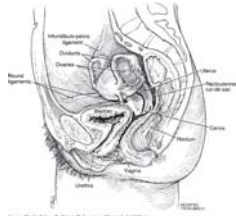


# 骨盆腔急症之應用

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## Learning Objectives

- Describe the differential diagnosis of lower abdominal pain in female patients
- Discuss the use of ultrasonography in the differential diagnosis of gynecologic field
- Consider other pelvic disease with the aid of ultrasonography

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## Gynecologic Concepts: Pelvic pain

### GASTROINTESTINAL

Appendicitis  
Inflammatory bowel disease  
Irritable bowel syndrome  
Constipation  
Gastroenteritis  
Diverticulitis

### URINARY TRACT

Cystitis  
Pyelonephritis  
Nephrolithiasis

### REPRODUCTIVE

Ectopic pregnancy  
Intrauterine pregnancy  
Pelvic inflammatory disease  
Tubo-ovarian abscess  
Ovarian cyst  
Hemorrhagic functional cysts  
Ovarian torsion  
Mittelschmerz  
Dysmenorrhea  
Endometriosis

Table 14-1. Differential Diagnosis of Lower Abdominal Pain in Female Patients  
(From Emergency Ultrasound - Chapter 14)

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Table 35-3. Pelvic Pain in Early Pregnancy

Failing IUP (contractions)  
Ectopic pregnancy  
Ovarian cyst—torsion, rupture, pressure  
Incarceration of the uterus  
Stretching of the round ligament  
Ureteral stones  
Appendicitis

Obstetric and Gynecologic Emergencies: Diagnosis and Management > Section VII. The Reproductive Age and Older Women > Chapter 35. Ultrasound in Obstetrics and Gynecology > Ultrasonography of Gynecologic Disorders >

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## Surgical Findings in Patients with Pelvic Pain

Semin Reprod Med. 2008;26(3):252-265.

Findings	Percent of Total Patients in Series		
	Howard	Carter	Shwayder
Endometriosis	33	80.0	46.8
Adhesions	24	48.0	46.3
Leiomyomas	< 1	42.0	13.3
Ovarian cysts	3	-	9.5
Pelvic inflammatory disease / tubo-ovarian abscess	5	-	0.5
Hydrosalpinx	-	-	3.2
Pelvic varicosities	< 1	-	-
Ovarian cancer	-	-	0.5
Other	4	27.4	5.4
Negative	35	-	13.3

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## Ultrasound in Diagnosing Adnexal Masses in Patients with Pelvic Pain

Semin Reprod Med. 2008;26(3):252-265.

Gynecologic Causes		Other Causes
Benign ovarian cysts	Dermoid	Appendicitis
Functional ovarian cysts	PID/TOA	
Ovarian torsion	Ectopic pregnancy	Diverticulitis
Endometriomas	Uterine leiomyomata	

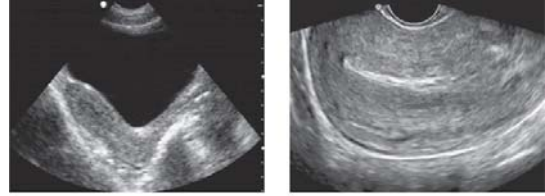
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## Clinical Considerations

- **Imaging the pelvis** is a crucial step in the evaluation of women with lower abdominal pain or pelvic pain. Ultrasound has proven to be a rapid, noninvasive, portable, repeatable, inexpensive, and accurate method for visualizing and diagnosing pathology within the pelvis.
- Ultrasound improve patient satisfaction, provides them with more time to ask questions, and ultimately increases their confidence in their physician and understanding of their condition. Another advantage unique to ultrasound is the ability of color flow Doppler sonography to evaluate pelvic organs for adequacy of blood flow.
- The main disadvantage of ultrasound with respect to the other imaging modalities is its limited scope. Other imaging modalities, such as CT and MRI, may yield valuable information about other organ system pathology and the extent to which a disease process may have progressed. Sonograms occasionally may be of poor image quality due to interference from bowel gas.

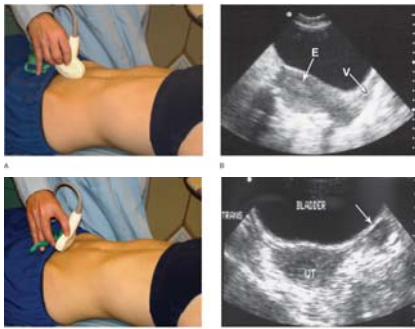
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## Technique and Normal Ultrasound Findings



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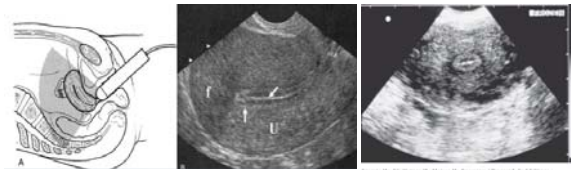
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## Transvaginal sonography

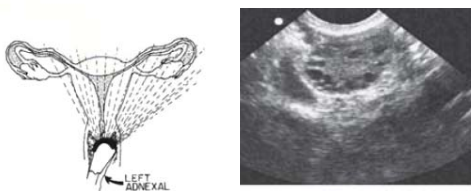


1. Side to side movement
2. Anterior-posterior movement

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## Transvaginal sonography



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## Ectopic pregnancy (EP)

- Ectopic pregnancy (EP) is currently the **leading cause of maternal death in the first trimester**. It is not often clear what causes the implantation of a fertilized ovum in a location other than the endometrium, often in the ampulla of the fallopian tube, but the EP often presents a **diagnostic dilemma**.
- Many women are treated in outpatient venues, but the documented rate probably approaches about 19-20 per 1000 of all reported pregnancies.
- A variety of conditions that alter tubal integrity or block the migration of a fertilized ovum to the uterus are considered as risk factors, and that more than half of EPs are discovered in women with no known risk factors.

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(A) Ampullary, 80%; (B) Isthmic, 12%; (C) Fimbrial, 5%; (D) Cornual/Interstitial, 2%; (E) Abdominal, 1.4%; (F) Ovarian, 0.2%; (G) Cervical, 0.2%.

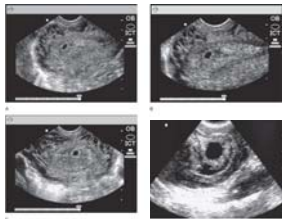
oPregnancy can even occur in both the womb and the tube at the same time (heterotopic pregnancy), but this is rare, occurring in only about 1/10,000 pregnancies.

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- o There is frequent misdiagnosis of EP on the initial emergency department visit. The differential diagnosis includes appendicitis, spontaneous abortion, ovarian torsion, pelvic inflammatory disease, ruptured corpus luteum or follicular cyst, tuboovarian abscess, and urinary calculi.
- o An EP may be discovered up to the time of delivery; however, the most common gestational age at time of diagnosis is **6-10 weeks**.
- o The classic triad of symptoms for EP includes **abdominal pain** and **vaginal bleeding** after a period of **amenorrhea**. Clearly, these nonspecific findings may also be seen in other clinical situations.

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- o Glycoprotein **hCG** is synthesized by the syncytiotrophoblast. In a **normal pregnancy**, the serum hCG level doubles or increases by **at least 66% in 48 hours**. The discriminatory zone is the range of hCG at which the intrauterine gestational sac can be visualized on **transvaginal** ultrasound. This sac should be visualized when the hCG level reaches **1000-2000 mIU/mL**, and when it is **2400-3600 mIU/mL**, the intrauterine gestational sac should be visualized by **transabdominal** ultrasound.



Source: De G. Maher, Jr., Robert P. Program Director, Department of Obstetrics and Gynecology, University of Colorado Health Sciences Center, Denver, Colorado. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

- o A pregnancy of unknown location (PUL) may be suspected when there is a positive serum hCG level but no signs of intrauterine or extrauterine pregnancy on TVUS and no sign of miscarriage. Tracking of the hCG level helps track what may be happening within the body.
- o Progesterone has been used to diagnose EP but is somewhat controversial. A baseline serum progesterone of less than 20 nmol/L may correlate with increased chances of pregnancy failure. However, this finding does not help locate the site of the pregnancy.



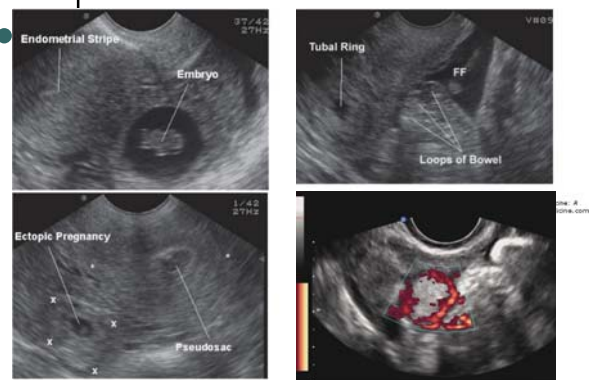
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## Ultrasound finding

- o TVUS is employed as a diagnostic strategy for EP in clinically stable women.
- o The diagnosis is made by visualization of an adnexal mass by TVUS rather than by the absence of an intrauterine gestation on scan.
- o If the TVUS is not diagnostic and there are falling hCG levels, a diagnostic dilation and curettage (D&C) may be required. The presence of chorionic villi will differentiate an EP from a spontaneous abortion.

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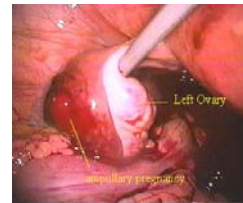
Source: Tintinalli, J.E., Kelen, G.D., Stappert, J.J., Fodor, G.L. Emergency Medicine: A Comprehensive Study Guide, 6th Edition. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

## Medical management of EP

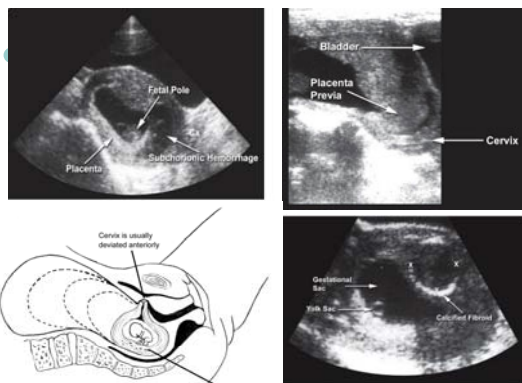
- Medical management following early diagnosis of EP may allow conservation of the fallopian tube when it is involved. In specific conditions, methotrexate may be used as a pharmacologic resolution to PUL. **Methotrexate** is a folic acid antagonist that interferes with DNA and RNA synthesis. It may selectively destroy cytotrophoblasts at the implantation site. The body then reabsorbs the remaining products of conception.
- Failing this, surgical laparotomy with removal of the involved tube has been both diagnostic and treatment for EP.

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- The classic treatment of tubal pregnancy is **salpingectomy** at laparotomy to remove a ruptured and bleeding tube -- life preservation
- Laparoscopy** is the only technique that enable diagnosis, management and assessment of prognosis at the same time
- Conservative** laparoscopic surgery is now considered to be optimum treatment for ectopic pregnancy -- preserve fertility



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As the uterus enlarges, it posteriorly rotation remains.  
 Source: Tenenbaum JB, Felson SD, Skopczynski JI. Felson's Emergency Medicine: A Comprehensive Study Guide, 4th Edition. <http://www.accessmedicine.com>  
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Uterine retroversion and incarceration progressing to sacculization as pregnancy advances  
 advance Page 48, O'Grady JH, Hoffman D. Maturation of the Uterus  
<http://www.accessmedicine.com>. 2002; 48

## Common and Emergent Abnormalities

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## 青少年經痛

- 月經疼痛是青少年時期女性最常見的婦科症狀 (約72%青少年有經痛的症狀)
- 青少年時期經痛通常是原發(功能)性的，而且與正常月經週期有關，但是沒有骨盆腔異常病變
- 約有 10%青少年有嚴重月經疼痛的現象，此時需要排除子宮內膜異位症或是子宮異常的情形

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## 子宮先天異常與青少年經痛的關係

- 尤其是初經來潮前嚴重腹痛(可能是週期性)時要特別排除阻塞性子宮先天異常現象
- 約11%有子宮等生殖道先天異常的青少年伴隨有子宮內膜異位症的情形

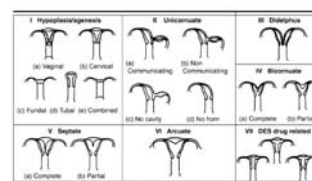
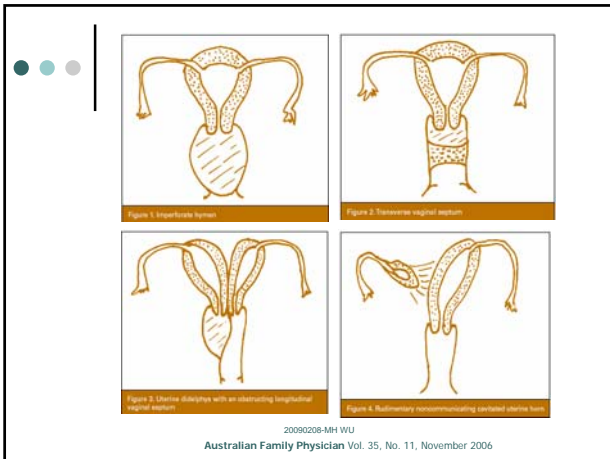


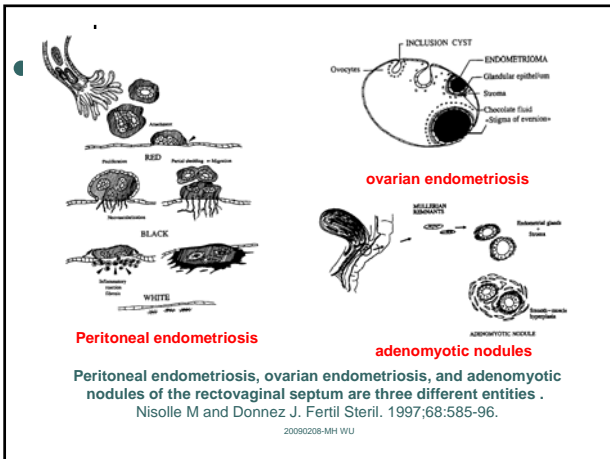
Figure 2. Classification system of anomalies and anomalies identified by the National Institutes of Health (NIH).



## 次發性經痛

- 次發性經痛通常與骨盆腔內異常有關
- 成年人較青少年時期常見，例如子宮內膜異位症或肌瘤
- 常伴隨慢性骨盆腔疼痛，月經週期間疼痛，月經量增加或性交疼痛

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The typical and atypical transvaginal B-mode findings of endometrioma. **(A)** Typical findings: a round homogeneous hypoechoic 'tissue' of low-level echoes, with a clear demarcation from the parenchyma and without papillary proliferation. **(B)** Atypical findings: a round-shaped homogeneous hypoechoic 'tissue' of low-level echoes with an echogenic portion. This kind of mass must be evaluated by color Doppler to exclude the presence of flow in this intracystic portion.

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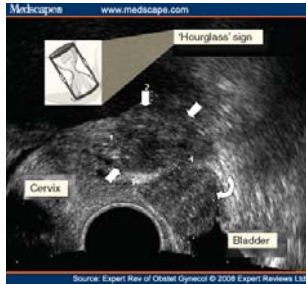
The presence of ovaries (containing one endometrioma each) that are joined together behind the uterus in the cul-de-sac are called 'kissing ovaries'.

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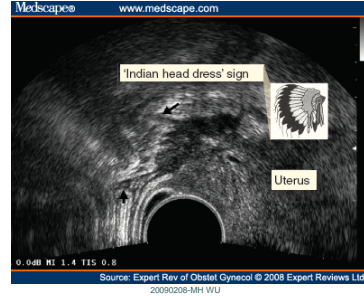
A nodule of deep endometriosis in the vaginal wall characterized by a hypoechoic thickening protruding in the vagina. Note the increase of acoustic window between the transvaginal probe and the surrounding vaginal structures (curved arrow) that permits the visualization of this small nodule. **(B)** A nodule in the rectovaginal septum (straight arrows).

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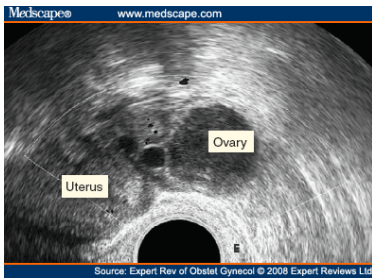
During the evaluation of the anterior compartment, the presence of bladder endometriosis was observed (curved arrow). In this case, next to the endometriotic nodule protruding in the bladder, another nodule (straight arrow) can be seen in the pouch between the uterus/cervix and the bladder with an appearance resembling an 'hourglass'.



An endometriotic nodule with rectosigmoid involvement. The rectosigmoid involvement should be suspected by the presence of nodules with some thin band-like echoes departing from the center of the mass (straight arrows), with an appearance resembling an 'Indian head dress'.

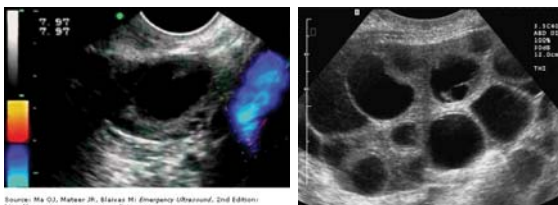


Ultrasonography showing the fixation of the ovary to the uterus as a sign of presence of pelvic adhesions.



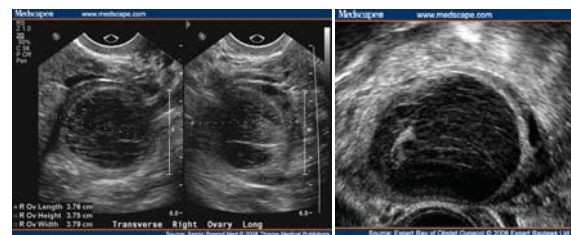
## Ovarian Cyst

- These cysts are common and generally cause no trouble. Each time a woman ovulates, she forms a small ovarian cyst (3.0 cm. in diameter or less). Depending on where she is in her menstrual cycle, you may find a small ovarian cyst. Large cysts (>7.0 cm.) are less common and should be followed clinically or with ultrasound.
- Occasionally, ovarian cysts may cause a problem by:
  - Delaying menstruation
  - Rupturing
  - Twisting
  - Causing pain
  - Bleeding
- 95% of ovarian cysts disappear spontaneously, usually after the next menstrual flow. Those that remain and those causing problems are often removed surgically.



Source: Ma OJ, Malver JK, Blazek M: Emergency Ultrasound, 2nd Edition. <http://www.accessmedicineonline.com>. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

A mass with internal echoes with a pattern of fine interdigitating lines described as 'reticular', 'fishnet', 'lacelike' or 'jelly-like'. This is the typical transvaginal B-mode finding of luteal hemorrhagic cysts.



- ● ● Characteristic "Ring of Fire" Surrounding a Corpus Luteum With Power Doppler.

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- ● ● Ovarian Torsion

- The only specific grey-scale sonographic sign of ovarian torsion is demonstration of **multiple follicles in the cortical part of a unilaterally enlarged ovary**. Transudative fluid flows into the multiple follicles as the ovary becomes congested from circulatory impairment. Ovarian enlargement, when present, is relatively obvious.

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Source: Wu, D., Malhotra, R., Blakeslee, M. Emergency Ultrasound, 2nd Edition. http://www.accessmedicine.com. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

- ● ● **A and B**, Two types of target appearances of the twisted vascular pedicle (arrows). BL indicates urinary bladder; and CYST, ovarian cyst. J Ultrasound Med 2004; 23:1643-1649

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- ● ● Twisted vascular pedicle showing the circular string-of-beads appearance of dilated veins (arrows). BL-indicates urinary bladder; and CYST, ovarian cyst. J Ultrasound Med 2004; 23:1643-1649

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- ● ● **A**, Snail shell appearance of the twisted pedicle (arrows). BL indicates urinary bladder; and CYST, ovarian cyst. **B**, Color Doppler study of the twisted artery and vein. J Ultrasound Med 2004; 23:1643-1649

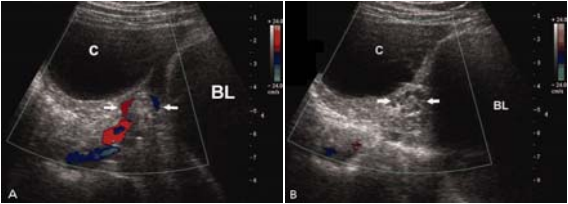
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- ● ● Twisted pedicle appearing as a large echogenic mass (arrows). **B**, Color Doppler study of the pedicle showing absent flow. J Ultrasound Med 2004; 23:1643-1649

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Color Doppler study of the pedicle showing the twisted artery alone in the proximal part (A) and no flow in distal part (B). BL indicates urinary bladder; and C, ovarian cyst.

J Ultrasound Med 2004; 23:1643-1649




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Ultrasound Image of Hydrosalpinx.



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B-mode ultrasonography of hydrosalpinges. (A) An elongated shaped mass with **incomplete septa** (curved arrow) is related to the presence of a hydrosalpinx. (B) Another elongated shaped mass presenting hyperechoic mural nodules measuring approximately 2-3 mm, called **'beads-on-a-string'** (straight arrow). (C) The **'waist sign'**, defined as indentations along opposite sides of the cystic mass (straight arrow) is another feature related to hydrosalpinx.



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Fallopian tube torsion

- Fallopian tube torsion is an uncommon cause for acute low abdominal pain in women.
- Because it has no pathognomonic clinical symptoms or findings on imaging or laboratory studies, a history of current or previous pelvic pathologic conditions or surgery, as well as pregnancy, should draw the attention of the attending physician to its occurrence.
- Early laparoscopy is the reference standard in the diagnosis and treatment.

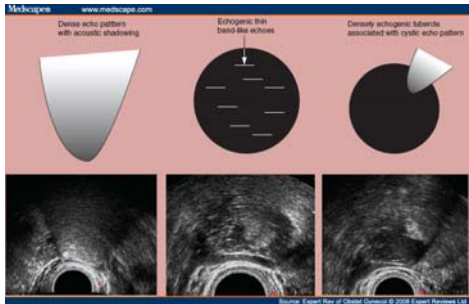
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Mature Cystic Teratoma (Dermoid), With a Somewhat Bizarre Appearance.



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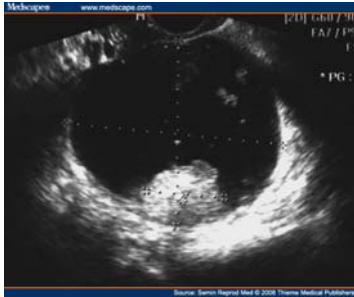
Typical transvaginal B-mode findings of cystic teratoma.



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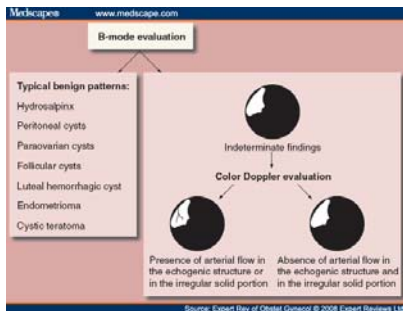
## Papillation on Cyst Wall in a Serous Cystadenocarcinoma.



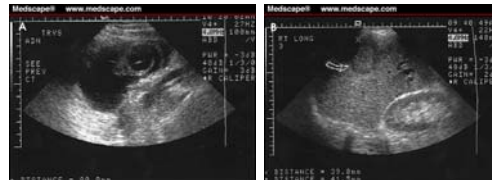
An invasive ovarian serous cystadenocarcinoma characterized by a large irregular solid portion showing several small and irregular vessels inside the mass (curved arrows) using color Doppler.



## Flow chart for the diagnosis of ovarian cancer.



Krukenberg's tumors. (A) Transverse ultrasound of the lower abdomen in this elderly patient demonstrating an 8-cm complex mass corresponding to metastatic disease from prior colon cancer. Tumors were bilateral. (B) Longitudinal ultrasound of the patient's liver demonstrating metastatic liver lesion (curved arrow).



## Morphologic Scoring of Adnexal Masses

Semin Reprod Med. 2008;26(3):252-265.

Value	Inner Wall Structure	Wall Thickness	Septa	Echogenicity
1	Smooth	≤ 3 mm	None	Sonolucent
2	Irregular < 3 mm	> 3 mm	≤ 3 mm	Low
3	Papillation > 3 mm	Not applicable	> 3 mm	Low with echogenic core
4	Not applicable	-	-	Mixed
5	Mostly solid	-	-	High
Maximum	4	3	3	5

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## Pelvic inflammatory disease (PID)

- PID is a frequent infection of the female upper genital tract commonly associated with infertility, chronic pelvic pain, ectopic pregnancy and recurrent infection.
- Both rapid and sensitive diagnosis and effective treatment are needed to optimally manage PID. Unfortunately, the diagnosis of PID is challenging and imprecise, as the symptoms and signs vary widely. PID may be confused with other pelvic conditions that exhibit similar symptoms, such as endometriosis, appendicitis or ectopic pregnancy.
- Owing to the potential for serious sequelae, a low threshold including the following criteria should be used for the diagnosis of PID: **uterine/adnexal tenderness or cervical motion tenderness.**

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- Four ultrasound markers that suggest evidence of PID include **free fluid** in the cul-de-sac, **multicystic ovaries**, visualization of **fallopian tube or tubal fluid**, and presence of an **adnexal mass or TOA**.

Source: Ma OJ, Mather JR, Blaivas M: Emergency Ultrasonod, 2nd Edition: <http://www.accessmedicine.com>. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

- This tubo-ovarian abscess is characterized by a cystic component (curved arrow) with an apparently solid area (straight arrow).

Source: Expert Rev of Obstet Gynecol © 2008 Expert Reviews Ltd  
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- Tubo-ovarian complex. Endovaginal image of the left adnexa (A) shows a distorted ovary (OV) partially encircled by a fluid-filled hydrosalpinx (TUBE). Power Doppler (B) shows marked hyperemia throughout this similar complex structure.

Source: Ma OJ, Mather JR, Blaivas M: Emergency Ultrasonod, 2nd Edition: <http://www.accessmedicine.com>. Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

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- A Peritoneal Pseudocyst Indicative of Cul-de-sac Adhesions.

Source: Savin Rogard Med © 2008 Trauma Medical Publishers  
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### Acute appendicitis

- In most situations, the diagnosis or exclusion of acute appendicitis will be apparent clinically.
- US may prove very useful. Ultrasound is best performed using a 4- to 5-MHz curved sector scanner examining the entire abdomen. After performing this portion of the study, graded compression US using a 7.5-MHz linear probe is performed in the right lower abdomen. If a gynecological process is suspected or cannot be excluded, endovaginal scanning may be performed.
- By a meticulous examination performed by well-trained personnel, US will have a fairly high accuracy in diagnosing appendicitis. Either sonography or CT may be used to drain periappendiceal or pelvic abscesses associated with appendicitis.

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### Ultrasound findings of appendicitis

- Thickened wall >3 mm
- Diameter >6 or 7 mm
- Blind-ended tubular structure
- Noncompressible
- Appendolith
- Circumferential color flow
- Echogenic mesentery
- Free fluid
- Abscess

Acute appendicitis. Ultrasound of the RLQ of the abdomen demonstrating blind-ended tubular structure (open arrows) corresponding to acutely inflamed appendix. Note the distended lumen [L], the echogenic surrounding mesentery [M], and the echogenic structure with acoustic shadow (arrow) at the base of the appendix corresponding to an appendolith.

Source: Expert Rev of Obstet Gynecol © 2008 Expert Reviews Ltd  
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Normal bowel. (A) Ultrasound examination of the RLQ demonstrating 1-cm loop of fluid-filled bowel (arrow). (B) With compression and normal peristalsis, the diameter of this normal loop of bowel decreases to 5 mm (arrow).

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Acute appendicitis. Transverse color-flow ultrasound of the RLQ of the abdomen demonstrates increased vascularity (arrow) in a fluid-filled structure corresponding to acute appendicitis. External iliac artery [A] is identified.

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Ureter stone. (A) Longitudinal ultrasound of the right upper quadrant of the abdomen demonstrated mild dilatation of the renal collecting system (arrow). (B) and (C) Longitudinal ultrasound through the patient's bladder in the right lower quadrant demonstrating distal uretral stone (arrow). Note, ureteric jet (open arrow). There is only partial obstruction.

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## Conclusion

- Female patients with lower abdominal pain presenting to the emergency department or acute care clinic may represent a diagnostic challenge. Faced with a large differential diagnosis, their clinical work-up is often time and resource consuming.
- Bedside **ultrasound is the diagnostic imaging modality of choice for the majority of cases.** It provides real-time information that expedites patient care and disposition.

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## Thanks for your attention

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