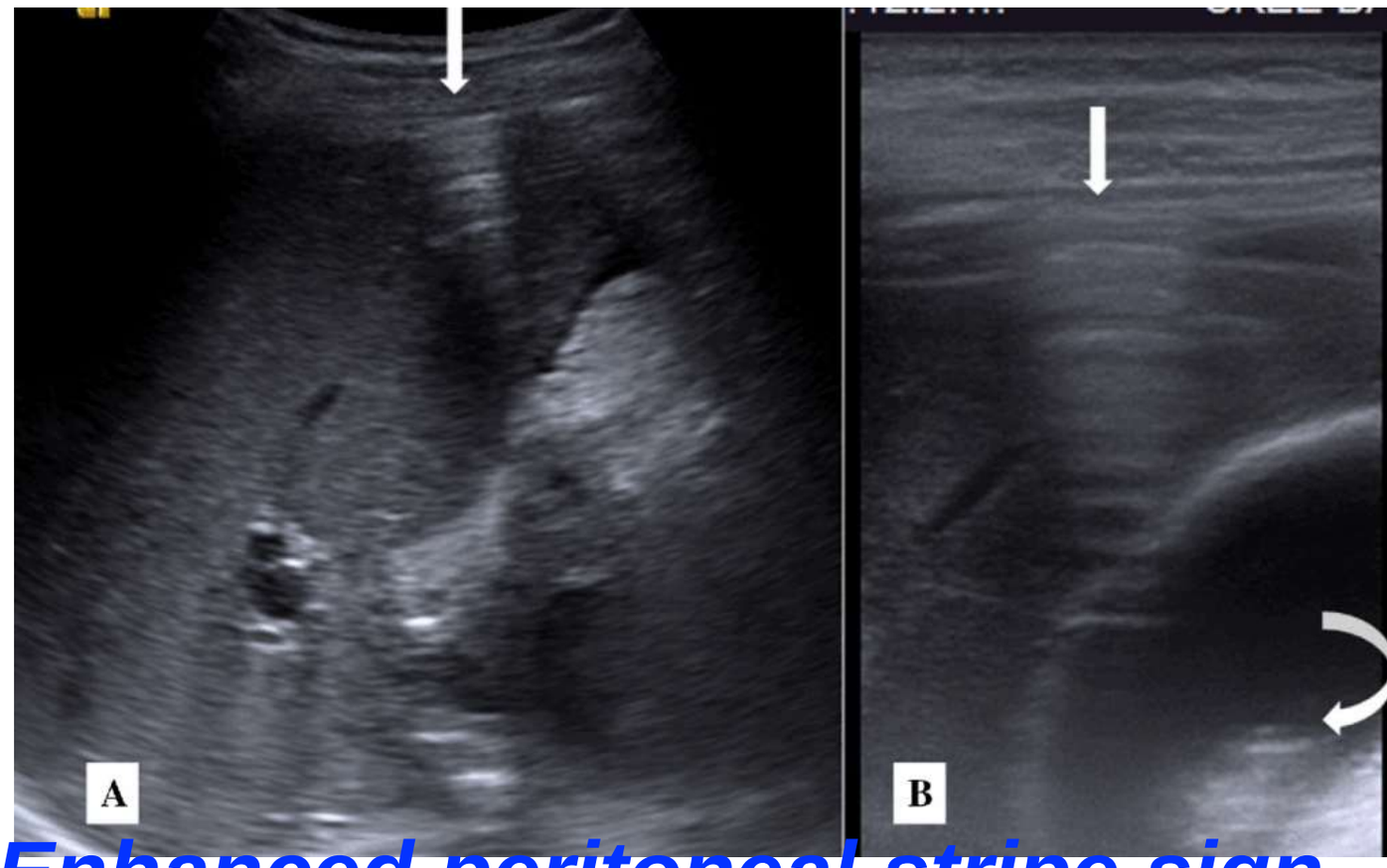
ATRIAL APPENDAGE HAEMOPERICARDIUM

Enhanced Peritoneal Stripe Sign (EPSS).

PNEUMOPERITONEUM – eFAST

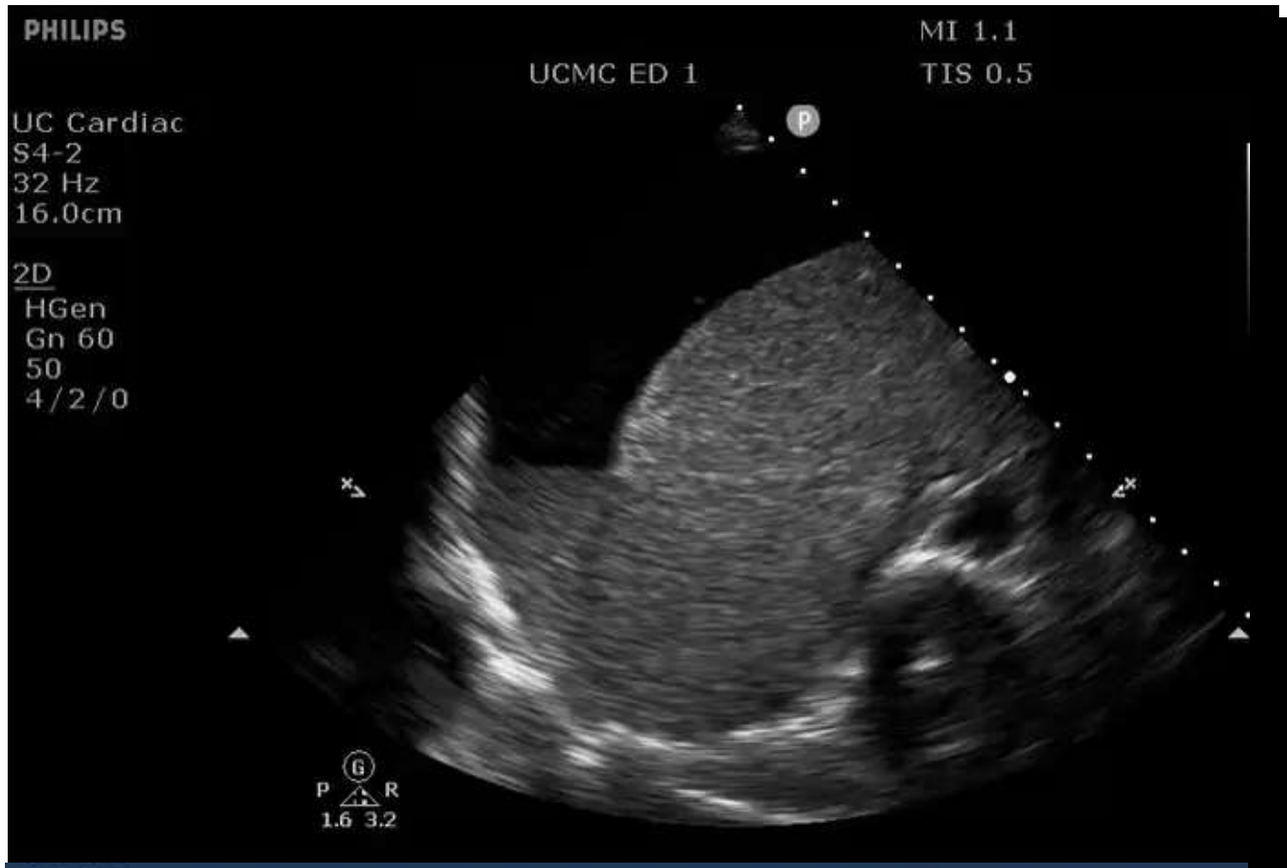
This is when air within the peritoneal space rises and causes an “echoing” of the usually single, hyperechoic peritoneal stripe that separates the abdominal wall from underlying peritoneal fluid and fluid-filled organs

if you can’t get any good abdominal views despite having your probe in the



Enhanced peritoneal stripe sign (EPSS) seen anterior to the liver in both images (straight arrows), indicating the abnormal presence of air between the liver

Pneumoperitoneum from perforated duodenal ulcer



Complex Ascites with Air Bubbles in Colonic Perforation on POCUS

ultrasound VILLAGE

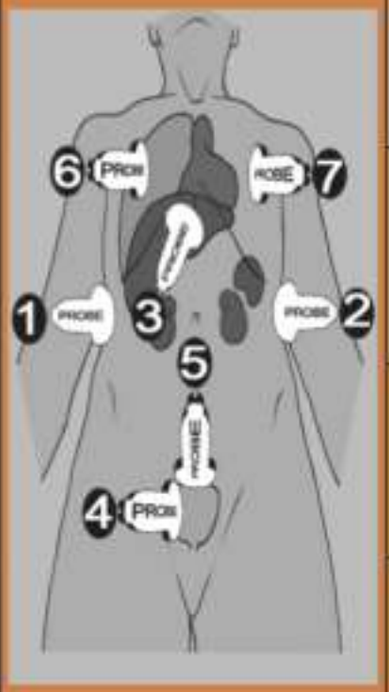
E-FAST

E-FAST is a limited trauma ultrasound that only aims to detect:
- Intra abdominal free fluid
- Pericardial effusion
- Major haemothorax
- Pneumothorax

A normal E-FAST does not exclude significant intra abdominal injury

Patient details

Mechanism of Trauma	Pulse	BP	RR	Sats
Examination Findings				

Probe Position	Views	Notes
	1 RUQ 	**RUQ** Fluid collects in Morison's Pouch Look above diaphragm for HTX 5° head down tilt will increase RUQ fluid
	2 LUQ 	**LUQ** Fluid can collect around the entire spleen Look above the diaphragm for HTX
	3 Subcostal 	**Subcostal** Tamponade is a clinical diagnosis Look for fluid in the pericardial space Intra-abdominal fluid above the liver can simulate fluid in front of the right ventricle - although it is on the other side of the diaphragm Pericardial fat pads may give the appearance of pericardial fluid Fluid must have a depth of >5mm; traces of pericardial fluid are normal
	4 Male Pelvis LS 	**Pelvis** Look for free fluid behind and above the bladder In the female, fluid collects initially in the Pouch of Douglas A small amount of pelvis free fluid is normal in women
	5 Female Pelvis TS 	
	6 & 7 Lung LS 	**Lung** Sliding sign and comet tail artefact are normal; loss of these indicate PTX Pleurodhesis, large bullae, COPD and non-ventilation (eg endobronchial intubation) can simulate PTX

Findings				Optional Information
Right Upper Quadrant	Normal	Inadequate	Positive	< 2mm maximal depth 2 - 10mm maximal depth > 10 mm maximal depth
Right Haemothorax	Normal	Inadequate	Positive	
Left Upper Quadrant	Normal	Inadequate	Positive	< 2mm maximal depth 2 - 10mm maximal depth > 10 mm maximal depth
Left Haemothorax	Normal	Inadequate	Positive	
Subcostal	Normal	Inadequate	Positive	Maximal depth_____mm
Pelvis	Normal	Inadequate	Positive	< 2mm maximal depth 2-10mm maximal depth > 10 mm maximal depth
Right Lung Pneumothorax	Normal	Inadequate	Positive	Detected anteriorly Anteriorly and laterally
Left Lung Pneumothorax	Normal	Inadequate	Positive	Detected anteriorly Anteriorly and laterally

Conclusions (Note: E-FAST findings must be consistent with clinical suspicion; integrate history, examination, investigations and EFAST findings to reach a conclusion)

Clinician	Signature	Date	Time

To complete the procedure…

Doc

the **standard views**, plus any additional images of pathology.

Explain to the patient that the procedure is now **complete**.

Dispose of PPE appropriately and **wash your hands**.

Document findings in the patient's notes.

Discuss options for appropriate **management** based on sonography findings:

- Haemodynamically unstable patients with positive eFAST: emergency laparotomy
- Haemodynamically unstable patients with negative eFAST: CT scan, assess for non-peritoneal haemorrhage or repeat eFAST
- Haemodynamically stable patients with positive eFAST: CT scan

DAMAGE CONTROL

- **Stage 1**:Minimum surgery is done
  - achieve haemostasis.
  - Limit the contamination
  - Temporary stabilisation of unstable fractures
- **Stage 2**:Physiological restoration in ICU.
- **Stage 3**:Return to operation theatre for definitive surgery.

Conclusion

High velocity trauma is aptly called neglected step child of modern civilisation being the number one cause of death in 18 to 34 years age group. Despite the major economic productivity losses due to this problem injury receives < 2 % of the total health budget allocation. Adequate funding & legislations must be passed to reduce the enormous impact on the society.

AUTOMATED INTELLIGENCE