POCUS Club

Echo in Life Support & Shock

Evidence

Cardiac arrest - Gaspari et al. 2016

- Non-randomised, prospective observational study, 20 hospitals in US/Canada, **n= 793**.
- Included OHCA or in-ED arrest in PEA (n=411) and asystole (n=379). Excluded pts with short resuscitation time (<5 min). US performed at beginning of ALS.
- Primary outcome was **survival to hospital admission**.
- **Cardiac activity on US associated with ↑ survival** to admission (OR 3.6, 2.2-5.9) and discharge (OR 5.7, 1.5-21.9).
- **No cardiac activity + asystole strongly associated with non-survival** (though 0.6% survived to discharge).

Non-survival to Hospital Discharge if no Cardiac Activity on Echo	
Rhythm: Asystole	
Sensitivity	90
Specificity	0
Positive Predictive Value	0.99
Negative Predictive Value	0.00
Rhythm: PEA	
Sensitivity	47
Specificity	91
Positive Predictive Value	1.00
Negative Predictive Value	0.04

Echo in cardiac arrest

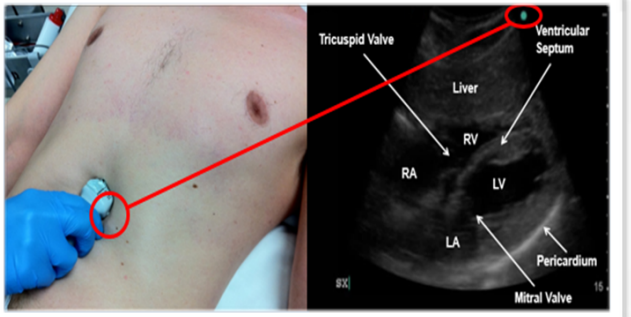
Indication

PEA/Asystole - to differentiate low-flow states (organised cardiac activity) from true PEA (with cardiac standstill).

Technique

Subxiphoid view - ideal as out of the way of chest compressions. Use **overhand grip**.

Try parasternal views on subsequent rhythm check if no subxiphoid window.



What to look for?

1. **Cardiac activity** - better prognosis if cardiac activity present, may be indication to continue resuscitation.
2. **Pericardial effusion/tamponade** - US is the only reliable way to exclude this.
3. **Gross RV dilatation/dysfunction** - Note that cardiac arrest itself may cause RV dilatation (shown in pigs, Aagaard 2017), so not always be specific for PE. Consider hx, repeat echo in ROSC & look for other signs!

KEY QUESTIONS

Is there **cardiac activity**?

Is there **pericardial effusion**?

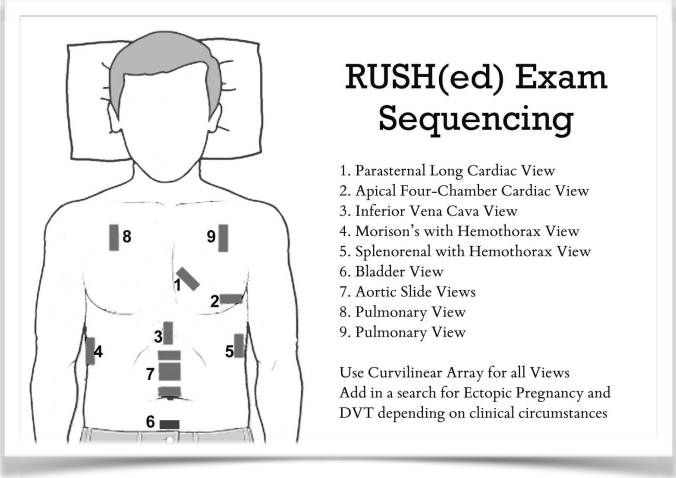
Is there **gross RV enlargement**?

"Can anyone feel a pulse?"

- No cardiac windows? Consider US for **detecting pulse** instead of manual pulse check (which can be unreliable).
- Use linear probe, vascular preset.
- Femoral is most straightforward.
- Consider inserting A-line whilst at it!

Tips to avoid prolonged pauses to CPR

1. Have US turned on and probe pre-gelled prior to patient arrival.
2. Have probe in position during chest compressions to find window and minimise time to getting a view.
3. **Record a clip**, which you can review whilst CPR ongoing.
4. Have a counter (count down from 10) to avoid getting task-focussed.



Shock

POCUS can help diagnose or categorise the cause of shock. Consider in unexplained **hypotension**, **tachycardia**, **tachypnoea** or **looks sick** (LLS+ve).

RUSH protocol - "HI-MAP (ED)"

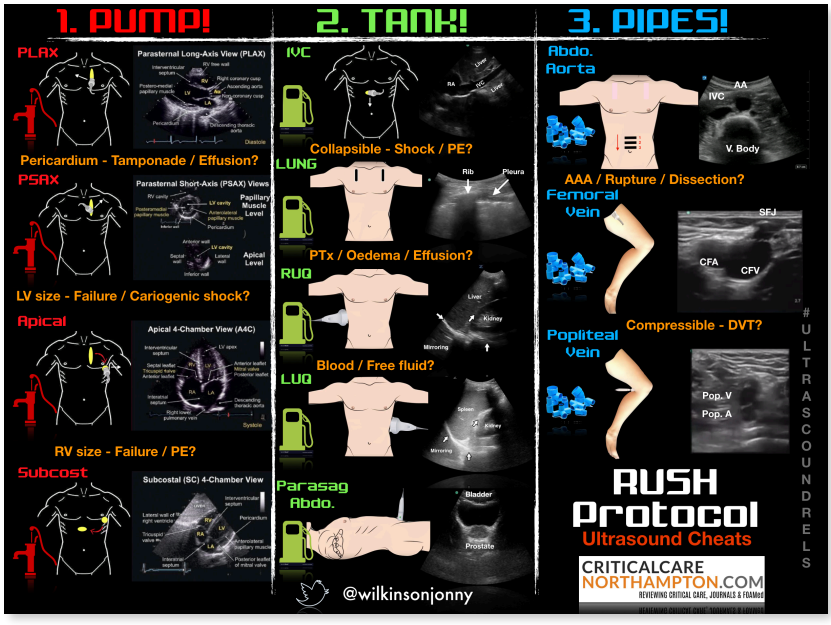
Easy to remember mnemonic for sequence of scan.
Asking **focussed questions** will reduce time.
Can be done in <5 min if well-practiced!

Heart	**Global LV function**? **Pericardiac effusion**? **RV strain**?
IVC	**Flat** or **distended**?
Morisson's pouch (+rest of FAST)	Peritoneal or pleural **free fluid**?
Aorta	**Aneurysm** or **dissection**?
Pulmonary	**Pneumothorax**? **B-lines**?
Optional	Ectopic? DVT?

Pump, Tank & Pipes approach

Helps to categorise shock using sonographic signatures.

Combining heart, lung and IVC can help determine where patient lies on Starling's curve! Use it to guide fluid resuscitation.



RUSH Evaluation	Hypovolemic Shock	Cardiogenic Shock	Obstructive Shock	Distributive Shock
Pump	Hypercontractile heart Small chamber size	Hypocontractile heart Dilated heart	Hypercontractile heart Pericardial effusion Cardiac tamponade RV strain Cardiac thrombus	Hypercontractile heart (early sepsis) Hypocontractile heart (late sepsis)
Tank	Flat IVC Flat jugular veins Peritoneal fluid (fluid loss) Pleural fluid (fluid loss)	Distended IVC Distended jugular veins Lung rockets (pulmonary edema) Pleural fluid Peritoneal fluid (ascites)	Distended IVC Distended jugular veins Absent lung sliding (pneumothorax)	Normal or small IVC (early sepsis) Peritoneal fluid (sepsis source) Pleural fluid (sepsis source)
Pipes	Abdominal aneurysm Aortic dissection	Normal	DVT	Normal

RESOURCES

5 Min Sono: http://5minsono.com/rush_/
POCUS Atlas: http://www.thepocusatlas.com/ea-echo
EMCrit: https://emcrit.org/rush-exam/ https://emcrit.org/wp-content/uploads/2011/03/New-RUSH-Review-Article1.pdf
Critical Care Northampton: https://criticalcarenorthampton.com/pocusgrams/
EMLRC: https://www.emlrc.org/rush-vti/
Books: Echo Guided Life Support eBook (EGLS), Manual of Emergency and Critical Care Ultrasound (Noble), Introduction to Bedside Ultrasound Volume 1 (Dawson), Emergency Point-of-Care Ultrasound (Connolly)