Point of Care Ultrasound provides important **diagnostic**, **procedural** and **prognostic** guidance in the management of patients in cardiac arrest. To use ultrasound effectively to guide resuscitation, it is important to have a predefined strategy to incorporate insonation into the flow of ACLS care.

**Diagnostic point of care ultrasound in Cardiac Arrest**

**VF/VT** – ultrasound plays a limited role. May be useful in differentiation fine ventricular fibrillation from asystole.

**PEA/Asystole** – ultrasound has greater utility. PEA/Asystole arrests have a much broader differential than VF/VT. Many causes of PEA/Asystole can be uncovered by ultrasound.

<table>
<thead>
<tr>
<th>Hypovolemia</th>
<th>Tension Pneumothorax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoxia</td>
<td>Tamponade (Cardiac)</td>
</tr>
<tr>
<td>H+ Ion (Acidosis)</td>
<td>Toxins</td>
</tr>
<tr>
<td>Hypo/Hyperkalemia</td>
<td>Thrombosis (PE)</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>Thrombosis (ACS)</td>
</tr>
</tbody>
</table>

**Table 1. Differential Diagnosis of PEA/Asystole.** The “H”s and “T”s. US definable etiologies are bolded.

A number of protocols have been designed for both cardiac arrest and the intimately related problem of unexplained hypotension.
Table 2. Cardiac Arrest and Hypotension US protocols

Of these protocols, the one which includes only those elements we find essential and performable during a cardiac arrest is the RUSH exam. With the current paradigm of minimally interrupted CPR, the views obtained need to be split between those that can be performed during chest compressions and those that must be done with a still chest – i.e. during the rhythm or pulse check. The RUSH exam can be tweaked to allow this separation as noted below in Figure 1.

Figure 1. The RUSH Exam in Cardiac Arrest Resuscitation. (see last page)
In addition to a formal, algorithmic approach to the integration of ultrasound into ACLS, the ultrasound machine itself needs to be integrated into the team roles and positioning. As in trauma codes, when cardiac arrest team members have designated places and roles, resuscitation is run most efficiently. Figure 2 demonstrates the optimal placement of the team member assigned to sonography.

**Figure 2. Cardiac arrest team positions and roles.**
For efficiency, limit yourself to scanning with one multifunctional probe if for your cardiac arrest patients. This can be either a large curvilinear or a phased array transducer.

Figure 3. Curvilinear and Phased array transducers

Prognostic utility of ultrasound in cardiac arrest

Cardiac standstill carries exceedingly poor prognostic value. Most studies have shown no survival when standstill is seen on intraarrest echo (Blaivas, Salen). Of those few cases where patients survived to admission, no cases of survival with good neurologic outcome have been published.

Standstill can be documented as a video clip. Or with m-mode through the still heart.

Figure 3. Cardiac Standstill on M-Mode
References

More at sinalem.us


The RUSH exam in Cardiac Arrest Resuscitation

Patient in Cardiac Arrest
1. Start CPR
2. Place on Cardiac Monitor and check rhythm:

PEA/Asystole

VF/pVT

Unshockable Rhythm Pathway
1. Epinephrine 1mg IV/IO every 3-5 min
2. RUSH Exam (HI MAP)

Shockable Rhythm Pathway
1. Defibrillate
2. Continue ACLS

(H) Subxyphoid

Pericardial Effusion

Pericardiocentesis

Collapse

Crystalloid Infusion

Free Fluid

Consider surgical consultation, blood products

> 4 cm

Consider surgical consultation, blood products

(A) Aorta

Pneumothorax

Decompression

(M) Morison's, FAST

(DURING CPR)

(DURING CPR)

(P) Lung

Repeat Subxyphoid

Ventricular Fibrillation

Follow VF/pVT ACLS Pathway

RV > LV size, Thrombus

Consider Thrombolysis

Myocardial Contractility / Pseudo-PEA

Consider other causes:
- Hypoxia
- Acidosis
- Hypertension
- Hypokalemia
- Myocardial Infarction

Cardiac Standstill & EtCO2 <10 mmHg

END RESUSCITATION

Follow VF/pVT ACLS Pathway

Consider Thrombolysis

Consider other causes:
- Hypoxia
- Acidosis
- Hypertension
- Hypokalemia
- Myocardial Infarction

Cardiac Standstill & EtCO2 <10 mmHg

END RESUSCITATION