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## Case Report

# Just a mirage: heterotopic intrauterine and twin ectopic pregnancy mimicked by mirror imaging on ultrasound

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## ABSTRACT

Heterotopic pregnancies are rare and are usually diagnosed by transvaginal ultrasound. Despite the routine use of sonography in early pregnancy, artifact created by mirror imaging can drastically and erroneously alter medical decision making by interfering with image interpretation. A heterotopic pregnancy with a single intrauterine gestation and twin left adnexal ectopic gestational sacs was observed on ultrasound in a woman presenting with abdominal pain. During laparoscopy, an ectopic pregnancy was not identified, and subsequent intraoperative ultrasound reproduced the heterotopic pregnancy through manipulation of bowel, confirming mirror image artifact. This phenomenon is rarely seen in obstetric imaging; therefore, lack of awareness can lead to false diagnosis of heterotopic pregnancy. Techniques to verify correct diagnosis should be used to resolve potential mirror artifact before proceeding with surgical management.

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## Case report

A 20-year-old G1P0 woman presented to the emergency department with 4 weeks of worsening pelvic pain. Gestational age was 11 and 3/7 weeks determined by last menstrual period. At the time of presentation, she reported an acute onset of left lower quadrant pain associated with nausea and

vomiting that continued to worsen. She also reported intermittent vaginal bleeding that ceased by the time of presentation. Her past medical history included endometriosis for which she had previously undergone operative laparoscopy and a history of chlamydia for which she had received treatment. She denied use of assisted reproductive technologies or known uterine anomalies.

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On evaluation, her vital signs were within normal limits. Physical examination was significant for moderate suprapubic and left lower quadrant tenderness without significant rebound or guarding. Pelvic examination showed a grossly normal appearing cervix with a closed cervical os. Her hemoglobin and hematocrit were 13.5 g/dL and 41%, respectively. Serum human chorionic gonadotropin level was 229,140 mIU/mL. Blood type was O positive. Her urinalysis was normal.

Initial post-void transvaginal ultrasound (TVUS) demonstrated an intrauterine gestational sac containing a yolk sac and fetal pole with crown rump length measuring 17.7 mm (Fig. 1A) consistent with a gestational age of 8 and 2/7 weeks. Fetal cardiac activity was 180 beats per minute on cine gray scale and M-mode imaging (Fig. 1B). In addition, there appeared to be an ectopic gestational sac containing a fetal pole in the left adnexa lateral to the lower uterine segment. A thick ring of echogenic tissue surrounded this gestational sac. Initially, cardiac activity could not be detected in the ectopic gestational sac. To better characterize the findings of the suspected heterotopic pregnancy, the TVUS was repeated during her evaluation in the emergency department. This time, 2 gestational sacs were noted adjacent to each other in the left adnexa (Fig. 2). Each gestational sac contained a fetal pole, and cardiac activity was again confirmed on cine gray scale and M-mode imaging. The adnexa could not be adequately evaluated via transabdominal approach due to gaseous bowel distention.

Given the reproducibility of the findings on imaging and worsening pelvic pain, a heterotopic triplet pregnancy was high on the differential diagnosis. Because of the viable intrauterine pregnancy and the large twin ectopic pregnancy, the decision was made to proceed with diagnostic laparoscopy and potential salpingectomy.

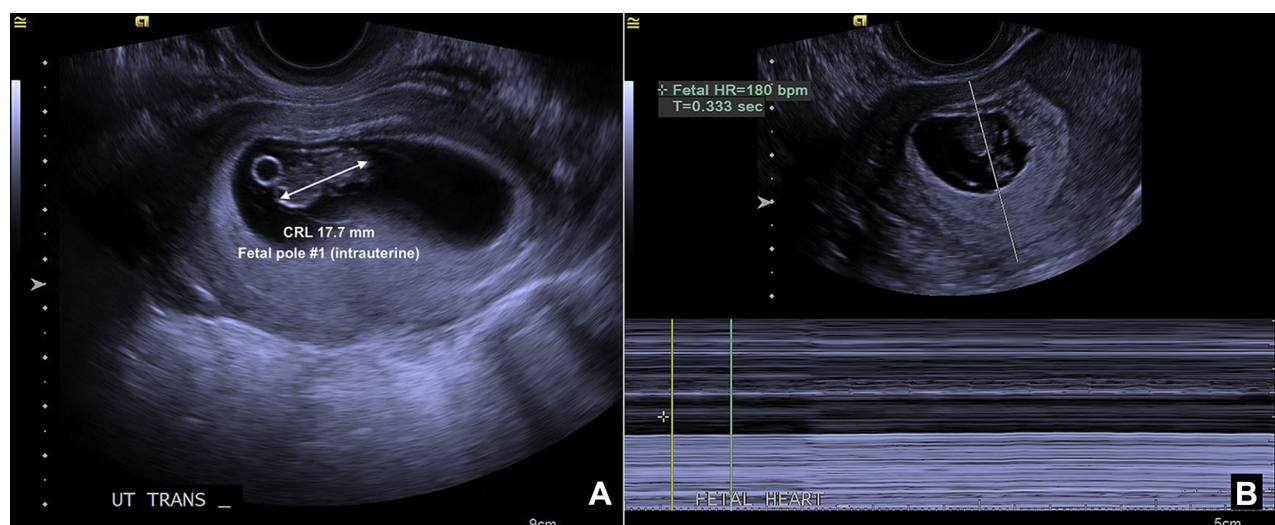
Significant bowel gas distention was noted intraoperatively, but an ectopic pregnancy could not be identified. Because of discordance with her initial evaluation, a TVUS was performed while in the operating room, demonstrating normal adnexa, and a single live intrauterine pregnancy. Mirror images

mimicking the heterotopic gestational sacs were reproduced with careful manipulation of the ultrasound probe, uterus, and the bowel (Fig. 3). The mirror gestations appeared deep to the true intrauterine gestation, and both were simultaneously noted in the field of view. This differed from the preoperative ultrasound examinations, where the ectopic mirror gestations were noted laterally, and the true intrauterine gestation was outside the field of view. Mirror image artifact was confirmed by simultaneously keeping the ectopic gestational sacs in view while manipulating the bowel immediately adjacent to the uterus, which distorted the mirror image. The findings were discussed with the patient after recovery. The procedure was uncomplicated, and the patient was discharged home in stable condition with outpatient follow-up.

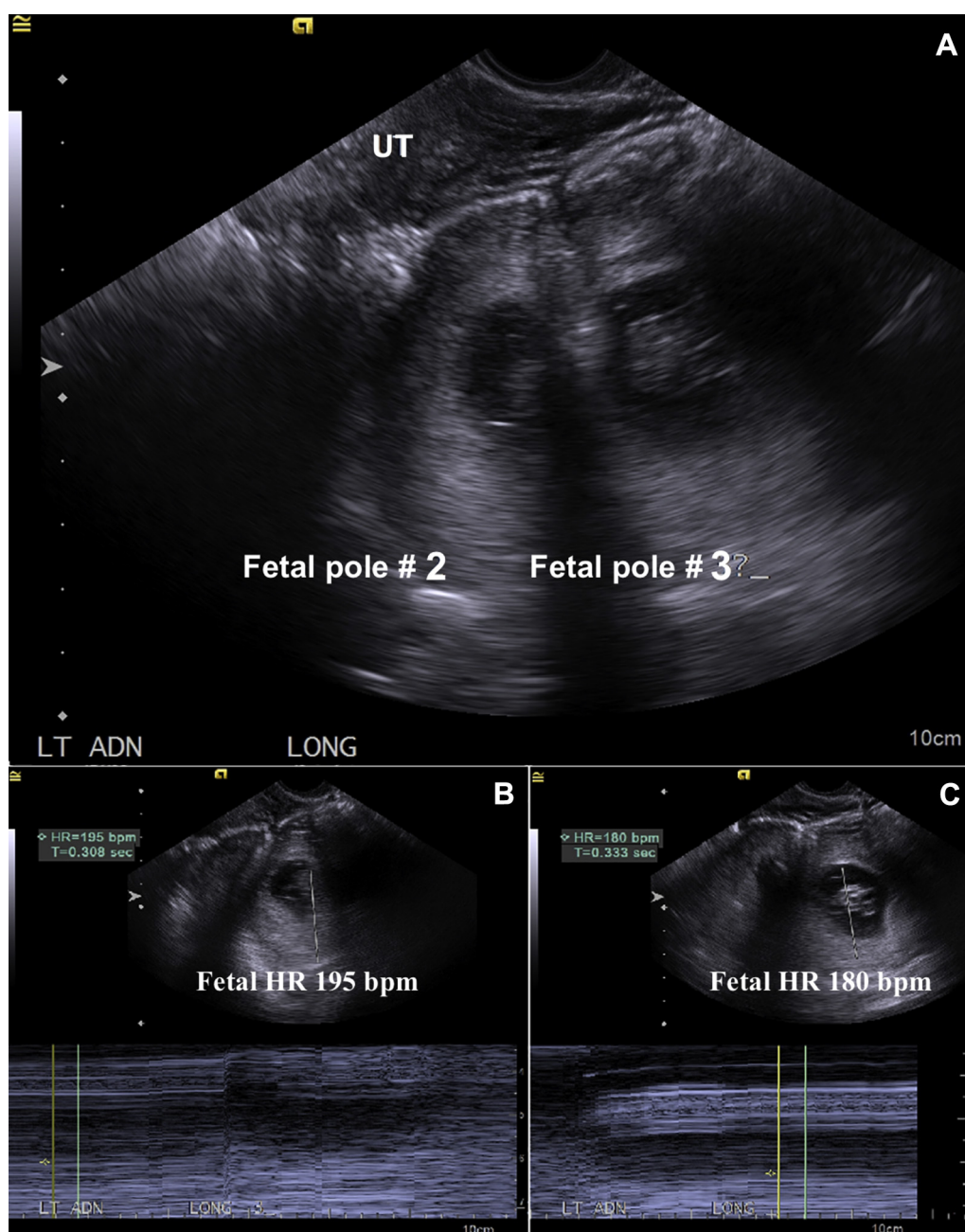
## Discussion

A heterotopic pregnancy refers to the occurrence of an intrauterine pregnancy and concomitant pregnancy at an ectopic site, such as the cervix, fallopian tube, or abdominal cavity. The diagnosis is established with TVUS, which allows for rapid detection of multiple gestational sacs. Mirror image artifact (MIA) is commonly encountered by radiologists and ultrasound technicians but is seldom reported in obstetrical imaging. In Doppler sonography, mirror artifacts have been reported in 2.5% of cases [1]. However, there are only few case reports on similar findings and subsequent misinterpretation in obstetric literature, with the true incidence of MIA being unknown [1]. Lack of awareness of MIA makes it less likely to be recognized in critical situations, subsequently leading to diagnostic error. Obstetricians must understand the physical explanation of this artifact so that this phenomenon can be easily distinguished.

In ultrasonography, the term “artifact” refers to an inaccurate representation of an anatomic structure, which occurs in many different ways [2]. The principle behind ultrasound imaging lies in the assumption that the ultrasound beam emitted from the transducer travels in a straight path at a



**Fig. 1 – (A) Transvaginal ultrasound demonstrating intrauterine fetal pole #1 with crown rump length (CRL) measuring 17.7 mm. (B) M-mode via transvaginal ultrasound demonstrating fetal cardiac activity of intrauterine fetal pole #1, 180 bpm.**



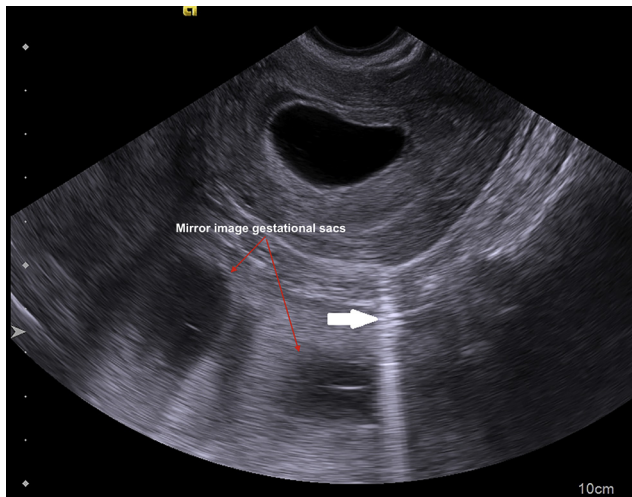
**Fig. 2 – (A) Transvaginal ultrasound demonstrating 2 ectopic gestational sacs containing fetal poles in the left adnexa labeled “Fetal pole #2” and “Fetal pole #3.” The uterus (UT) is seen to the left of the image. (B) M-mode via transvaginal ultrasound demonstrated cardiac activity in ectopic fetal pole #2, 195 bpm. (C) M-mode via transvaginal ultrasound demonstrated cardiac activity in ectopic fetal pole #3, 180 bpm.**

constant velocity and is reflected directly to the transducer once it encounters a structure in the body. MIA occurs when the primary ultrasound beam encounters a highly reflective surface, known as a “specular reflector” (ie, air-containing bowel), and is scattered away from the straight path from which it was emitted (Figs 4A and 4B) [3,4]. The angle of refraction can differ as the ultrasound beam is reflected between the transducer, the specular reflector, and the structure being mirrored. This can produce single or multiple mirror images. In this case, the gas-fluid interface of the patient’s bowel and pregnant uterus

created a unique reflection of an intrauterine gestational sac into the adnexa, which retained the ability to obtain a fetal heartbeat in the ectopic gestational sacs, resulting in the false interpretation of a heterotopic triplet pregnancy. Bowel manipulation at the time of laparoscopy disrupted the gas-fluid interface and thus eliminated the mirage.

Common scenarios that illustrate MIA include the diaphragm-lung and gallbladder-liver interfaces [3]. However, mirror imaging is rarely noted in pelvic sonography despite the regular use of TVUS in obstetrics and gynecology. There





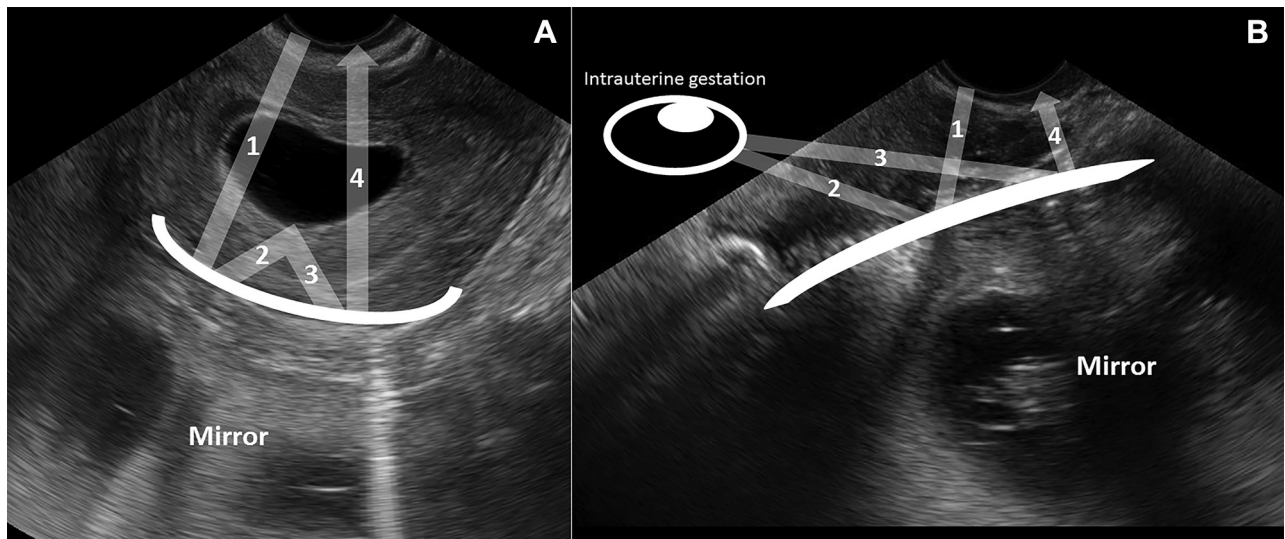
**Fig. 3 – Transvaginal ultrasound performed during laparoscopy while the abdomen was distended with CO<sub>2</sub>. Deep to the uterus are 2 mirror image gestational sacs (red arrows) that appear to lie outside of and deep to the uterus. Note the echogenic ring artifact caused by the laparoscopic instrument (white arrow). Gentle manipulation of adjacent bowel caused distortion of the mirror image.**

are 3 prior case reports and 1 case series of intrauterine gestational sacs mirroring to create the appearance of ectopic gestational sacs [1,5–7]. However, unlike our case, in the previous reports, the mirror image artifact resolved on reimaging or after emptying or filling the bladder.

The artifact seen during preoperative imaging (Fig. 2) could not be reproduced in the operating room. We believe the highly reflective interface between the intraluminal bowel air in the rectosigmoid region and the bowel wall served as a specular reflector causing the initial artifact. This case demonstrates that when a specular reflector is encountered by the primary beam, any structure in the vicinity may be mirrored even if it is not included in the field of view.

Cases of mirror image artifact in obstetrical imaging have now been demonstrated via transabdominal and transvaginal approach, with a full and empty bladder, and when the intrauterine gestational sac is beyond the field of view [1,5–7]. The variability of presentation can make pseudo-heterotopic pregnancy a challenging entity to recognize. Lack of reproducibility on repeat examinations, poor visualization of the ectopic gestational sac, and changes in ultrasound images with maneuvers such as filling or emptying the bladder, or maternal position changes, may help in accurately differentiating true vs false anatomy. A thick rim of tissue surrounding the gestational sac may also provide a clue to the presence of MIA because true ectopic pregnancies typically have little surrounding tissue [7].

However, in clinical circumstances with suspicion for ectopic pregnancy, there often may not be enough time to repeat examinations or sonography. This case demonstrates that if suspicion of a heterotopic pregnancy is seen on transvaginal imaging in the setting of gaseous bowel distention, then the presence of a reflective surface producing artifact should be considered. If troubleshooting techniques are unsuccessful, more detailed imaging such as magnetic resonance imaging may be considered before proceeding with



**Fig. 4 – (A) Schematic of MIA seen during transvaginal ultrasound intraoperatively, with the abdomen insufflated with CO<sub>2</sub>. The curved thick white line represents the specular reflector (CO<sub>2</sub>/uterus interface during laparoscopy). The beam pathway is represented by the transparent white line and travels from the transducer to the reflector (1), is reflected back and forth between the reflector and the intrauterine gestation (2 and 3), and is finally reflected back to the transducer (4). (B) Schematic explaining the unusual mirror image artifact seen during preoperative ultrasound. The curved thick white line represents the specular reflector (intraluminal air/bowel wall interface). The beam is reflected by the specular reflector (1), interacts with the gestational sac (2 and 3) outside the field of view (schematic shows approximate location), and is finally reflected back to the transducer (4). Unlike panel A, the intrauterine gestation being mirrored lies outside the field of view. MIA, mirror image artifact.**

more invasive interventions; however, this may not be cost or time effective. Recognizing a gas-fluid interface can help physicians mitigate the risk of interpreting artifact but should not delay definitive evaluation of an suspected ectopic pregnancy via surgical management.

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