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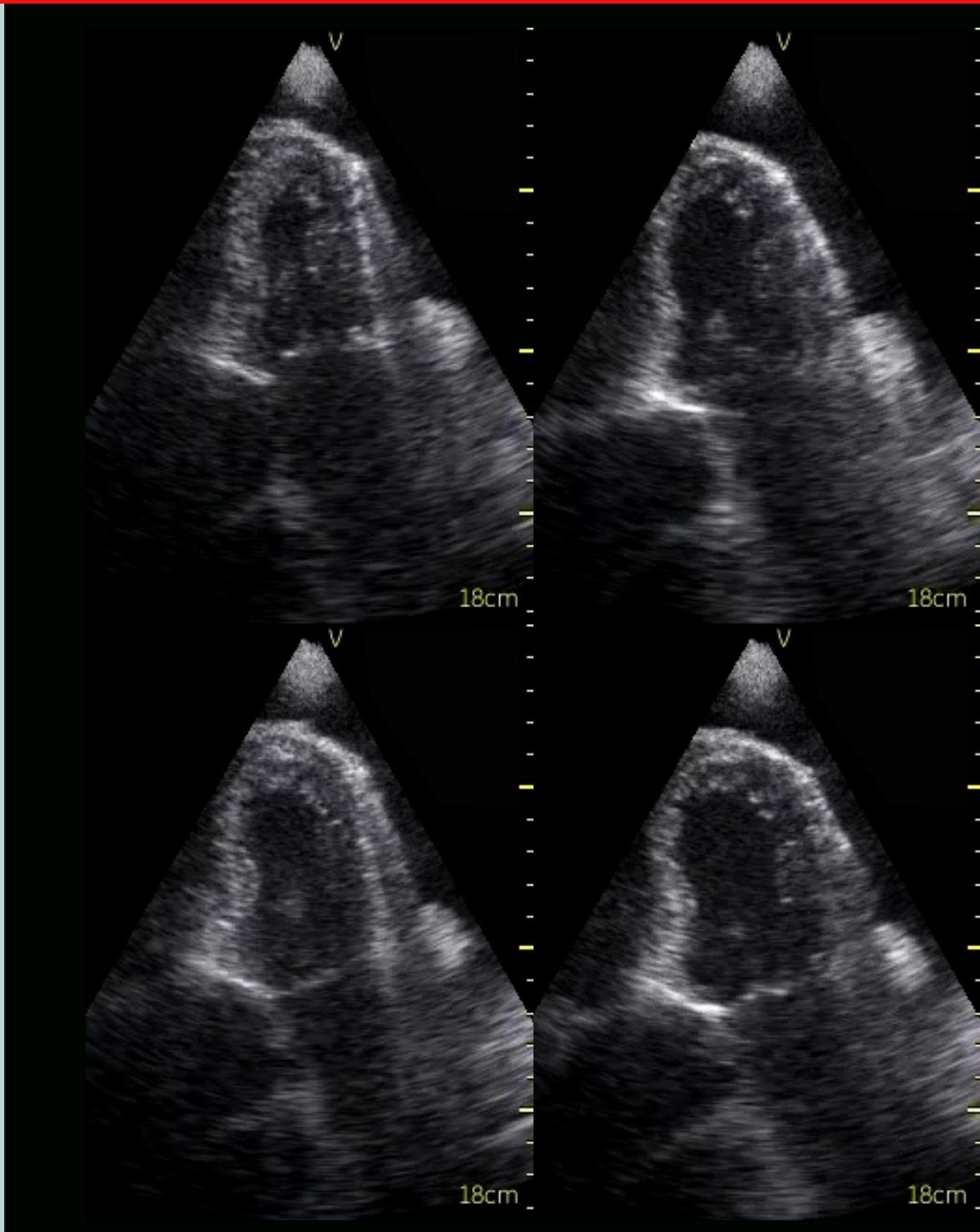
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## Rapid diagnosis of pericardial effusion

by Jeffrey Wilkinson, MD and Amer M. Johri, MD  
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**M**r. DB was a 95 year old man who presented to the emergency department with dyspnea progressing over the last 3 months. Chest x-ray demonstrated an enlarged cardiac silhouette.

He had a past medical history significant for coronary artery disease, hypertension and a lobectomy due to tuberculosis.

A point of care cardiac ultrasound was conducted by an internal medicine resident as part of his physical examination in the emergency department. A large pericardial effusion was found. There were no clinical signs of tamponade.

Video 1 (online supplement; Figure 1) demonstrates a parasternal long axis view with the pericardial effusion noted to be posterior to the left ventricle in this view. Video 2 (online supplement; Figure 2) is a short axis view of the heart which is showing that the effusion is surrounding the heart. Video 3 and 4 (online supplements; Figures 3 & 4) demonstrates that the pericardial effusion is present significantly surrounding the apex as well. An echocardiogram confirmed the POCUS findings and cardiology was consulted to conduct a pericardiocentesis, following which the patient's symptoms resolved. The effusion was thought to be chronic and transudative. In this case, the use of POCUS at the bedside allowed for rapid detection of a large pericardial effusion and subsequent treatment.

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Figure 1. Parasternal long axis view with pericardial effusion. (see online Video 1).



Figure 2. Parasternal short axis view with pericardial effusion. (See online Video 2).

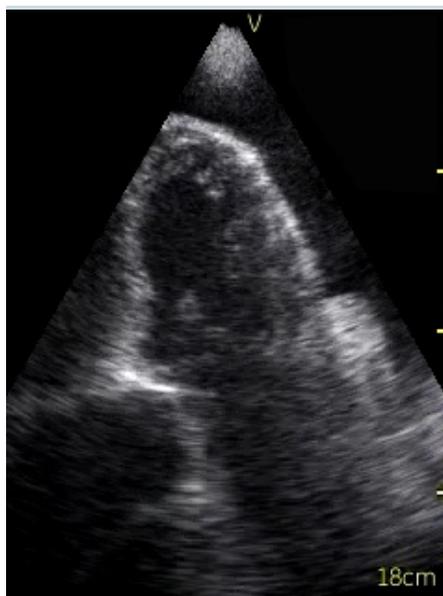


Figure 3. Four-chamber view depicting significant pericardial effusion surrounding the apex. (See online Video 3).



Figure 4. Close-up of four-chamber view depicting significant pericardial effusion surrounding the apex next to the left ventricle. (See online Video 4).

## FAST ultrasound interpretation in trauma resuscitation

by Stuart Douglas<sup>1</sup>, Joseph Newbigging<sup>2</sup>, David Robertson<sup>3</sup>

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### FAST Background

**F**ocused Assessment with Sonography for Trauma (FAST) is an integral adjunct to primary survey in trauma patients (1-4) and is incorporated into Advanced Trauma Life Support (ATLS) algorithms (4). A collection of four discrete ultrasound probe examinations (pericardial sac, hepatorenal fossa (Morison's pouch), splenorenal fossa, and pelvis/pouch of Douglas), it has been shown to be highly sensitive for detection of as little as 100cm<sup>3</sup> of intraabdominal fluid (4,5), with a sensitivity quoted between 60-98%, specificity of 84-98%, and negative predictive value of 97-99% (3). Further increasing sensitivity, ATLS recommends a repeat FAST exam in 30 minutes to increase sensitivity in slow bleeds, or early post-trauma presentations in the case that the first exam was negative (4). Recently, the Extended FAST (E-FAST) exam has become standard and includes assessment for post-traumatic pneumothoraces (6).

With respect to trauma resuscitation, FAST exam offers the opportunity for quick, serial exams to identify potentially fatal conditions, including peritoneal free fluid and pericardial tamponade (1). It is indicated for the triage of blunt trauma patients (7) to direct decision making (1). In penetrating abdominal trauma FAST selects for patients requiring emergent exploratory laparotomy (5).

### Case Summary

A 38-year old male was transferred to a Level 1 Trauma Center from a peripheral Emergency Department. Approximately four hours prior he was a belted front-passenger in a motor vehicle collision with intrusion to the passenger side at speeds approximately 50km/h. There was no loss of consciousness, but the patient endorsed sudden right-sided abdominal pain. Upon arrival at the

peripheral Emergency Department, the patient was tachycardic between 130-150bpm, though hemodynamically stable. Primary survey identified right upper and lower abdomen tenderness, persistent tachycardia despite crystalloid resuscitation, and peritoneal free fluid on E-FAST exam.

Upon arrival at the Level 1 Trauma Center, the patient remained tachycardic and demonstrated localized right lower quadrant peritonitis. A repeat E-FAST exam was positive for intraperitoneal free fluid in Morison's pouch (see Figure 1). After further resuscitation, the patient was hemodynamically stable enough to undergo CT imaging of the abdomen/pelvis. The CT demonstrated a large right-sided retroperitoneal complex fluid collection measuring 82 x 132 x 172 mm that extended from the posterior pararenal space to the peritoneal fat anteriorly. Mottled locules of gas were evident

within the collection, suspicious for traumatic colonic perforation. There was also fluid in Morison's pouch (see Figure 2), consistent with what was seen on the E-FAST exam. As such, the patient was emergently taken to the Operating Room (OR) for exploratory laparotomy.

Intraoperatively, a large abscess with chronic features was identified in the right lower quadrant. It was contiguous with the retroperitoneum and dissected towards the right groin in the peri-psoas plane. The grossly abnormal appendix was identified within the abscess. Based on the operative findings, a tentative diagnosis of a chronic missed appendicitis was made, rather than acute traumatic bowel perforation. The patient underwent open appendectomy and wash-out, and was discharged from hospital in excellent condition two weeks later.

Of note, following the OR, the pa-

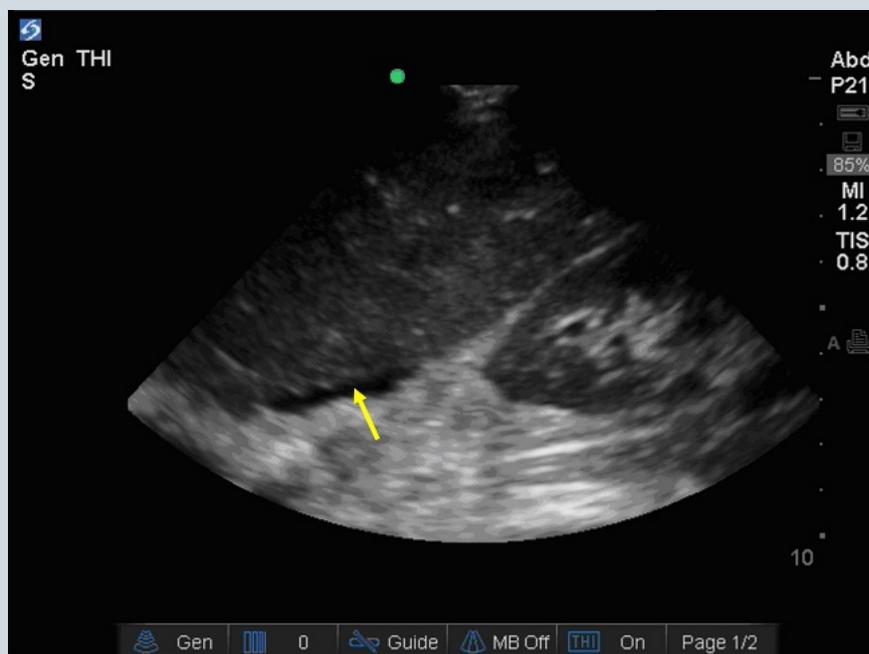


Figure 1. Right upper quadrant of FAST scan showing free fluid (yellow arrow) on Morison's pouch.

tient reported that he had been assessed for right lower quadrant pain and diagnosed with a partial small bowel obstruction one month prior to this presentation. He reported ongoing abdominal pain and significant weight loss since that assessment. In retrospect, it was felt that his original small-bowel obstruction diagnosis was actually an ileus from acute appendicitis.

### Limitations of FAST

E-FAST exam has become an integral adjunct to trauma resuscitation. In skilled hands it is a powerful tool with ability to drastically improve patient outcomes. Although fast, non-invasive, and sensitive, E-FAST examination should be interpreted skilfully. An appreciation for E-FAST limitations and sensitivity is required for successful trauma resuscitation.

Of note, decreased sensitivity for intra-abdominal injury has been linked to specific patient populations, including those with higher Injury Severity Scores (3), and hemodynamically stable patients with blunt abdominal injury (7). Negative FAST exams in these cohorts should be interpreted with caution, and consid-

eration of further investigations or serial exams considered. Further recognized limitations include failure to identify retroperitoneal or solid organ injuries, failure to recognize clotted blood as hematoma, and difficult patient groups including those that are obese (8).

As portrayed in this case report, E-FAST offers little ability to discern the specific fluid identified (8). Free fluid on E-FAST could be blood, but could also be urine, ascites, bile, pus, peritoneal dialysate fluid, or bowel contents. In the setting of trauma, peritoneal free fluid must be considered blood, and the trauma patient resuscitated appropriately, with CT imaging as tolerated versus emergent exploratory laparotomy. This case illustrates an interesting example of a trauma patient's E-FAST exam that was falsely positive for blood in the peritoneum.

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Figure 2. Axial image CT abdomen demonstrating free fluid to Morison's pouch.

# Incarcerated femoral hernia containing ovary, unusual presentation of uncommon groin hernia

by Priyank Gupta, MD, FRCR<sup>1</sup>; Hadiel Kaiyasa, MRCS Glasgow<sup>2</sup>; Mahra AISuwaidi, MRCS Glasgow<sup>2</sup>

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Of all groin hernias, femoral hernias account for around 2–8%. They occur four to five times more commonly in females than males and have a peak incidence in those between 30 and 60 years old [1,2]. In adult population, femoral hernias are more commonly found in patients with previous inguinal hernia repair [3]. We present an unusual case of a 28-year-old woman who presented to our institution with an incarcerated femoral hernia containing the right ovary & fallopian tube occurring after inguinal hernia repair. The point of care ultrasound that was done in the emergency department had helped in prompt diagnosis of the condition, hence sending the patient to operation theatre for urgent surgical intervention.

**Case Presentation:** A 28-year-old female presented to the emergency department with a sudden onset of abdominal pain in the right iliac fossa and suprapubic area. The pain was dull, mild to moderate in severity with no radiation. Patient gave history of chronic right groin swelling that was reducible for the last 2 months. Prior to presentation to accident & emergency department, she developed an irreducible swelling. There was no associated vomiting or constipation. Of note in her surgical history was significant for Left inguinal hernia repair ten years ago. She was normotensive and afebrile at presentation. Examination revealed a scar in the left inguinal region. Her abdomen was soft. There was an irreducible firm tender lump palpated below the level of the right inguinal ligament and lateral to the pubic tubercle.

**Investigations:** All her laboratory tests were within normal limits. The patient was reviewed by the surgical oncall doctor who made the provisional diagnosis of irreducible right femoral hernia based on the clinical

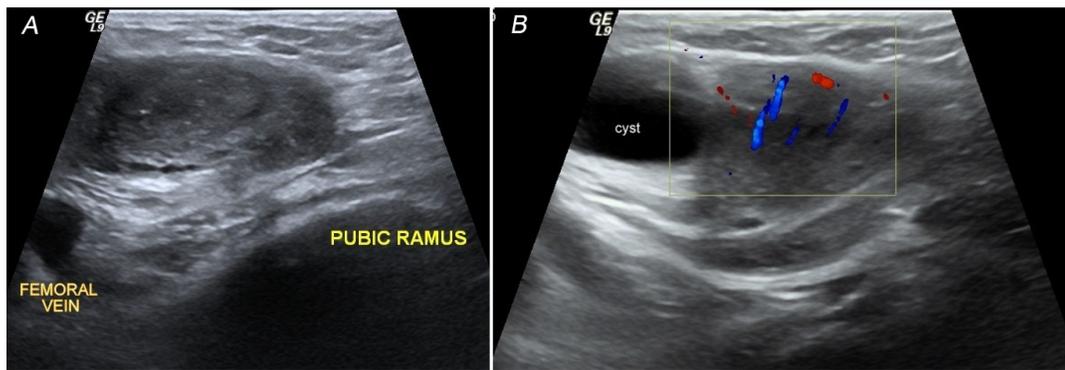
examination. Initially a point of care ultrasound (POCUS) was done by the attending surgical doctor, who was able to appreciate a localized cystic swelling within the hernia sac. A departmental Ultrasonography of the right groin area was obtained to confirm the findings of POCUS. It revealed a well-defined rounded soft tissue echogenicity lesion with a well defined cystic component containing no internal septations or mural nodules. The lesion was located subcutaneously anterior & medial to the femoral vein & reaching medially up to the level of pubic symphysis with no obvious intra-abdominal extension (Figure 1A). The lesion was not reducible and did not change in the size on Valsalva maneuver or cough impulse. No evidence of any peristalsis or free fluid noted within contents of the swelling. Color Doppler imaging revealed central branching pattern of vascularity consistent with ovarian vasculature pattern (Figure 1B). The ultrasound findings were in keeping with right femoral hernia with the ovary within the hernia sac.

**Treatment:** The patient was admitted under the care of the general surgery team with provisional diagnosis of an incarcerated right femoral hernia with a plan for urgent laparoscopic repair of the right femoral hernia. Intra-operatively, exploration revealed no fluid in the abdomen and no signs of bowel obstruction. A hernia sac was present protruding down towards the femoral canal. The contents were reduced & found to be the ovary and fallopian tube (online Figure S1). Both structures were looking viable. The anatomy of the area was clarified and dissected reaching to the pubic tubercle medially and the inguinal ligament superiorly and laterally. A prolene mesh was applied and fixed using endoscopic clips (takar). The peritoneum was closed and the abdomen deflated.

**Outcome and Follow-Up:** Patient was doing well post-operatively and responded well to the planned management. She had an uneventful recovery and was discharged home on the next day. Follow up after 6 weeks revealed no complication.

**Discussion:** The anatomical location of the ovaries and fallopian tube at a level below femoral ring makes herniation of these structures through it unusual, particularly in adults [4]. According to the most acceptable theory, the primary cause for the formation of femoral hernia is a congenitally narrow posterior inguinal wall attachment onto Cooper's ligament with a resultant enlarged femoral ring, while the secondary aetiology is a state of prolonged and increased intra-abdominal pressure, which forces preperitoneal fat into the congenitally large femoral ring [1,5,6]. However, it should be noted that in younger ages with femoral hernias, processes responsible for elevated intra-abdominal pressure are rarely encountered. Due to the rigid ligamentous borders & relatively narrow lumen, incarceration occurs more frequently in femoral hernias than other abdominal hernias [7,8]. The incidence of recurrent femoral hernia occurring after inguinal herniorrhaphy has been reported to be up to 35% [8]. The increased incidence of femoral hernia after inguinal herniorrhaphy may be due to an overlooked hernia or a new spontaneous hernia due to weakening of the femoral region caused by inguinal herniorrhaphy [8,9]

Femoral hernias typically present as a painless or painful groin lump, although may present simply as groin pain or with features of their complications such as obstruction. The differential diagnoses include inguinal hernia, lipoma, saphena varix, enlarged lymph nodes, femoral artery



**Figure 1.** Transverse view of the ultrasound scan of the groin swelling revealed ovary lying anterior & medial to the femoral vein

aneurysm, sarcoma, obturator hernia, psoas abscess, psoas bursa, and in males, ectopic testis [4,10]. Different contents in femoral hernias have been reported in the literature, such as small intestine, omentum, bladder, cecum, colon, appendix (what is known as De Garengeot's hernia), Meckel's diverticulum (Littre hernia), testis, ovary, and even stomach or kidney [11,12].

The preoperative diagnosis of femoral hernia is a challenging issue. In previous reports, the clinical diagnostic accuracy ranged from 25% to 40% [13]. The ovary is quite sensitive to ischemia [14,15]. Should it tort or become incarcerated in a femoral hernia sac, a delay in diagnosis may necessitate its resection [16]. Imaging studies could prove to be a valuable preoperative investigation in women of childbearing age presenting with femoral hernia. Nowadays POCUS is a valuable tool in the initial assessment of irreducible hernia cases, whether performed by the emergency physician or the attending surgeon. The most important points to keep in mind while performing POCUS are:

- Femoral hernia is visualized as a subcutaneous swelling in contact with the femoral vein.
- Assess the contents of hernia sac, whether loop of bowel within or a cystic swelling (e.g ovary like in our case).
- In cases where bowel loops are within a hernia sac, observe for signs of strangulation, such as oedematous bowel wall or absent peristalsis.

Doppler ultrasound may identify reduced blood flow in ovaries suggestive of torsion. Cross-sectional

imaging with CT may be similarly beneficial in identifying a groin hernia containing an ovary provided it causes no delay in the timing of surgery [17].

Operative management of an incarcerated femoral hernia containing an ovary follows the same surgical principles for femoral hernia repair. Intraoperative Reduction of the sac content should be attempted in reproductive young woman and children without any ovarian and tubal abnormalities [18], provided that any life-threatening complication such as acute salpingitis does not exist [19]. If the ovary can't be preserved due to inviability, a salpingo-oophorectomy is to be undertaken. Hernia repair could be done via mesh plug repair, which is considered to have the lowest recurrence rate [1].

**Conclusion:** Incarcerated femoral hernia containing ovary, is an unusual presentation of uncommon groin hernia. The point of care ultrasound that was done in the emergency department had helped in prompt bedside clinical diagnosis of the condition, hence early urgent surgical intervention & better outcome.

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