

## The UHP Ultrasound Protocol: A Novel Ultrasound Approach to the Empiric Evaluation of the Undifferentiated Hypotensive Patient

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## The UHP Ultrasound Protocol

- Undifferentiated hypotensive patient
  - Found reversible condition!
- free fluid evaluation
- qualitative cardiac evaluation
- abdominal aorta evaluation

## Case I

- 70 y/o female , sent to ER due to syncope
- At ER: BP: 80/palpation; HR: 120; RR: 30
- PE: normal; No trauma
- Normal ECG
- the UHP ultrasound protocol
  - aorta revealed a 6-centimeter aneurysm with associated intraluminal clot

## Case II

- 40y/o woman with SLE and recurrent PE hx sent to ER due to SOB
- the UHP ultrasound protocol
  - pericardial effusion

## Case III

- 45y/o man, hypotension with left flank pain
- the UHP ultrasound protocol
  - Morison's pouch view showed intraabdominal fluid

## Discussion

- Goal: for systemic evaluation of reversible and time-dependent cause of hypotension
  - hemoperitoneum, pericardial effusions, and aortic aneurysms
- May also apply to PEA patient
  - D/D: hypovolemia, pericardial effusion

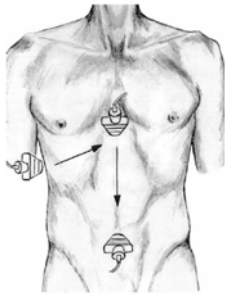


FIGURE 2. Single hepatorenal view.

Morison's pouch: for evaluation of intra-abdominal fluid

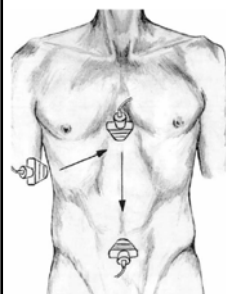


FIGURE 3. Transverse subxyphoid view.

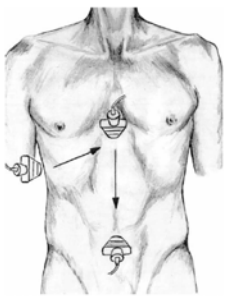


Figure 4. Transverse aortic view.

from the substernal position  
down to the bifurcation of the iliac vessels

## Limitation

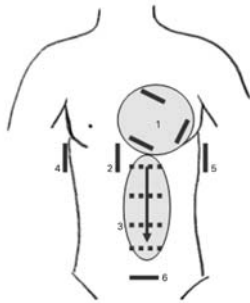
- Single Morison's pouch view: lower sensitivity
- Aortic evaluation
  - Obesity, bowel gas
  - Saccular aneurysm
- Transverse subxyphoid view: enough for detected pericardial effusion

Thank you for your attention!!

Abdominal and Cardiac Evaluation  
with Sonography in Shock (ACES): an  
approach by emergency physicians  
for the use of ultrasound in patients  
with undifferentiated hypotension

P R T Atkinson, D J McAuley, R J  
Kendall, et al.  
Emerg Med J 2009 26: 87-91

## The Abdominal and Cardiac Evaluation with Sonography in Shock (ACES) protocol



- 1 one or more cardiac views
- 2 an inferior vena cava view
- 3 a screen of the abdominal aorta
- 4 Right and 5 left flank view
- 6 pelvic view

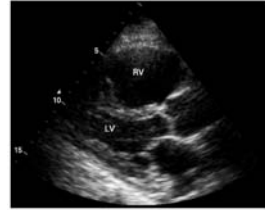


Figure 3 Focused cardiac scan (parasternal long-axis view) showing a dilated right ventricle (RV), LV, left ventricle.

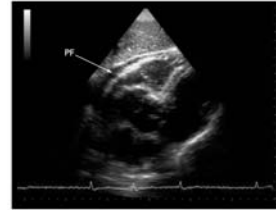


Figure 4 Focused cardiac scan (subcostal view) showing pericardial fluid (PF).



Figure 5 Left upper quadrant view showing haemoperitoneum/peritoneal fluid (PF).

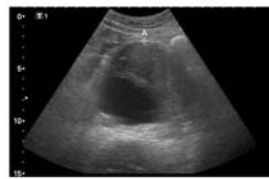
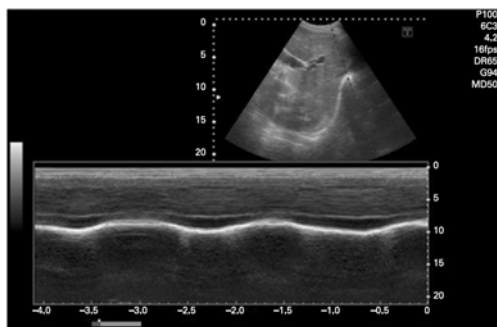


Figure 6 Aortic scan showing an 8-cm abdominal aortic aneurysm (between markers).

## Discussion- Hypovolemia

- IVC diameter
    - Reliable for indicator of blood loss
    - Collapsed index
- | Expiratory (max) diameter IVC | Collapse index (%)<br>100 - (max - min diameter) / max diameter | Estimated right atrial pressure |
|-------------------------------|---|---------------------------------|
| <2 cm                         | >40-50%   | <10 mm Hg                       |
| >2 cm                         | <40-50%   | >10 mm Hg                       |
- Must consider with ventricular size, wall motion and pericardial fluid
  - With other view: haemoperitoneum or haemothorax, abdominal aortic aneurysm

## Subcostal longitudinal view of the inferior vena cava



## Discussion- Obstruction

- Pericardial effusion
  - reduced IVC collapse index
  - collapse of the right side of the heart during diastole
- Heart motion, and morphology
- Embolism, thrombosis
  - IVC distension or non-collapsibility

## Discussion-

- **Cardiogenic**
  - gross abnormalities of cardiac function and size
- **Distributive**
  - Hyperdynamic left ventricle, which has a 94% specificity for sepsis
- **Adjuncts**
  - Femoral vein, parasternal and apical views of the heart, thoracic views

**Table 1** Abdominal and Cardiac Evaluation with Sonography in Shock (ACES) protocol: possible ultrasound findings in shock

Category of shock	Cardiac	IVC	Aorta	Peritoneal fluid/ blood	Pleural fluid/ blood
Septic	Hyperdynamic left ventricle Hypodynamic in late sepsis	Narrow IVC Collapses	Normal	?Surgical/ gynaecological sepsis	?Pneumonia
Cardiogenic	Hypodynamic left ventricle	Normal	Normal	Normal	Normal
Hypovolaemic	Hyperdynamic left ventricle	Narrow IVC Collapses	?AAA	?Spontaneous splenic rupture ?Perforated viscous ?Gynaecological bleed	Normal
Obstructive (cardiac tamponade)	Pericardial fluid  Diastolic collapse right ventricle	Variable IVC  Minimal collapse	Normal	Normal	Normal
Obstructive (pulmonary embolus)	Dilated right ventricle	Dilated IVC  Minimal collapse	Normal	Normal	Normal

AAA, abdominal aortic aneurysm; IVC, inferior vena cava.

Thank you for your attention!!

**C.A.U.S.E.:** Cardiac arrest ultrasound exam— A better approach to managing patients in primary non-arrhythmogenic cardiac arrest

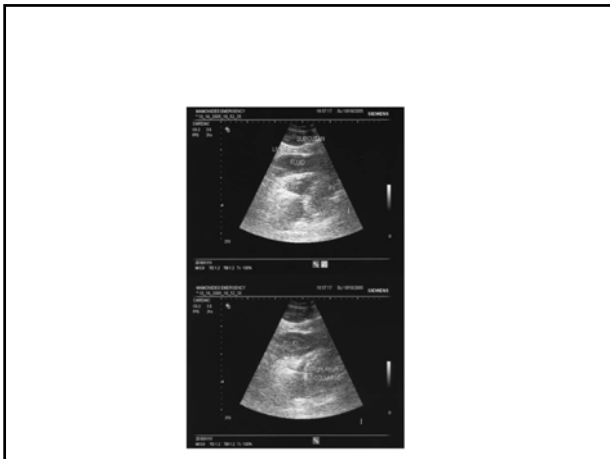
Caleb Hernandez, Klaus Shulera, Hashibul Hannana, Chionesu Sonyikaa,  
Antonios Likourezosa,\*; John Marshalla,b  
RESUS-3413; No. of Pages 9

## Introduction

- **Cardiac arrest**
  - VT, VF: focus on treatment
  - PEA, asystole: focus on underlying cause
- **C.A.U.S.E. (cardiac arrest ultrasound examination)**
  - cardiac tamponade, severe hypovolemia, pulmonary embolus, tension pneumothorax, and true asystole

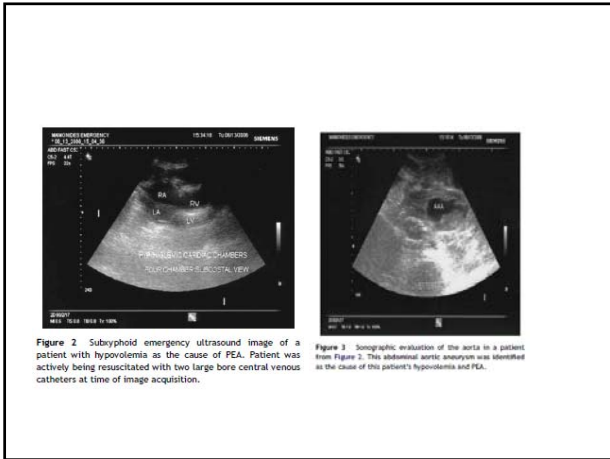
## Sonograph for Cardiac Tamponade

- Visualizing pericardial effusion and right chamber collapse
- D/D from tension pneumothorax
  - AHA: neck vein distention and no pulse
- Avoid inappropriate therapy



### Sonograph for Hypovolemia

- Echo: flattened right and left ventricles
- IVC diameter
  - Volume status and RV pressure
  - Flap or Collapsed IVC: hypovolemia
  - dilated IVC (>20mm): pump failure
- Avoid inappropriate therapy

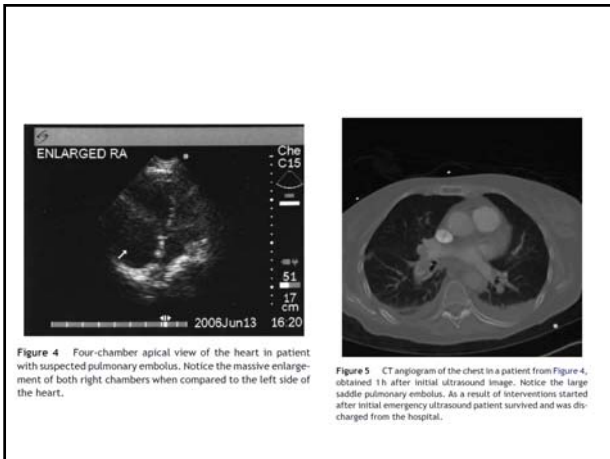


**Figure 2** Subxyphoid emergency ultrasound image of a patient with hypovolemia as the cause of PEA. Patient was actively being resuscitated with two large bore central venous catheters at time of image acquisition.

**Figure 3** Sonographic evaluation of the aorta in a patient from Figure 2. This abdominal aortic aneurysm was identified as the cause of this patient's hypovolemia and PEA.

### Sonograph for Pulmonary Embolus

- 5% of cardiac arrest case
- Sonograph showed an engorged RV with a flattened LV
  - low to moderate sensitivity and high specificity
  - Echo would be evident after acute obstruction of more than 30% of the pulmonary arterial bed



**Figure 4** Four-chamber apical view of the heart in patient with suspected pulmonary embolus. Notice the massive enlargement of both right chambers when compared to the left side of the heart.

**Figure 5** CT angiogram of the chest in a patient from Figure 4, obtained 1h after initial ultrasound image. Notice the large saddle pulmonary embolus. As a result of interventions started after initial emergency ultrasound patient survived and was discharged from the hospital.

### Sonograph for Tension Pneumothrax

Sonograph for Tension Pneumothrax

- Absent of Sliding sign
- Can diagnosed within 30s with high sensitivity and specificity
- D/D: Cardiac tamponade

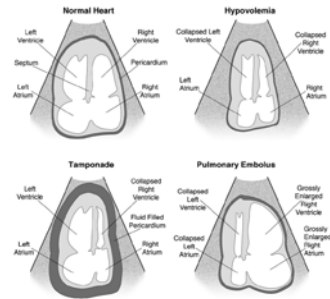
### Sonograph for True asystole

- Complete absence of any heart motion
- Time for terminating resuscitation
  - Blaivas et al.: 100% death rate

## C.A.U.S.E

- Addresses for leading cause of cardiac arrest
- Four-chamber view
  - subcostal, parasternal or apical thoracic windows
  - Hypovolemia, massive PE, Cardiac tamponade
- Anteromedial views of the lung and pleura
  - at the level of the second intercostal space at the midclavicular line bilaterally

## Four Chamber View



## Echo finding on Pneumothorax

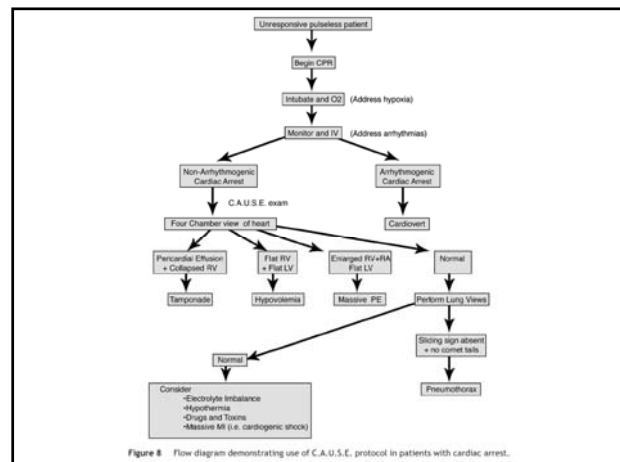
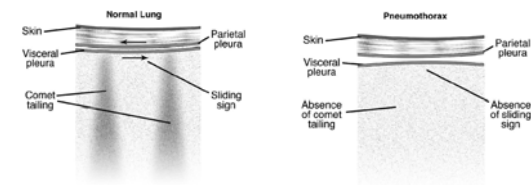


Figure 8 Flow diagram demonstrating use of C.A.U.S.E. protocol in patients with cardiac arrest.

## Summary

- Cardiac arrest patient divided to arrhythmic and non-arrhythmic
- If non-arrhythmic
  - First: Four chamber view for Massive PE, Cardiac tamponade and hypovolemia
  - Then: Pulmonary View for pneumothorax
- If all normal: Consider e- imbalance, hypothermia, drugs or toxins, Massive MI

Thank you for your attention!!