
PICTORIAL ESSAY

Ectopic Pregnancy

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ABSTRACT

This essay describes the different ultrasonographic features of ruptured and non-ruptured ectopic gestation in β -human chorionic gonadotrophin-positive women with a history of vaginal bleeding.

Key Words: Chorionic gonadotropin, beta subunit, human; Hemoperitoneum; Pregnancy, ectopic; Ultrasonography

INTRODUCTION

Ectopic pregnancy during the first trimester is the leading cause of pregnancy-related death in the USA.¹ The incidence rate has risen dramatically during the past 30 years,² as a consequence of injudicious antibiotic therapy, reconstructive tubal surgery, and the use of intrauterine contraceptive devices.

Clinical signs and symptoms of ectopic pregnancy are often non-specific, and the diagnosis is initially missed in up to 70% of patients.³ The classic triad of pain, bleeding, and adnexal mass (Figure 1) is present in 45% of patients.⁴

Multiple non-obstetric and gynaecologic problems may present with a similar clinical scenario. Therefore, ultrasonography (USG) has been increasingly used for evaluating pelvic pain and vaginal bleeding in women of childbearing age in addition to clinical history, physical examination, and laboratory data.

With the availability of high-resolution transvaginal USG and the development of a highly specific/sensitive serum pregnancy test, ectopic gestations are detected at an earlier stage, enabling an elective approach to treatment. The accuracy of USG can be increased if findings are interpreted with reference to serum β -human chorionic gonadotrophin (β -HCG) discriminatory levels.

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This article illustrates the spectrum of USG appearances of ectopic pregnancy, and highlights the role of high-resolution USG in establishing an early diagnosis in clinically confusing situations.

Computed tomography (CT) findings are non-specific in ectopic pregnancy and pose a hazard of ionising radiation, which may be harmful to normal fetuses. CT is not appropriate for analysis of ectopic pregnancy.

Magnetic resonance imaging (MRI) is time consuming and costly. MRI has been used as a problem-solving tool for patients in a stable condition or in special circumstances. Tubal wall enhancement and presence of a tubal haematoma or gestational sac-like structure are considered to be diagnostic findings.⁵

No clinically useful nuclear medicine studies have been identified for ectopic pregnancy.

SITES OF ECTOPIC IMPLANTATION

The following implantation sites have been reported:⁶

- tubal (95% to 97% of all ectopic pregnancies) — the ampulla is the most common site (75% to 80%), followed by the isthmus (10% to 15%), fimbria (5%), and cornua (2%)
- abdominal (1.3%)
- ovarian (0.5%)
- cervical (0.1%).

SONOGRAPHIC AND COLOUR DOPPLER FINDINGS

Suspicion for an ectopic pregnancy should be high in an β -HCG-positive patient without an identifiable intrauterine gestation (Figure 1). Approximately 15% to 35%

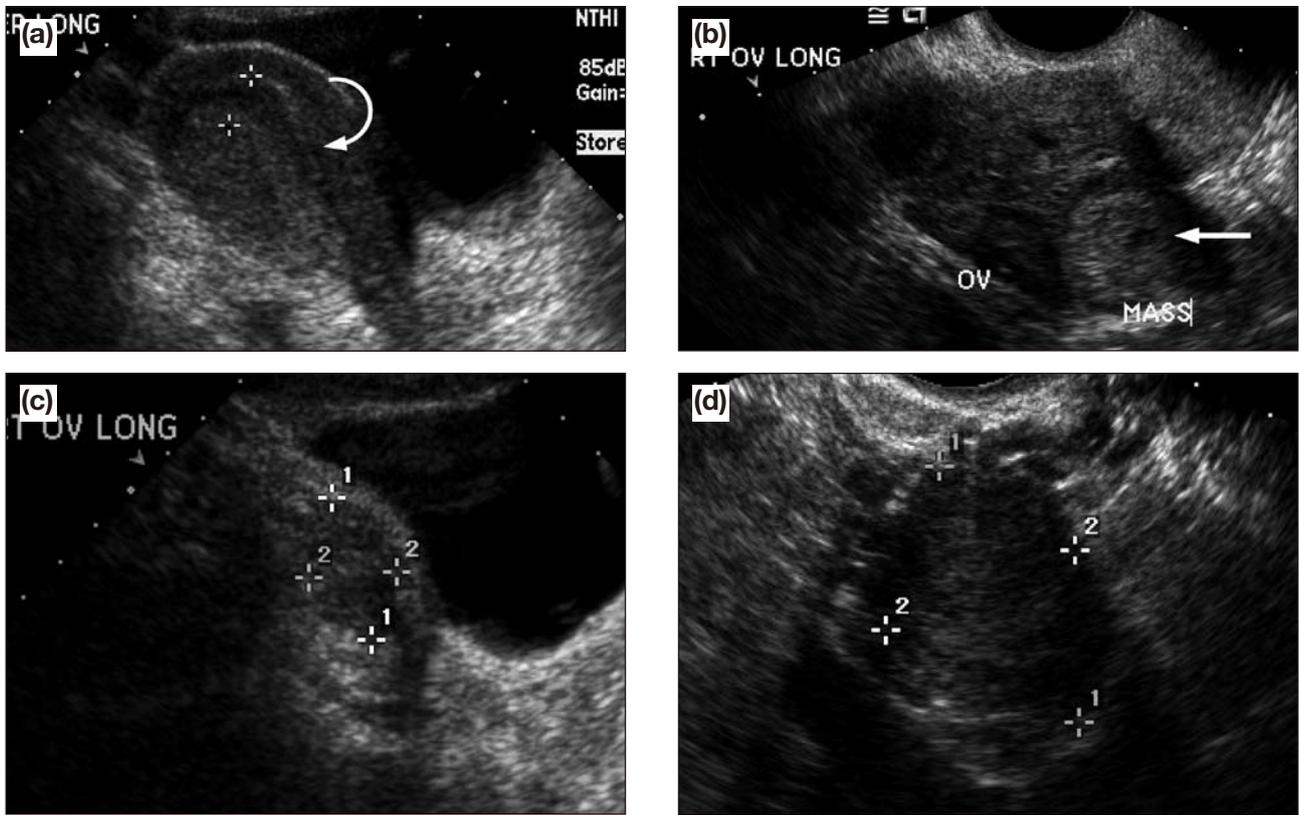


Figure 1. Extraovarian adnexal mass. (a) Sagittal transabdominal scan showing no evidence of intrauterine gestation and thickened endometrium (arrow); (b) transvaginal sonogram showing a right adnexal mass (arrow) separate from the right ovary with a possible gestational sac-like structure; and (c and d) normal appearing ovaries separate from the mass.

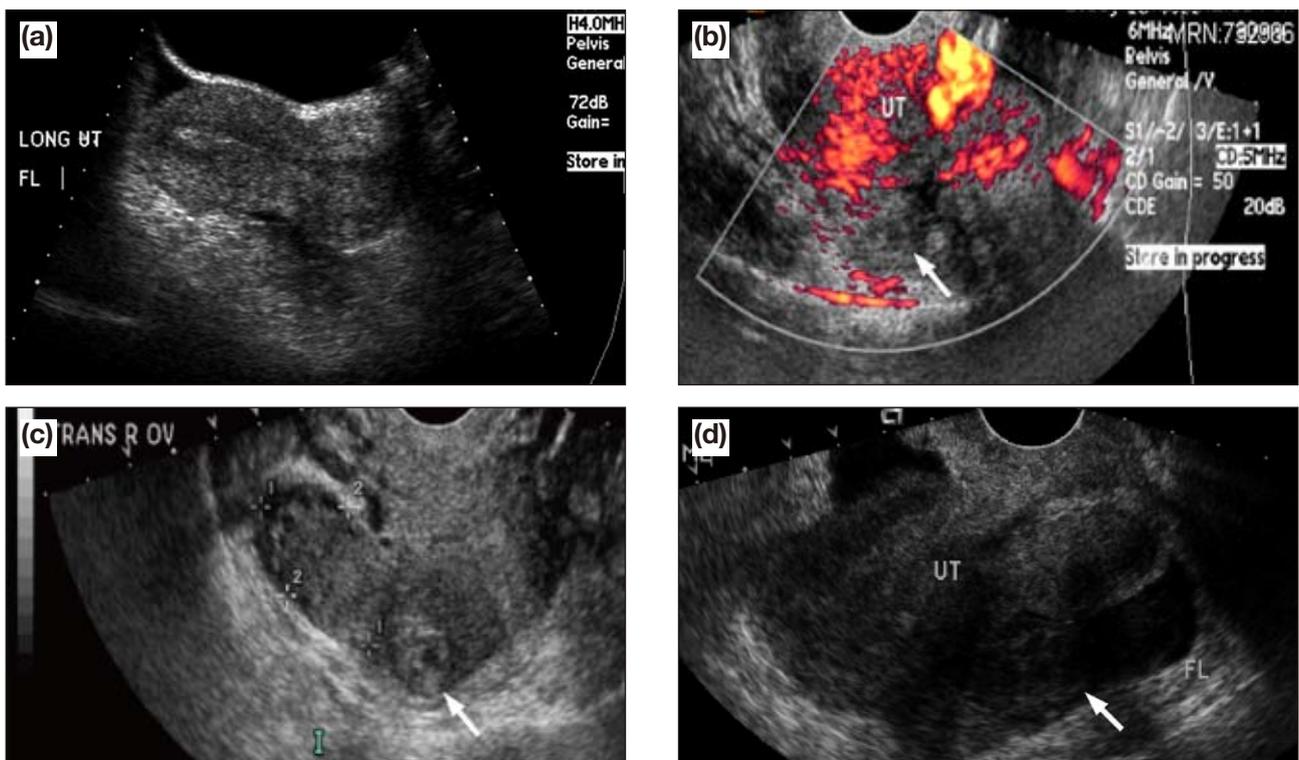


Figure 2. Extraovarian adnexal mass. (a) Sagittal transabdominal scan showing no evidence of a uterine gestational sac; (b and c) complex right adnexal mass (arrows) adjacent to the right ovary, with flow on power Doppler evaluation; and (d) minimal pelvic free fluid with internal echoes (arrow) suggestive of haemorrhage.

Table 1. Ultrasonographic findings that are suggestive of ectopic gestation.

Finding	Sensitivity (%)	Specificity (%)
Extrauterine gestational sac containing a yolk sac with or without an embryo	8-34	100
Dilated and thick-walled fallopian tube (adnexal ring)	40-68	100
Cystic or solid adnexal mass separate from the ovary	89-100	92-99
Any fluid*	46-75	6-83
Moderate amount of fluid*	29-63	21-96
Free echogenic intraperitoneal fluid	56	96
Decidual cast	21	92

* The presence of free fluid is not specific to ectopic pregnancy. The chances of the mass/lesion being an ectopic pregnancy generally increases with the amount of fluid. Free echogenic intraperitoneal fluid indicates a ruptured/leaking ectopic pregnancy.

of patients do not demonstrate an identifiable extrauterine mass on transvaginal USG.⁷ So an ectopic gestation cannot be excluded when no adnexal mass is seen. An early intrauterine pregnancy, spontaneous abortion, or ectopic pregnancy can all present with an empty uterus (Figure 2). The USG findings that are suggestive of ectopic gestation include one or a combination of those shown in Table 1.

Colour-flow Doppler imaging may be helpful for the diagnosis of ectopic pregnancy (Figure 3). There is low-resistance flow at the site of placental implantation, which is not seen in pseudosac of ectopic gestations.⁸ Colour-flow Doppler imaging demonstrates sparse distribution of pulsatile vascular colour pattern with a low-velocity arterial waveform (peak systolic velocity <10 cm/second) and low diastolic flow (indicating high

resistance); the typical waveform of a radial branch of the uterine artery.

Ectopic gestations demonstrate high-velocity low-impedance Doppler flow signal. Taylor et al reported high-velocity low-impedance flow in 54% of ectopic pregnancies in their series.⁹ However, this finding is also seen in a corpus luteum cyst.

Resistive index values can be helpful for differentiating between a corpus luteum cyst and an ectopic pregnancy, although a substantial overlap exists between them. The resistive index values for ectopic pregnancy range from 0.15 to 1.60, and for corpus luteum cyst range from 0.39 to 0.70. A resistive index <0.39 has a positive predictive value of 100% but a sensitivity of only 15% for the diagnosis of ectopic pregnancy.^{10,11}

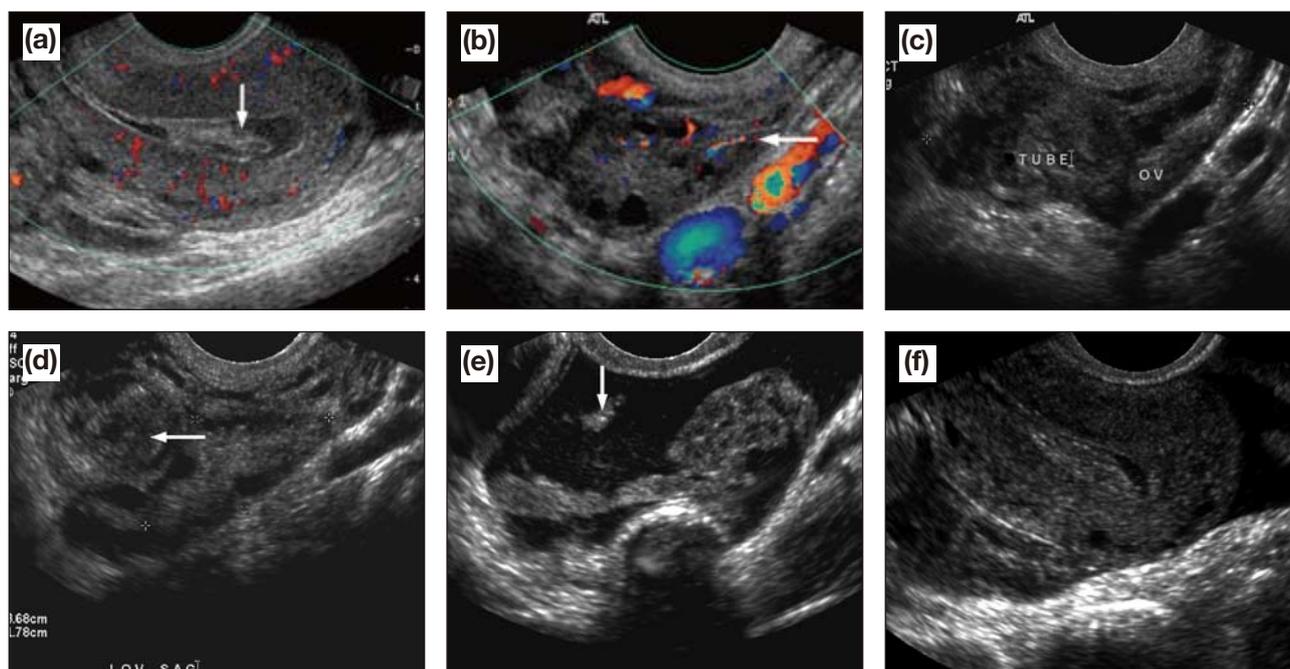


Figure 3. Extraovarian adnexal mass. (a) Sagittal transvaginal scan of the uterus without intrauterine gestational sac, with hyperechoic material in the endometrial canal (arrow) suggestive of a clot; (b) transvaginal scan showing a normal appearing left ovary (arrow) with normal flow; (c and d) transverse and coronal transvaginal scans showing a heterogenous lesion (arrow) separate from the ovary located between the uterus and the left ovary suggestive of a left ectopic gestation; and (e and f) a small-to-moderate amount of complex free fluid (arrow) consistent with haemorrhage in the pelvis and left adnexa.

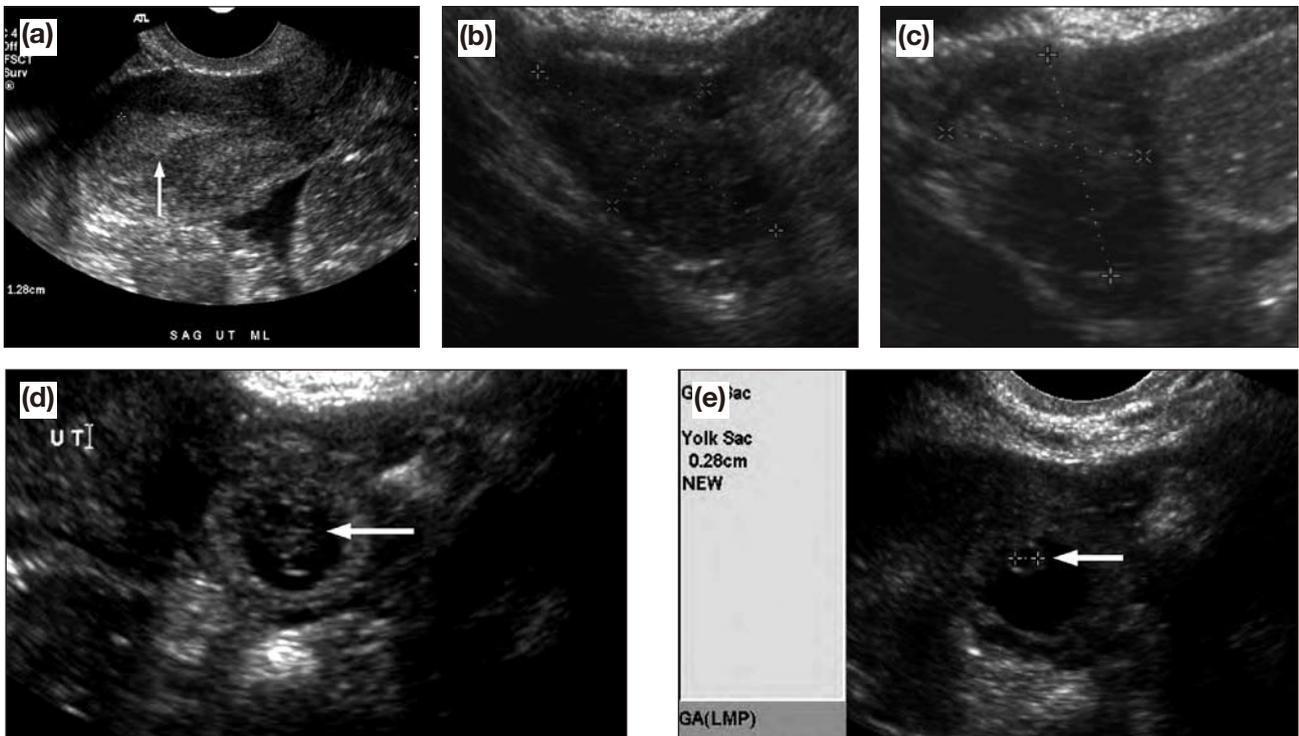


Figure 4. Extraovarian adnexal mass. (a) Sagittal transvaginal scan of the uterus without intrauterine gestational sac, with thickened endometrium and minimal free fluid in the pelvis (arrow); (b and c) the ovaries are unremarkable; (d) gestational sac with a live foetus in the left adnexa (arrow); and (e) transverse transvaginal scan showing a yolk sac (arrow).

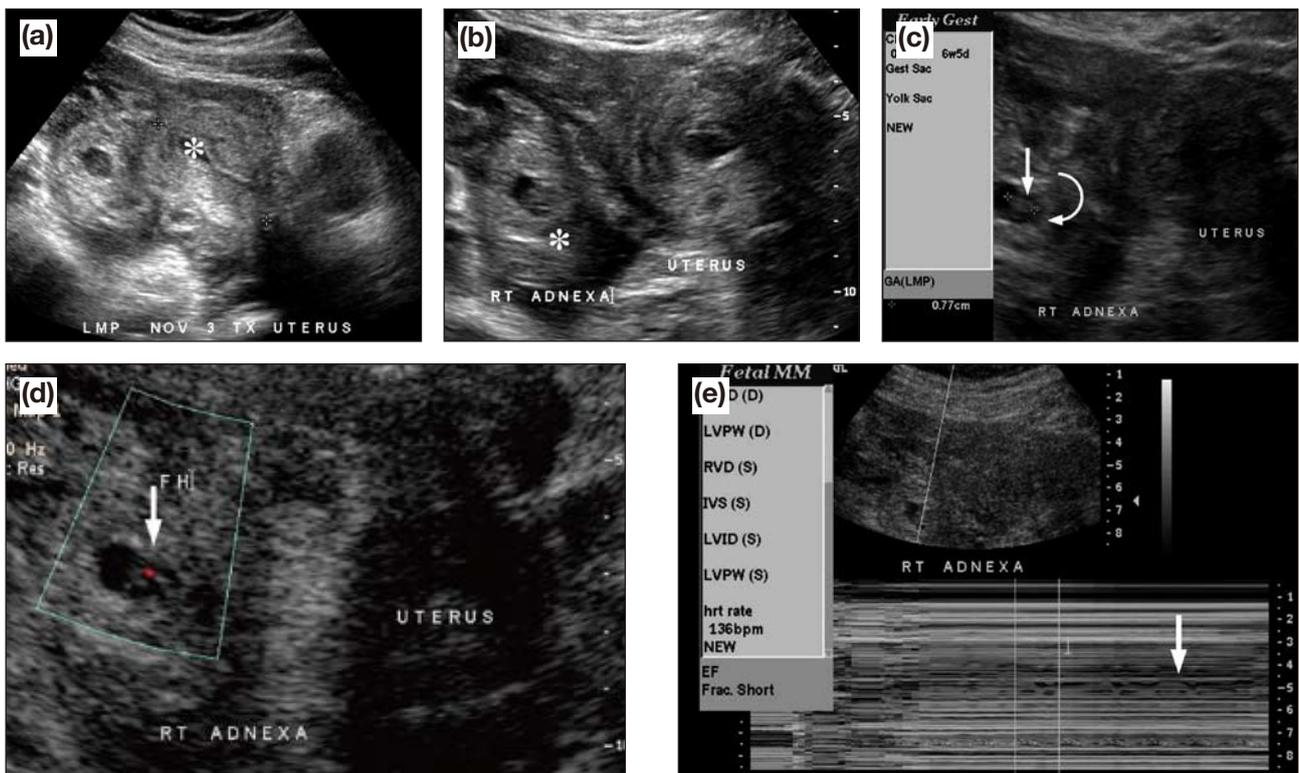


Figure 5. Extraovarian adnexal mass. (a) Transverse transabdominal scan of the pelvis showing no evidence of intrauterine gestation — fluid (asterisk) is noted in the endometrial cavity (pseudogestational sac) and there is a right adnexal lesion with a gestational sac-like structure in the centre; (b and c) transverse transabdominal scan of the pelvis showing a right adnexal mass (asterisk) and a gestational sac (curved arrow) with a foetal pole (straight arrow); and (d and e) transabdominal scan showing a foetus (arrow) — foetal cardiac activity is present on the M-Mode image (arrow).

In patients with a positive pregnancy test without an intrauterine gestation, the combined use of both transvaginal/transabdominal USG with colour-flow Doppler imaging must be employed to exclude the possibility of an extrauterine gestation (Figure 4). A follow-up scan should be recommended because even small gestational sacs grow at 0.8 mm/day and a repeat examination 2 to 3 days later will show a change.¹⁰

The identification of an intradecidual sign, which is a well-defined fluid collection surrounded by decidual tissue and adjacent to the central cavity echo complex, is suggestive of an intrauterine gestation, with a limited sensitivity of 34% to 66% and specificity of 55% to 73%.¹² This sign is universally found in sacs with mean sac diameter >10 mm. The double-decidual sign, which can be used to identify an intrauterine pregnancy before visualisation of the yolk sac or embryo, must be distinguished from the decidual cast or pseudogestational sac of ectopic pregnancy.¹³ The importance of establishing

a diagnosis of early intrauterine gestation in a woman with suspected ectopic gestation lies in the fact that concomitant intra- and extrauterine gestations occur in 1 in 30,000 pregnancies.¹⁴

Hormonal changes associated with pregnancy can result in a pseudogestational sac (Figure 5). A pseudogestational sac is an intrauterine fluid collection surrounded by a single decidual layer rather than the 2 concentric rings of the double-decidual sign of intrauterine pregnancy. A pseudogestational sac is seen in 20% of patients with ectopic gestations.

The isolated finding of free intraperitoneal fluid in the absence of intrauterine gestation has been shown to have a specificity of 69% and sensitivity of 63% for the diagnosis of an extrauterine gestation. In particular, echogenic fluid has a high positive predictive value for bleeding or ruptured ectopic pregnancy (Figure 6). The volume of haemoperitoneum does not correlate with

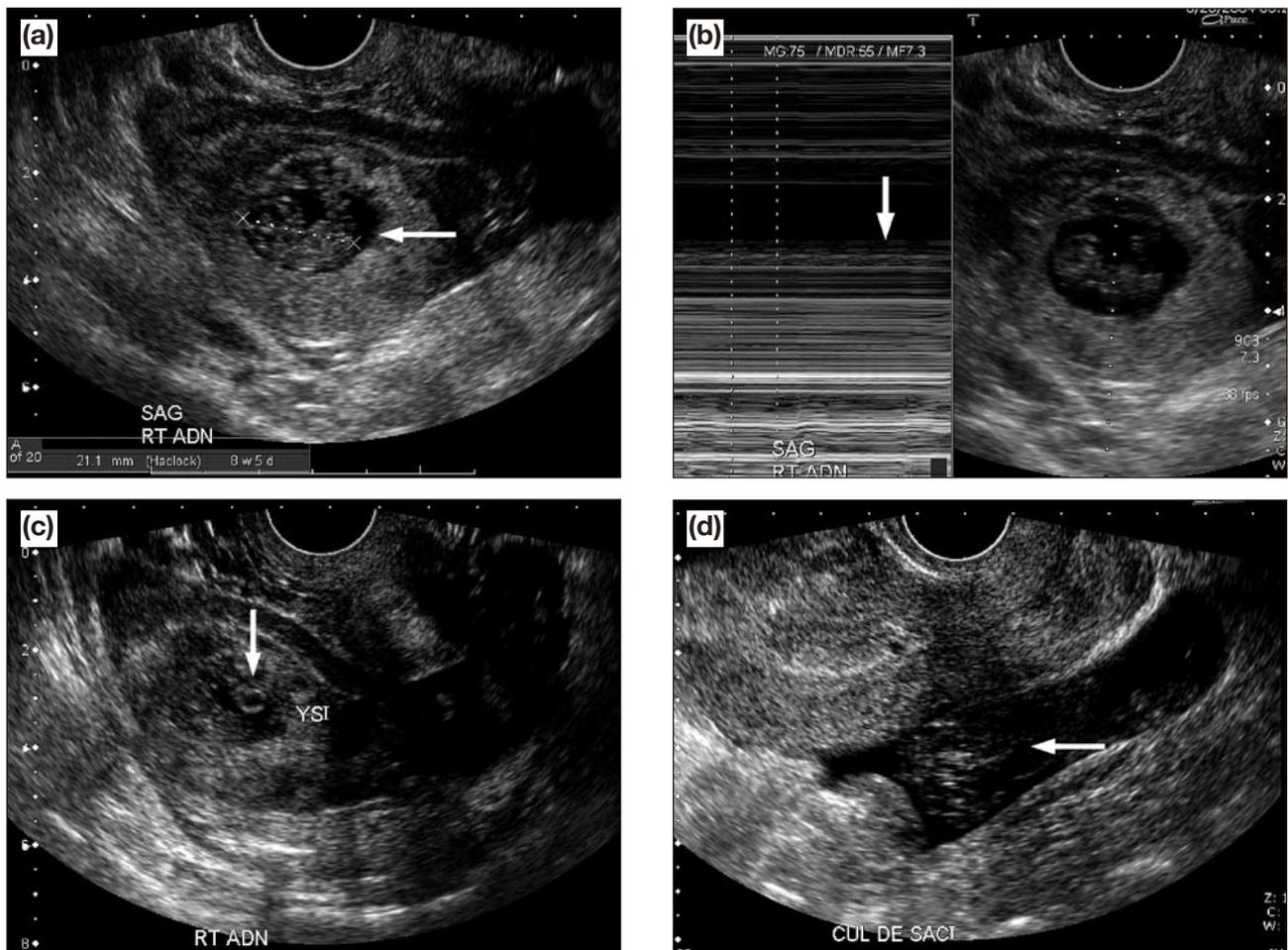


Figure 6. Extraovarian adnexal mass. (a) Transvaginal scan showing a well-formed foetal pole (arrow) in the right adnexa; (b) transvaginal scan on M-Mode showing cardiac activity in the ectopic gestation (arrow); (c) right adnexal ectopic gestation with a yolk sac (arrow); and (d) echogenic free fluid in the cul-de-sac (arrow) consistent with haemorrhage associated with ruptured ectopic gestation.

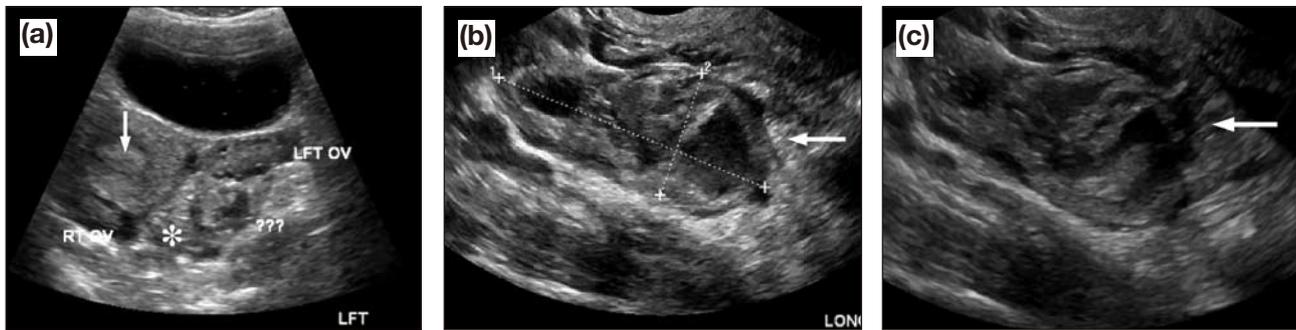


Figure 7. Extraovarian adnexal mass. (a) Transverse transabdominal scan of the pelvis showing an empty endometrial cavity (arrow) with a left adnexal mass (asterisk); and (b and c) an oblong complex structure with thick irregular walls and internal echoes in the left adnexa (arrows), better visualised in the transvaginal scan which is suggestive of a dilated fallopian tube with haemorrhage (haematosalpinx).

tubal rupture. A large volume of haemoperitoneum may also occur with active bleeding from the tubal fimbria, tubal abortion, or rupture of the corpus luteum.¹⁵

The most specific finding for an ectopic gestation is that of an extrauterine live embryo. However, this finding is not sensitive, as shown in Table 1.

The presence of an extraovarian adnexal mass is more sensitive and equally specific depending on the patient selection, ie, women with suspected pregnancy with abdominal pain or vaginal bleeding require further evaluation by transvaginal USG (Figure 7). A β -HCG level of 1000 mIU/mL or lower should increase suspicion of ectopic pregnancy.¹¹

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