GOAL OF THE FAST EXAM

Demonstrate free fluid in abdomen, pleural space, or pericardial space.

EMERGENCY ULTRASOUND APPROACH

The focused assessment of sonography in trauma is unique for ultrasounds performed in the emergency department as it is designed as a screening assessment for patients involved in penetrating or blunt trauma. Although it is possible to use ultrasound to determine solid organ injury, the FAST scan is designed as a screening tool for peritoneal blood and should be used as such. Once the initial screening has been accomplished, it is possible to return to areas of interest and more fully evaluate for solid organ injury, but this should not impede patient care. Other imaging modalities are better suited to determining solid organ injury (i.e., CAT scan).
ANATOMY

The anatomy of interest in the FAST scan covers three areas of the abdomen and one of the thorax.

Right Upper Quadrant
Liver
Kidney
Diaphragm
Morison’s pouch (potential space between liver and kidney)

Left Upper Quadrant
Spleen
Kidney
Diaphragm
Splenorenal recess (potential space between spleen and kidney)

Suprapubic
Bladder
Uterus
Vesicouterine space or anterior cul-de-sac (potential space between bladder and uterus)
Rectouterine space or posterior cul-de-sac (pouch of Douglas) (potential space between uterus and rectum)

Subxiphoid/Parasternal
Liver
Diaphragm
Heart
Pericardial space (potential space around heart)

The anatomy of the abdomen during the FAST exam is unique in that the area of interest is the interface between the various abdominal or chest organs. The organs of three views of the FAST scan are used to identify the potential peritoneal spaces, but the first view identifies the pericardial space.
PATIENT POSITION

Supine
As a majority of patients are scanned following trauma, these patients will be “boarded and collared” with cervical spine and long board immobilization. There may be limited opportunity to reposition the patient secondary to concerns for cervical spine injury. In other words, the patient will be flat on his or her back and cannot be moved.

TRANSDUCER

3.0 to 5.0 MHz

Tricks of the Trade

- Deep breathing – Moves liver or spleen inferiorly and flattens the diaphragm, bringing the cardiac window closer to the subxiphoid region.
- Trendelenburg – Increases likelihood of detecting small amounts of fluid by bringing the fluid away from the air-filled bowel and into a space that is easier to view sonographically (i.e., splenorenal and hepatorenal windows).
- Infuse fluid in bladder catheter – Displaces bowel and creates a sonographic window to check for free fluid lateral and posterior to the bladder.

ULTRASOUND IMAGES

FAST Essential Images
- Subxiphoid
- Right upper quadrant (RUQ)
- Left upper quadrant (LUQ)
- Suprapubic (sagittal and transverse)

FAST Optional Images
- Right costophrenic angle
- Left costophrenic angle
- Parasternal long view of heart
FAST: SUBXIPHOID (LONG AXIS OR SHORT AXIS)

**Landmarks**
- Liver–cardiac interface
- Cardiac motion

**Image Elements**
- Liver–cardiac interface

**Tricks of the Trade**
- A distended stomach following an endotracheal intubation will prevent an adequate view of the pericardium. Repeating the subxiphoid view following the placement of a nasogastric tube may improve image quality.
- Have the patient take a deep breath and hold it if possible. This will flatten the diaphragm, bring the heart closer to the probe, and improve the image.
- Advance the probe laterally along liver margin until the heart appears on the screen. This uses the liver as a window to improve visualization of the pericardium.

**Partial View Probe Positioning**
Note: Many of the partial views contain information that is needed to accurately identify pathology. The ideal view may be unobtainable due to patient characteristics and multiple “partial views” will be required to complete the scan.
Too Close to Xiphoid Process
Liver dominates view
Incomplete view of heart

Too Far from Xiphoid Process
Liver dominates view
No or incomplete view of heart

Too Far Right
Liver–pulmonary interface
No heart in view
Too Far Left
No liver in image
No heart in view
Stomach gas obscures view

FAST: RIGHT UPPER QUADRANT

Landmarks
- Liver–kidney interface
**Image Elements**
- Liver–kidney interface
- Diaphragm
- Inferior pole of kidney

**Tricks of the Trade**

- On most patients it will be necessary to slide the probe toward the head to obtain more diaphragm, and toward the feet to get down to the lower pole.

- Rib shadows represent missing information that prevents you from obtaining all the necessary information on one static image. Rather, think of it as a dynamic process that involves “seeing around” the ribs to obtain all the necessary information.

- With practice, your mind will eventually “subtract out” the rib shadows as you manipulate the probe and as the patient breathes in and out.

- Retroperitoneal blood may be visualized “deep” to the kidney.

- When performing a FAST exam do not be distracted by pathology in other organs unrelated to the traumatic event (e.g., mild hydronephrosis in the kidney).

**Partial View Probe Positioning**

Note: Many of the partial views contain information that is needed to accurately identify pathology. The ideal view may be unobtainable due to patient characteristics and multiple “partial views” will be required to complete the scan.

**Too Cephalad**

Liver dominates view
Incomplete view of Morison’s pouch
Missing inferior tip of kidney, or
Missing inferior tip of liver, or
Excessive view of lung
**Too Caudad**

Kidney on left of screen
Incomplete view of Morison’s pouch
No view of diaphragm, or
Loops of bowel dominate image

**Too Medial**

Liver–bowel interface dominates screen
No view of Morison’s pouch
No view of kidney
(+/−) Vena cava or aorta in view

**Too Lateral or Too Posterior**

Kidney dominates image
Limited view of Morison’s pouch
No view of diaphragm
**FAST: LEFT UPPER QUADRANT**

**Landmarks**
- Liver–spleen interface

**Image Elements**
- Liver–spleen interface
- Diaphragm
- Inferior pole of kidney
- Inferior tip of spleen

**Tricks of the Trade**

- Poor images usually result from approaching the LUQ from too far anterior. In the emergency department we rarely have the luxury of a fasting patient during a trauma. A full stomach will obscure much of the kidney–spleen interface.

- Most kidneys are more posterior and superior than one might think. If you do not see the kidney, move more posterior and superior.

- Be careful of calling free fluid around the stomach. The food, fluid, gas interface in the stomach from recent eating may simulate free fluid. This will not extend to the inferior spleen which is the most common area of a positive FAST scan in the LUQ view.

- An intercostal view of the spleen–kidney interface will usually have some rib shadows. Rotating the probe 5 to 10 degrees clockwise may remove the shadow and improve your view.

- Perirenal fat may appear as a hypoechoic area between the kidney and spleen but will contain some internal echoes.

**Partial View Probe Positioning**

Note: Many of the partial views contain information that is needed to accurately identify pathology. The ideal view may be unobtainable due to patient characteristics and multiple “partial views” will be required to complete the scan.
**Too Cephalad**
Pulmonary air obscures part of view
Excessive view of lung
Spleen on right of screen

**Too Caudad**
Kidney on left or center of screen
No diaphragm in view

**Too Medial (Anterior)**
Stomach obscures view
Kidney not in view
**Too Posterior**
Kidney dominates image
Limited view of spleen–kidney interface
No view of inferior tip of spleen

**Too Shallow**
Kidney dominates image
No inferior tip of spleen
No view of diaphragm

**SUPRAPUBIC**

**Landmarks**
- Bladder–uterine interface
- Bladder–bowel interface

**Male Bladder Long Axis**
**Male Bladder Transverse Axis**

**Female Bladder Long Axis**

**Female Bladder Short Axis**

**Image Elements**
- Outline of bladder
- Uterine silhouette (female)
Partial View Probe Positioning

Note: Many of the partial views contain information that is needed to accurately identify pathology. The ideal view may be unobtainable due to patient characteristics and multiple “partial views” will be required to complete the scan.

Too Cephalad or Angle Too Steep

No bladder in image, or
Bladder on right of screen
Bowel dominates view
**Angle Too Shallow**
Pubic symphysis obscures view
Nonvisualization of internal structures

![Diagram](image1)

**Too Caudad**
Pubic symphysis partially obscures view
Bladder on left of screen

![Diagram](image2)

**Too Far Right or Left**
Bladder off-center (transverse)
Small view of bladder (long)
Bowel dominates view

![Diagram](image3)
Alternative or Unusual Views

Costophrenic angle (right)
Similar to RUQ too high

Costophrenic angle (left)
Similar to LUQ too high

Suprapubic during catheter insertion
ULTRASOUND PROTOCOL TECHNIQUE

Still Image Protocol

RUQ – Sagittal plane, anterior
Transducer at costal margin
or lower intercostal spaces
Right anterior axillary line
Indicator toward patient’s head
Angle probe slightly medial
RUQ – Coronal plane, lateral
  Transducer at costal margin or lower intercostal
  Right middle axillary line
  Indicator toward patient’s head
  Angle probe slightly posterior
Subxiphoid – Transverse plane, anterior
Transducer at costal margin
Midline abdomen, subxiphoid
Indicator toward patient’s right side
Angle probe toward right scapula

LUQ – Coronal plane, lateral
Transducer at left intercostal
Left posterior axillary line
Indicator toward patient’s head
Angle probe anterior
Suprapubic – Sagittal plane, anterior
Transducer at midline abdomen
Superior to pubic symphysis
Indicator toward patient’s head
Angle probe inferior
-Alternative-
Suprapubic – Transverse plane, anterior
  Transducer at midline abdomen
  Superior to pubic symphysis
  Indicator toward patient’s right
  Angle probe inferior

Optional Still Images
Parasternal long view of pericardial space
  Oblique plane, anterior
  Transducer at intercostal space
  Lateral to sternum, left side
  Indicator toward patient’s right shoulder
  Probe perpendicular to chest wall
Costophrenic angle, right
Coronal plane, lateral
Transducer at costal margin
Right middle axillary line
Indicator toward patient's head
Angle probe toward patient's head
Costophrenic angle, left
Coronal plane, lateral
Transducer at costal margin
Left middle axillary line
Indicator toward patient’s head
Angle probe toward patient’s head
ULTRASOUND PROTOCOL TECHNIQUE

**Videotape Protocol**

RUQ – Starting point, sagittal plane, anterior
   Transducer at costal margin or lower intercostal
   Right anterior axillary line
   Indicator toward patient’s head
   Angle probe slightly medial

RUQ – Taping protocol
   Focus on renal–liver interface
   Sweep medial to lateral
   Include view of diaphragm
   Include view of inferior kidney

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**Alternative**

RUQ – Starting point; coronal plane, lateral
   Transducer at costal margin or lower intercostal
   Right middle axillary line
   Indicator toward patient’s head
   Angle probe slightly posterior

RUQ – Taping protocol
   Focus on renal–liver interface
   Sweep probe anterior to posterior
   Include view of diaphragm
   Include view of inferior kidney
Subxiphoid – Starting point, transverse plane, anterior
   Transducer at costal margin
   Midline abdomen, subxiphoid
   Indicator toward patient’s right side
   Angle probe toward right scapula
Subxiphoid – Taping protocol
   Focus on heart–liver interface
   Sweep anterior to posterior

LUQ – Starting point, coronal plane, lateral
   Transducer at left intercostal
   Left posterior axillary line
   Indicator toward patient’s head
   Angle probe anterior
LUQ – Taping protocol
   Focus on kidney–spleen interface
   Sweep probe anterior to posterior
   Include view of diaphragm
   Include view of inferior kidney
   Include view of inferior tip of spleen
Suprapubic – Starting point, sagittal plane, anterior
   Transducer at midline abdomen
   Superior to pubic symphysis
   Indicator toward patient's head
   Angle probe inferior
Suprapubic – Taping protocol
   Focus on outline of bladder
   Sweep probe side to side
   Demonstrate retrovesicular space
   Demonstrate retrouterine space

—Alternative—
Suprapubic – Starting point, transverse plane, anterior
   Transducer at midline abdomen
   Superior to pubic symphysis
   Indicator toward patient's right
   Angle probe inferior
Suprapubic – Taping protocol
   Focus on outline of bladder
   Sweep probe superior to inferior
   Demonstrate retrovesicular space
   Demonstrate retrouterine space
Optional Video Images
Pericardial space – Starting point, parasternal long view
  Oblique plane, anterior
  Transducer at 5th intercostal space
  Lateral to sternum, left side
  Indicator toward patient’s right shoulder
  Probe perpendicular to chest wall
Pericardial space – Parasternal long tape protocol
  Focus on outer silhouette of heart
  Slight sweep from left shoulder to right hip
  Only limited movement of probe is needed

Costophrenic angle right, starting point
  Coronal plane, lateral
  Transducer at costal margin
  Right middle axillary line
  Indicator toward patient’s head
  Angle probe toward patient’s head
Costophrenic angle right – Tape protocol
  Focus on pleural space superior to diaphragm
  Sweep probe anterior to posterior
  Similar protocol to RUQ except orientation is superior
Costophrenic angle left
   Coronal plane, lateral
   Transducer at costal margin
   Left posterior axillary line
   Indicator toward patient's head
   Angle probe toward patient's head
Costophrenic angle left – Tape protocol
   Focus on pleural space superior to diaphragm
   Sweep probe anterior to posterior
   Similar protocol to LUQ except orientation is superior