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## Case Report

# The double bladder sign: Challenges in early sonographic diagnosis of ovarian torsion <sup>☆</sup>

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## ABSTRACT

Ovarian torsion is an emergency whereby challenges in diagnosis may lead to delayed management. The morbidity associated with delayed diagnosis can be severe and includes loss of ovarian function. We present a case of a 24-year-old female who presented to the hospital with left lower quadrant abdominal pain with unremarkable physical examination. A transabdominal and transvaginal ultrasound were acquired and demonstrated a mildly enlarged left ovary and fallopian tube without other significant findings. However due to worsening pain and up trending inflammatory markers, diagnostic laparoscopy was performed and demonstrated a 12cm ovarian cyst, a necrotic left adnexal mass and a torsed left tubo-ovarian pedicle. These findings were not appreciated on the initial Doppler ultrasound acquired but retrospective analysis demonstrated a double bladder sign. Our case report aims to aid sonographers and physicians to promptly diagnose ovarian torsion through the “double bladder sign” and other salient ultrasonographic and clinical features.

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## Introduction

Ovarian torsion accounts for 3% of gynecologic emergencies [1]. Ovarian torsion occurs when the ovary twists on the axis between the infundibulopelvic ligament and the uteropelvic ligament [2]. This leads to interruption of blood flow to the ovary and can result in loss of ovarian function. Therefore, prompt diagnosis is vital in preventing morbidity. However, di-

agnosis is challenging as symptoms and sonographic findings are variable and non-specific.

Ovarian torsion can present with symptoms of acute lower abdominal pain, nausea, vomiting, and fever [3]. Risk factors include a history of ovarian mass, pelvic inflammatory disease, ovarian hyperstimulation, and pregnancy [4]. Although ovarian torsion is a clinical diagnosis, ultrasonography is the imaging modality of choice in aiding diagnosis. Sonographic findings include an abnormal ovarian location, enlarged ovary,

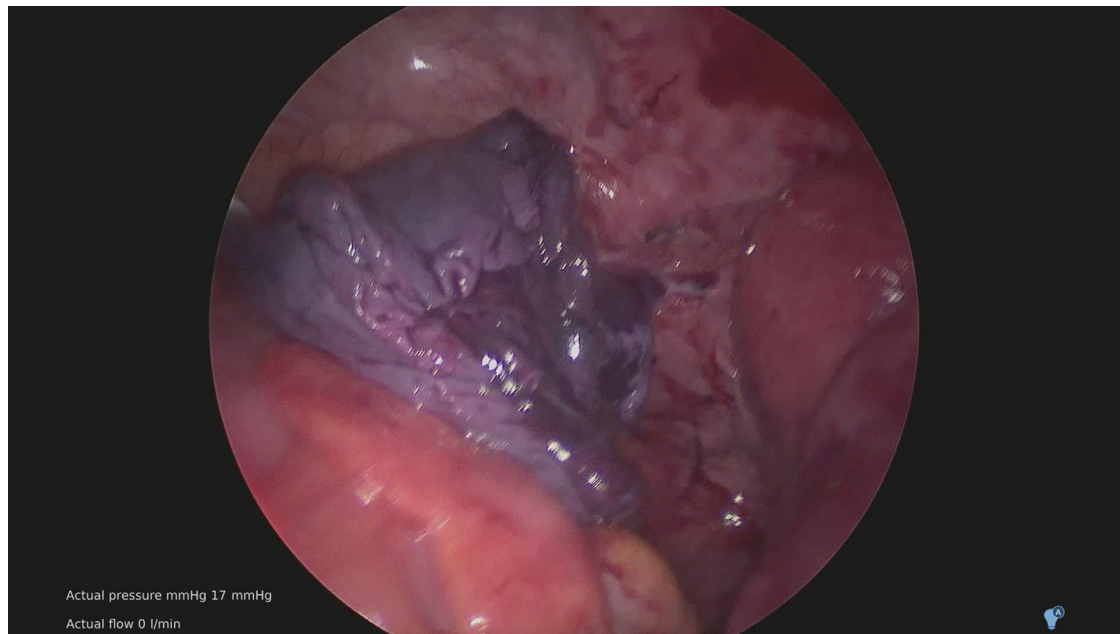
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**Fig. 1 – Laparoscopic image of a dilated and necrotic left adnexal mass with torsed left tubo-ovarian pedicle.**

ovarian mass, and decreased ovarian blood flow on Doppler [5].

We present a case of ovarian torsion in a young woman who experienced a delay in diagnosis due to non-specific symptoms and challenging radiological signs. We intend to review salient clinical and sonographic findings to aid emergency physicians, sonographers, radiologists, and obstetrician and gynecologists in prompt diagnosis. Through early diagnosis, we hope to decrease morbidity and achieve better outcomes for women.

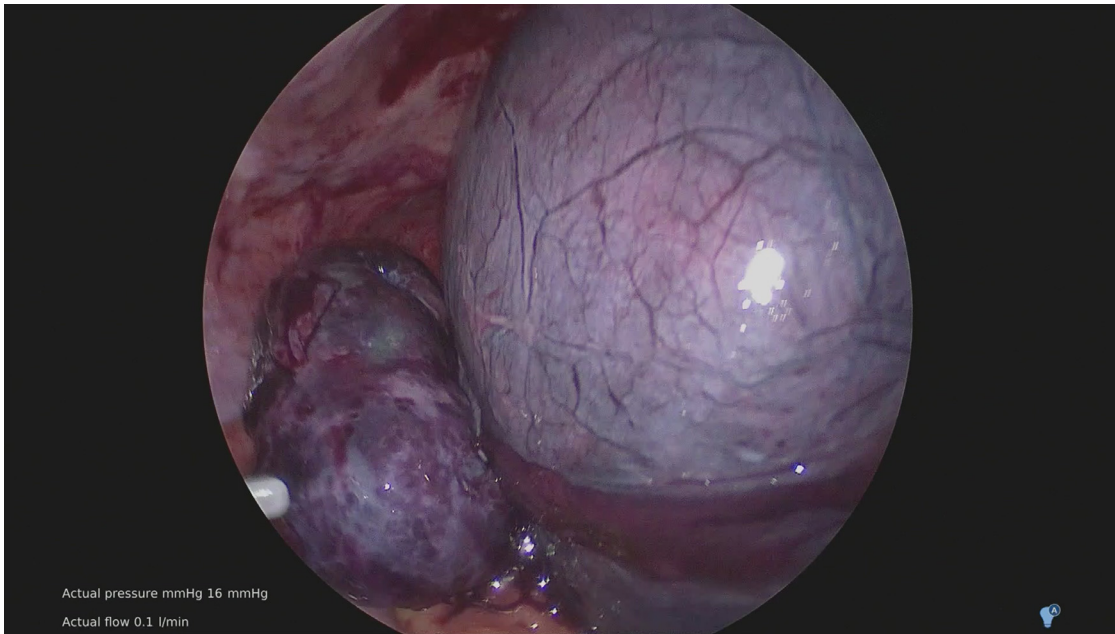
### Case report

A 24-year-old female presented to the Emergency Department with acute onset of severe left lower quadrant abdominal pain. Shortly after acute onset, the pain changed to intermittent and mild 3/10 abdominal pain. The patient denied fevers, vomiting, vaginal discharge, vaginal bleeding, dyspareunia, urinary symptoms, and abnormal bowel motions. The patient had a regular menstrual cycle and her last normal menstrual period was 3 weeks prior to the onset of symptoms. Gynecological history was unremarkable for sexually transmitted infections (STI), masses, menstrual dysfunction, and there was no history of pap-tests. Medical history was significant for coeliac disease and there was no history of abdominal or pelvic surgery. On examination, the patient was afebrile and hemodynamically stable. The patient was comfortable and in no acute distress. Abdominal examination revealed a soft abdomen with mild left lower quadrant tenderness without guarding or rebound. Speculum examination was unremarkable.

Inflammatory results were unremarkable with white cell count  $11.4 \times 10^9/L$ , neutrophils  $8.9 \times 10^9/L$ , and C-reactive

protein  $< 2 \text{ mg/L}$ . Pregnancy test was negative with serum B-HCG  $< 2 \text{ IU/L}$ . Urinalysis and vaginal swabs for infection were negative. Transabdominal and transvaginal pelvic ultrasounds were completed by a qualified sonographer with final interpretation rendered by a consultant Radiologist. Findings revealed a larger left ovary (4 ml volume) than right ovary (1.9 ml volume) but both were within normal size limits. There was no evidence of a discrete mass or cyst. The adjoining distal portion of the left fallopian tube appeared bulky with normal vascularity and no tubo-ovarian collection was visualized. Normal color Doppler flow to both ovaries was visualized. It was reported that the patient was unable to empty her bladder during the investigation.

Due to the patient's non-specific findings, the gynecology team admitted the patient for observation and analgesia whilst awaiting investigation results. Initially analgesic requirements were minimal. However, the patient became febrile to  $38.4 \text{ }^\circ\text{C}$  with increasing analgesic requirements on day 4 of admission. Empiric intravenous broad spectrum antibiotics were started to cover the differential of pelvic inflammatory disease but inflammatory markers began to up-trend with a C-reactive protein of 207 recorded on day 6 of admission. The decision was made for an exploratory laparoscopy which revealed a dilated, necrotic left adnexal mass with complete torsion of the left tubo-ovarian pedicle (Fig. 1). A 12 cm left ovarian cyst was also found (Fig. 2). The left fallopian tube and surrounding ovarian tissue appeared necrotic and edematous. The right ovary was normal in appearance. Left salpingectomy, cystectomy, and partial resection of non-viable ovarian tissue was performed. The patient had an uneventful recovery and was followed up in the gynecological clinic 3 months postoperatively. Histopathology revealed a congested and torted left fallopian tube and ovarian tissue, and a  $10 \times 6 \times 5 \text{ cm}$  torted benign cyst adenoma.



**Fig. 2 – Laparoscopic image of a 12 cm left ovarian cyst.**

## Discussion

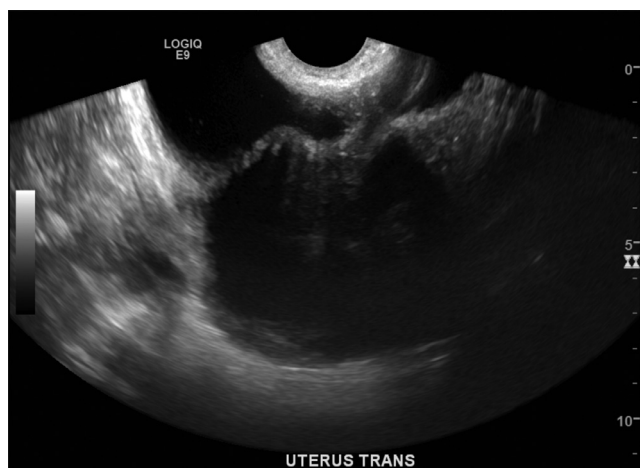
Ovarian torsion is a gynecological emergency that requires early diagnosis to allow for timely detorsion and restoration of ovarian blood flow to preserve fertility. A typical presentation is a female with acute pelvic pain, adnexal mass, fever, nausea, and vomiting [3]. However, these clinical findings are also perceived in other more common conditions such as pelvic inflammatory disease, tubo-ovarian abscess, ruptured ovarian cyst, appendicitis, diverticulitis, renal colic, and pyelonephritis [1,6]. Furthermore, atypical presentations with less severe symptoms are common [1]. Houry and Abott's 15-year review found more females experienced mild pain rather than severe pain and that the duration of symptoms ranged from hours to months [4]. Challenges in early clinical diagnosis were seen in our case. The patient had presented with non-specific mild abdominal pain that lasted for 4 days with minimal analgesic requirements, a normally tolerated diet and absent fever until day 4 of admission.

Pelvic ultrasound is the conventional first-line imaging modality for diagnosing ovarian torsion. Pelvic ultrasound is inexpensive, transmits minimal radiation, and is able to assess both ovarian anatomy and perfusion [7]. However, the accuracy of pelvic ultrasound is poor, with literature reporting correct diagnosis before surgery in only 22%-66% of cases [8]. The overall low and variable accuracy reported by literature, can be explained by non-specific sonographic signs. Typical sonographic features include abnormal ovarian location, increased maximum ovarian diameter (MOD), and decreased color flow Doppler. However, the absence of typical features is common. Literature is in agreement that a combination of multiple sonographic signs with a suggestive clinical presentation, increases diagnostic specificity.

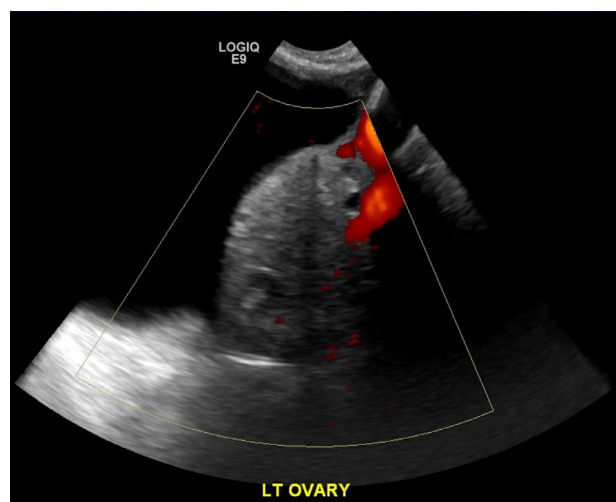
The heterogeneity of technicians plays a role in the diverse diagnostic accuracy [8]. This was seen in our case, where the large central ovarian cyst was confused as normal bladder. The comment in the ultrasound report that the patient could not empty her bladder was noted to retrospectively indicate that this was the central ovarian cyst and not the bladder. Experienced radiologists have suggested an in-out urinary catheter can aid diagnosis in similar circumstances by confirming an empty bladder.

Abnormal ovarian location as a “double bladder sign” has been described in recent literature as a highly suggestive finding of ovarian torsion [5]. Mashlach et al. found that abnormal ovarian location had a high specificity of 87.5% for ovarian torsion [8]. When abnormal ovarian location was combined with other typical sonographic features, ultrasound specificity reached 100% [5,8]. Lin and Buttar's case series described an abnormal ovarian location as a double bladder sign, owing to the visualization of 2 midline and adjacent anechoic structures that resemble 2 bladders. The midline ovarian cyst often appears more superior and circular on ultrasound, while the bladder is inferior to the cyst and irregular in shape. It is a common pitfall of mistakenly diagnosing cyst as bladder, and bladder as free fluid [5]. The double bladder sign is noted on transvaginal ultrasound in our case as seen in (Fig. 3). The cyst appeared more superior and the bladder much smaller and irregularly shaped (Fig. 4). Detection of the “double bladder sign” by the sonographer or gynecologist would have led to earlier intervention and decreased patient morbidity.

Asymmetric ovarian enlargement is the most commonly described sonographic finding suggestive of ovarian torsion. An enlarged ovary may result from an ovarian cyst, malignancy, edema, or ovarian hyperstimulation syndrome [9]. Maximum non-pathological ovarian size is approximately 2.0 cm x 3.0 cm [4]. Enlarged ovarian volumes due to torsion



**Fig. 3 – Transvaginal pelvic ultrasound demonstrating large left ovarian cyst with separate small bladder displaced to right creating the “double bladder” sign.**



**Fig. 4 – Transvaginal pelvic ultrasound showing large left ovarian cyst, and adjacent inferior small bladder.**

demonstrate significant variation and have been found to range from 38 to 4308ml in some cases [6]. In our case, the left ovarian volume was reported as 4 ml and the right ovarian volume was 1.9 ml. Although there was mild asymmetry, the volumes were within the normal range. It has also been shown that MOD is a useful tool in ruling out ovarian torsion. Budhram's study found that a MOD of > 3cm had sensitivity of 100%, and a MOD of > 5cm had sensitivity of 91% in the post-menarchal cohort [1]. In our case, the left ovarian MOD was 2.3 cm, which detracted from the suspicion of ovarian torsion. However, the limitation of our case is that the large ovarian cyst was misdiagnosed as bladder, giving significantly skewed results. Technicians and physicians should continue to interpret asymmetric ovarian enlargement as an indicator of ovarian torsion and be aware of surrounding ovarian masses.

Color Doppler sonography, although commonly used in the evaluation of ovarian torsion can be unreliable [1]. The pres-

ence of normal ovarian blood flow cannot exclude torsion. Diminished or absent flow to the ovary is often a late finding [10]. This can be explained by dual blood supply from the uterine and ovarian arteries and when the ovary undergoes intermittent or partial torsion [1,2,4]. For these reasons, Swenson's study reported high false negative rates of 45%-61% when Doppler ultrasound was relied upon in the investigation of ovarian torsion [7]. Overreliance of color Doppler sonography is a common pitfall that can lead to inaccurate diagnosis. It is also of note that normal ovarian flow with viability of tissue may even be seen after 6 weeks [2]. Therefore, physicians should be aware of the caveats and limitations of color Doppler sonography in the investigation of ovarian torsion.

Ovarian torsion remains a difficult clinical and sonographic diagnosis due to atypical presentations and non-specific imaging findings. The findings of abnormal ovarian location, the double bladder sign and asymmetrical ovarian enlargement are appreciable findings that should help guide improved diagnosis. Clinician and sonographer awareness of the pitfalls of overreliance on color Doppler sonography is paramount to improving imaging sensitivity. Our case has highlighted the clinical and sonographic salient features and challenges in diagnosing ovarian torsion. The combination of clinical and sonographic features should aid physicians in expediting diagnosis and achieve earlier surgical intervention and better outcomes for patients.

### Patient consent

Written patient consent for the case report writing and publication has been obtained. This information will be available upon request from the corresponding author.

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