Ultrasound for Shock & Cardiac arrest

Hsin-Liang Liu, MD
NCKUH
Hsin-Liang Liu, MD

• Instructor of emergency ultrasound for ER in four medical centers in southern Taiwan

• Attending physician of Emergency medicine, National Cheng Kung University Hospital, Tainan, Taiwan

• Clinical assessment physician of Sonography in emergency medicine of Taiwan society of Emergency Medicine
You will know...

• Ultrasound in cardiac arrest
• Ultrasound in shock
• Protocols...which is better?
We have CT. Why ultrasound?
Cardiac arrest

- FATE
- FEEL\(^1\)
- FICE
- CAUSE
- BLUE
- FAST
- EFAST

Shock

- UHP
- FLASH
- RUSH\(^1\)
- EGLS
- SESAM
- BLUE
- FEER
- FEEL\(^2\)
- ELS
- TRINITY
- FASH
- RUSH\(^2\)
- FALLS
- POCUS
Which protocol is better?
Cardiac arrest

- FATE
- FEER
- FEEL\(^1\)
- FEEL\(^2\)
- FICE
- ELS
- CAUSE
Resuscitation ultrasound

Earliest Protocol

http://www.fate-protocol.com/
Basic FATE views

Pos 1: Subcostal 4-chamber
- Point right (patient’s left)

Pos 2: Apical 4-chamber
- Point right (patient’s left back)

Pos 3: Parasternal long axis
- Point left (patient’s right shoulder)
- Point right (patient’s left shoulder)

Pos 3: Parasternal LV short axis

Pos 4: Pleural scanning
- Liver/spleen
- Diaphragm
- Lung

Right
- 1
- 2

Left
- 3
- 4
FEER Focus Echocardiographic Evaluation in Resuscitation

ACLS flow chart
pseudoPEA

Dr. Breitkreutz
German Anaesthesia

ACLS 30:2
ECG Defibrillator
Rhythm?
Rhythm?
Rhythm?
Rhythm?
Rhythm?
ED / ICU
FEER 2007
Focus Echocardiographic Evaluation in Resuscitation
Dr. Breitkreutz
German Anaesthesia
Table 1. Focused Echocardiographic Evaluation in Resuscitation (FEER) management examination in ten steps

<table>
<thead>
<tr>
<th>Phase</th>
<th>Step with Command, Element</th>
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</table>
| High-quality CPR, preparation, team information | 1) **Perform** immediate and accurate BLS and ACLS according to AHA/ERC/ILCOR guidelines, at least five cycles of chest compression/ventilation  
2) **Tell** the CPR team: “I am preparing an echocardiogram”  
3) **Prepare** portable ultrasound (let prepare) and **test** it  
4) **Accommodate** situation (e.g., best position of patient and doctor, removal of clothes), be ready to start |
| Execution, obtaining the echocardiogram | 5) **Tell** CPR Team to count down 10 secs and to undertake a pulse check simultaneously  
6) **Command:** “Interrupt at the end of this cycle for echocardiography”  
7) **Put** the probe gently onto the patients subxiphoidal region during chest compressions  
8) **Perform** a subcostal (long axis) echocardiogram as quickly as possible. If you cannot identify the heart after 3 secs, stop the interruption and repeat again five cycles later and/or with the parasternal approach. |
| Resuming CPR | 9) **Command** after 9 secs at the latest: “Continue CPR” and control it |
| Interpretation and consequences | 10) **Communicate** (after continuation of chest compressions only) the findings to the CPR team (e.g. wall motion, heart is squeezing, cardiac stand still, (massive) pericardial effusion, no conclusive finding, suspected pulmonary artery embolism, hypovolemia) and **explain** consequences and follow-up procedure |
CAUSE
Cardiac Arrest
Ultrasound Exam

Dr. Hernandez
USA
EM

One more thing...

Tension Pneumothorax
Figure 8  Flow diagram demonstrating use of C.A.U.S.E. protocol in patients with cardiac arrest.
Fig. 1. The US-CAB protocol in an advanced life support (ALS)-compliant manner.
Fig. 1. The US-CAB protocol in an advanced life support (ALS)-compliant manner.
Shock ultrasound

Earliest Protocol
Rapid Ultrasound in Shock and Hypotension

https://emcrit.org/rush-exam/original-rush-article/
RUSH 2010
Rapid Ultrasound in SHock

Dr. Perera
USA
EM

PUM
PUMP

TANK

PIPE

H L I F A D
<table>
<thead>
<tr>
<th>RUSH Evaluation</th>
<th>Hypovolemic Shock</th>
</tr>
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<tbody>
<tr>
<td>Pump</td>
<td>Hypercontractile heart</td>
</tr>
<tr>
<td></td>
<td>Small chamber size</td>
</tr>
<tr>
<td>Tank</td>
<td>Flat IVC</td>
</tr>
<tr>
<td></td>
<td>Flat jugular veins</td>
</tr>
<tr>
<td></td>
<td>Peritoneal fluid (fluid loss)</td>
</tr>
<tr>
<td></td>
<td>Pleural fluid (fluid loss)</td>
</tr>
<tr>
<td>Pipes</td>
<td>Abdominal aneurysm</td>
</tr>
<tr>
<td></td>
<td>Aortic dissection</td>
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</table>
EGLS
Echo Guided Life Support

2010
Dr. Lancto
Canada
EM

Pneumothorax
Tamponade
Hypovolemia
LV function
RV strain

H L I
The EGLS algorithm

1. Is there a pneumothorax?
   Thoracic views for:
   - B-Lines or lung sliding as it excludes pneumothorax
   - Lung point (?)

   YES → Drain and administer fluid
   Perform EFAST if trauma patient

   NO →

2. Is tamponade present?
   Subcostal window for:
   - Pericardial effusion
   - RA and RV diastolic collapse
   - Plethoric IVC without respiratory variation

   YES → Consider sepsis, occult blood loss, distributive shock

   NO →

3. Is the patient hypovolemic?
   Subcostal window for:
   - Dynamic LV function
   - LV walls kissing
   - Small or collapsing IVC
   - Clear lungs

   YES → Administer aggressive fluid resuscitation, antibiotics, steroids if indicated
   Ultrasound search for specific causes

   NO →
NO

Complete focused echocardiography (parasternal long/short axis, apical view)

4. If poor LV function noted: Is it the main cause of hypotension? Look for:
   - Association with B-Profile plus Plethoric IVC without respiratory variation

   YES
   - Consider myocardial infarction, intoxication, electrolytes and acid-base disturbances
   - Perform EKG
   - Consider revascularisation
   - Consider antidotes
   - Early intubation

NO

5. Are there signs of RV strain? Look for:
   - Dilated RV
   - "D-shape" left ventricle in short axis view
   - Paradoxical septal wall movement
   - Plethoric IVC without respiratory variation

   YES
   - Consider massive pulmonary embolism, RV infarction, chronic disease,
   - Perform EKG
   - Consider thoracic CTA
   - Consider thrombolysis
Figure 2  The causes of hypotension and their ultrasound findings
Sonographic Evaluation of Aetiology for Respiratory difficulty, Chest pain, or Hypotension using 9Es

- Empty thorax
- Effusion
- Exit
- Edema lung
- Equality
- Endocardial inward motion
- EF
- E/E’
Which protocol is better??
Heart + IVC

4 Focus

Fluid Function Form Filling

3 Point, 2 View

1 2 3 4 5
Lung

Dry

Wet
Diffuse coarse wheezing
JVD (-) LEG edema (-)
Same situation
Different Echo Pattern
Pul. Embolism
Hypovolemia
Ultrasound for shock & cardiac arrest

Heart

IVC

Lung
Ultrasound for shock & cardiac arrest

Heart + IVC

4 focus

Fluid Function Form Filling

3 point, 2 VIEW

Hsin-Liang Liu, MD
cutelpliu@gmail.com