

The ACES scan



Ultrasound in hypotension

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The ACES scan



- **A**bdominal
(and)
- **C**ardiac
- **E**valuation
(with sonography in)
- **S**hock

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The ACES scan

- Extension of more established emergency medicine uses of ultrasound
- Abdominal component
- Cardiac component
- (Peripheral component)

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Case 1

- 'Red call'
- Elderly female – collapsed and absent radial pulse
- Arrives – peri-arrest
- Groaning
- Initial resuscitation
- ACES scan

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Case 1

- Huge AAA, tender
- Terminal care instituted



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Case 2

- 'Red call'
- 62 year old man
- Hypotension, epigastric pain
- Unwell ?AAA
- 10 minutes

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Case 2

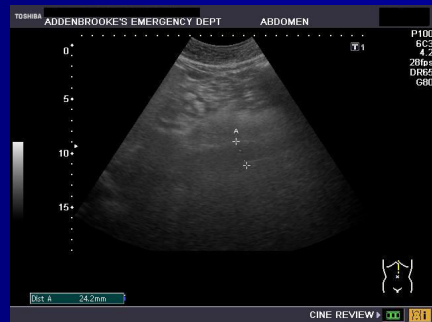
- BP 74/54, Pulse 110, clammy
- Initial resuscitation underway
- ACES scan

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Abdomen

- No AAA



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Abdomen



- No free fluid



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Abdomen - IVC



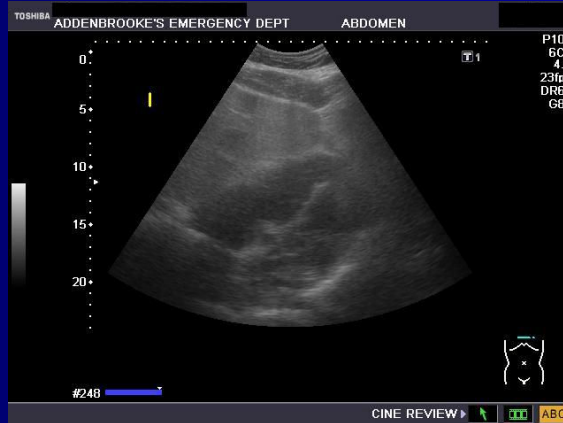
- Slight collapse on inspiration



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Cardiac - subcostal

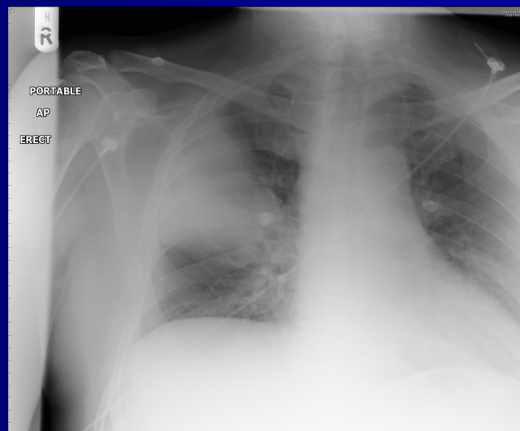
- No pericardial effusion
- Hyperdynamic
- Not small
- RV not dilated



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CXR

- Fluid challenge
- IV antibiotics
- IJ line
(us control)
- ICU



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ACES scan

- Aim is to help identify the likely cause of hypotension

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Causes of Hypotension

- Hypovolaemia
- Obstructive (tamponade)
- Obstructive (PE)
- Cardiogenic
- Distributive (septic)

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Hypovolaemia

Two aims of ACES scan:-

- To establish existence of hypovolaemic state
 - IVC
 - 'collapse index'
 - Cardiac
 - Small chamber size 'small heart'
 - Aggressive wall motion 'hyperdynamic'
- To identify possible causes
 - AAA
 - Free fluid (haemoperitoneum)

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Tamponade

Aims of ACES scan to:-

- Identify pericardial effusion
- Collapse RA/RV during diastole = tamponade

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PE

ACES scan aims to identify:-

- RV dilatation
 - RV hypokinesis
 - Paradoxical septal motion
- IVC distension
- (Peripheral views for DVT)

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Cardiogenic

ACES scan aims to identify gross abnormalities of cardiac:-

- Size
 - Normal
 - Small
 - Dilated
- Motion
 - Normal
 - Hyperdynamic
 - Hypodynamic

Hypodynamic myocardium = cardiogenic

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Sepsis

ACES scan aims to identify:-

- Hyperdynamic left ventricular function
- Hyperdynamic heart has sensitivity of 33% and a specificity of 94% for sepsis

Diagnostic accuracy of left ventricular function for identifying sepsis among emergency department patients with non traumatic symptomatic undifferentiated hypotension

Jones A et al

Shock 2005 Dec;24(6) :513-7

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ACES scan - 6 windows

1. Cardiac
2. IVC
3. Aorta
4. RUQ
5. LUQ
6. Pelvis

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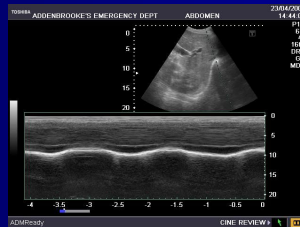
IVC and collapse index

- Relationship between IVC pressure and RA pressure
- Identify IVC
- Measure in inspiration and expiration
- M mode
- Calculate 'collapse index'

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IVC and collapse index



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Collapse Index

- Inspiration – IVC collapses slightly
- Expiration – IVC maximal diameter

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Collapse Index (CI)

$$CI = \frac{\text{Max diameter} - \text{Min diameter}}{\text{Max diameter}} \times 100\%$$

Maximum diameter - expiration

Minimum diameter - inspiration

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Collapse Index

- $CI > 50\%$ = RA pressure $< 10\text{mmHg}$
- $CI < 50\%$ = RA pressure $> 10\text{mmHg}$

Noninvasive estimation of right atrial pressure from the inspiratory collapse of the inferior vena cava

Kircher BJ et al

Am J Cardiol 1990 Aug 15;66(4):493-6

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ACES scan - subcostal

- Pericardial effusion
- Gross assessment of cardiac wall motion
 - Normal
 - Hypodynamic
 - Hyperdynamic
- Gross assessment of cardiac chamber size

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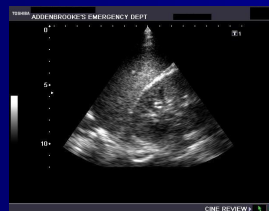
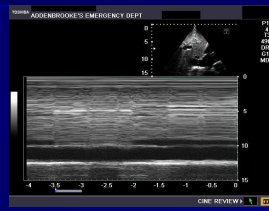
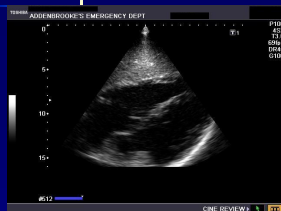
ACES scan – additional views



- Thoracic views – parasternal, apical
- Augment subcostal view
- (Peripheral views – DVT)

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Summary ACES scan



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