The Role of Ultrasound in the Trauma Patient

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Objectives

- Discuss the role of ultrasound in trauma patients
- Identify the areas to image when performing a FAST (Focused assessment with sonography for trauma) scan
- Discuss the literature as it relates to the use of ultrasound in trauma patients

Introduction

- Physical exam is unreliable
- DPL: Sens. 90-100% Spec. 73-100%
  - Invasive
  - Complication rate 2-5%
  - Non-therapeutic laparotomy rate
- CT: Spec. higher
  - Unsafe for unstable patients

Goals of US

- Determine need for further studies or laparotomy
- Decrease time to laparotomy
- Detection of:
  - Hemoperitoneum
    - As little as 250 cc can be detected
  - Pericardial effusions
  - Pleural effusions
Advantages of US
- Rapid, easy to use
- Non-invasive, safe
  - Can replace DPL
  - May decrease CT utilization
- No radiation or contrast agents
- Portable
- Serial Exams
- Sens. 79-89% Spec. 96-99%

Disadvantages of US
- Does not define injury
- Not sensitive for certain injuries
  - Solid organ
  - Retroperitoneal
  - Diaphragm
  - Hollow Viscous
- Unable to identify bleeding source

Sensitivity of US
- Increases with serial exams
- Influenced by:
  - Volume
  - Patient position (Trendelenberg)
  - Number of views
  - Prior abdominal surgery
  - Time since injury
  - Rate of bleeding
  - Training
  - Equipment
Penetrating Thoracic Injury

- Echo
  - Positive
  - Equivocal
  - Negative

Or

Pericardial Window

- Observe

Technique

- Key Principle of US:
  - Blood appears as echolucent or anechoic (black) stripe
  - ED ultrasound is a focused examination

- Key Question:
  - Is there free fluid?
  - YES/NO or inadequate study

Focused Assessment with Sonography for Trauma

- Ideally a 3.5 MHz microconvex probe
- Scan 4 regions:
  - RUQ (Morison’s pouch)
  - LUQ
  - Pelvis
  - Cardiac
  - +/- Pericolic gutters
  - +/- look for pneumothorax

Morison’s Pouch

- Place probe in mid to posterior axillary line (11th-12th interspace)
- Locate the liver and kidney
- Look for fluid (black, anechoic area) between these two organs
- Look for fluid above the diaphragm
- Positioning patient in Trendelenburg may help
**Perisplenic Area**

- Place probe in posterior axillary line at the 9th – 11th interspace
- Locate the spleen and kidney
- Look for fluid (black, anechoic area) between the spleen and diaphragm and at the splenorenal interface
- Look for fluid above the diaphragm
- Positioning patient in Trendelenburg may help
Suprapubic

- Ideally this exam should be done before a foley is placed.
- Place probe cephalad to the pubis
- Identify the bladder
- Look for fluid anterior, posterior and later to the bladder
  - Females will have uterus posterior to bladder
  - Look in cul-de-sac
Pericardium

- Place probe in subcostal region below xiphoid angled toward left shoulder
- Look for fluid surrounding the (white, hyperechoic) myocardium
Pericolic Gutters

- Sweep along the lateral aspect of the abdomen
- Look for free fluid and/or floating bowel
**Pneumothorax**

- Place high frequency linear probe in 2-4th interspace
- Lung sliding seen in normal lungs
  - Absent with pneumothorax
- M-mode: normal lung lines at top of screen with granular pattern below (seashore)
  - Area of pneumothorax shows all lines (stratosphere)

**Limitations of US**

- < 1% of pts. with neg US require laparotomy (Boulanger 1996)
- Up to 29% of pts. with intraperitoneal injury will not have hemoperitoneum by US
- 26% of patients with abd. injury had a negative ultrasound
  - Spleen, liver, kidney, mesentery (Sherbourne)
- NEGATIVE US DOESN’T R/O SURGICALLY CORRECTABLE INJURY
**Pitfalls**
- Failure to do multiple view exam
- Failure to consider other etiologies of free intraperitoneal fluid
- Failure to do serial exams
- Over reliance on ultrasonography
- Misinterpretation of US

**Training**
- SAEM 1994
  - 40 hrs of instruction and 150 exams for EM US
- ACEP 2001
  - Minimum 8 hrs of instruction and 25-50 proctored exams for Trauma US
  - Refer to ACEP web page and call for ACEP Resource Document

**Go Ultrasound!**