

Ultrasonographic diagnosis and laparoscopic management of an interstitial ectopic pregnancy: A case report and literature review

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Abstract. Interstitial ectopic pregnancy is a rare yet potentially life-threatening type of ectopic gestation, representing ~2-4% of all ectopic pregnancies. As implantation occurs within the interstitial portion of the fallopian tube, the clinical presentation is often delayed, and the risk of a catastrophic hemorrhage is increased in the event that rupture occurs due to its intramural location. Early and accurate diagnosis with high-resolution transvaginal ultrasonography (TVUS) is thus essential to improve outcomes and preserve fertility. The present case report describes the clinical course of a 35-year-old woman (gravida 2, para 1) who presented with prolonged vaginal bleeding and recent-onset hypogastric pain. Serum β -human chorionic gonadotropin (β -hCG) levels plateaued just below 1,000 mIU/ml. TVUS revealed an empty uterine cavity, a thin endometrium and an eccentrically located, mixed-echogenicity mass within the right uterine cornu, clearly separate from the endometrial cavity. Key sonographic findings included the interstitial line sign, marked asymmetric thinning of the myometrial mantle surrounding the gestational sac to <5 mm and the absence of an adjacent endometrium. Color Doppler imaging demonstrated mild peripheral vascularity. Emergency laparoscopy confirmed an unruptured interstitial pregnancy lateral to the right round ligament. A laparoscopic wedge resection

of the interstitial segment was successfully performed, with local vasopressin administration to minimize intraoperative blood loss. The post-operative course of the patient was uneventful, with a rapid decline in β -hCG levels and no requirement for adjuvant methotrexate therapy. On the whole, the present case report underscores the critical role of high-resolution TVUS in the early diagnosis of interstitial pregnancy, and highlights the safety and efficacy of minimally invasive laparoscopic excision in hemodynamically stable patients with unruptured interstitial gestations. Early recognition and individualized surgical management are essential for optimizing clinical outcomes and preserving fertility in this rare condition.

Introduction

Interstitial pregnancy is defined as the implantation of the embryo within the interstitial portion of the fallopian tube, which traverses the myometrial wall of the uterus and lies lateral to the round ligament (1). It accounts for ~2-4% of all ectopic pregnancies and can be distinguished from angular and cornual pregnancies (2,3). Angular pregnancy refers to implantation at the lateral angle of a normal uterine cavity, medial to the utero-tubal junction and the round ligament (3). By contrast, cornual pregnancy occurs within a uterine horn of an anatomically abnormal uterus, such as a unicornuate, bicornuate, or septate uterus (3). The risk factors for interstitial pregnancy largely overlap with those of other tubal ectopic pregnancies and include a history of smoking, pelvic inflammatory disease, prior pelvic surgery and sexually transmitted infections (1,4,5). Additional notable risk factors are a previous ectopic pregnancy, the use of assisted reproductive technologies and congenital uterine anomalies (1,4,5). A history of ipsilateral salpingectomy is considered a particularly significant and distinct risk factor for interstitial pregnancy (6). By contrast, the use of an intrauterine device is less frequently associated with interstitial pregnancies compared to tubal or ovarian ectopic gestations (1).

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Interstitial pregnancy is a potentially life-threatening condition, with a reported mortality rate of ~2.0-2.5%, primarily due to the risk of rupture within the highly vascularized uterine wall (1,2,5,7,8). It is frequently complicated by massive hemorrhage and is associated with higher maternal morbidity and mortality compared with other forms of ectopic pregnancy (1,2,5,7). The majority of ruptures occur at ~12 weeks of gestation, although cases have been reported as early as 7 weeks (1,2). The relatively thick myometrial wall in the interstitial region of the fallopian tube allows the gestation to enlarge more than other ectopic pregnancies; however, this same feature can also delay diagnosis and complicate early detection (1,2). The early ultrasonographic diagnosis of interstitial pregnancy is crucial to prevent severe complications, and reduce maternal morbidity and mortality rates (1,2). Surgical management options include both laparotomy and laparoscopic approaches, such as cornuostomy or cornual resection. A conservative alternative is the systemic or local administration of methotrexate, which is effective for early, unruptured interstitial pregnancies in patients who are hemodynamically stable. Treatment success is typically monitored through the serial measurements of serum β -human chorionic gonadotropin (β -hCG) levels on days 0, 4 and 7, following established protocols, such as those described by Stovall and Ling (9); success rates of up to 83% have been reported (6,9).

The present case report describes the case of a patient with unruptured interstitial ectopic pregnancy diagnosed via transvaginal ultrasonography (TVUS) and successfully managed with laparoscopic surgery. In addition, it provides a review of the literature to highlight characteristic ultrasonographic features of interstitial pregnancies, and to summarize current management strategies.

Case report

A 35-year-old woman presented to the Emergency Department of the 'Elena Venizelou' General and Maternity Hospital, Athens, Greece on June 16, 2025, with a 22-day history of bloody vaginal discharge and colicky hypogastric pain that began 48 h prior to admission. She reported regular menstrual cycles every 28 days, with bleeding lasting 3-5 days; her last menstrual period occurred 33 days prior to presentation. Her serum β -hCG level, measured 48 h prior, was 995.68 mIU/ml. The patient was gravida 2, para 1, with a history of an uneventful lower-segment cesarean section 5 years earlier.

She reported no history of reproductive disorders, including miscarriage, abortion, ectopic pregnancy, or molar pregnancy and no gynecological conditions, such as dysmenorrhea, dyspareunia, or abnormal uterine bleeding. There was no history of sexually transmitted infections, pelvic inflammatory disease, uterine anomalies, or prior gynecological procedures, including intrauterine device placement or tubal surgery. She smoked three cigarettes daily and did not consume alcohol. An investigation of her medical history did not reveal any notable findings, aside from a reported penicillin allergy. Previous surgeries included a cesarean section and an appendectomy.

Upon admission, the patient was hemodynamically stable, with a blood pressure of 107/65 mmHg and a heart rate of

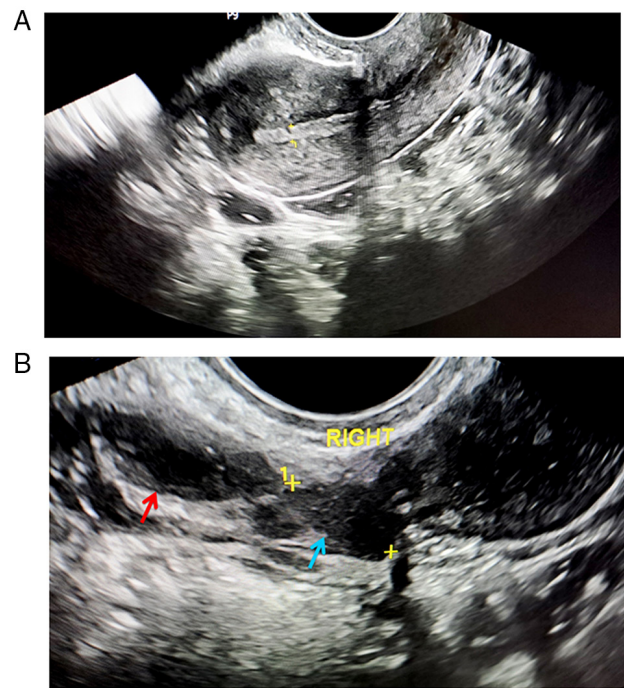


Figure 1. Transvaginal ultrasonography. (A) Empty uterine cavity with a thin endometrium measuring 3.7 mm. (B) Transverse view illustrating a heterogeneous right interstitial mass (blue arrow) measuring 1.35x0.88 cm, separate from the right ovary (red arrow). The blue arrow and the number '1' (+) delineate the margins of the right interstitial mass.

72 beats per minute. Laboratory tests revealed a white blood cell count of 5,800/ μ l, a hemoglobin level of 12.6 g/dl and a hematocrit of 36.8%. Serum β -hCG levels demonstrated a plateau at 931.91 mIU/ml. A clinical examination revealed localized lower abdominal tenderness without signs of an acute abdomen. A gynecological assessment revealed bloody vaginal discharge, a uterus of normal size with tenderness on palpation, and tenderness of the right ovary and fallopian tube, with no cervical motion tenderness.

A TVUS demonstrated a uterus in anteversion and anteflexion with an empty cavity and a thin endometrium measuring 3.7 mm (Fig. 1A). Both ovaries appeared sonographically normal. The TVUS demonstrated a mixed-echogenic mass (1.35x0.88 cm) in the upper right uterine wall at the right cornu, clearly separate from the endometrial cavity and lacking surrounding endometrial tissue (Fig. 1B). The interstitial line sign, extending from the mass to the endometrial echo complex, was also visualized (Fig. 1B). The myometrial mantle surrounding the gestational sac exhibited marked asymmetric thinning to <5 mm (Fig. 2). No fetal pole was observed, and there was no free fluid in the pouch of Douglas. A color Doppler transvaginal ultrasonography demonstrated peripheral vascular flow surrounding the gestational sac, consistent with a viable ectopic pregnancy (Fig. 3). In conjunction with plateauing serum β -hCG levels, these sonographic findings were highly suggestive of a viable right interstitial ectopic pregnancy. Based on this diagnosis, the patient was scheduled for emergency laparoscopic intervention.

Laparoscopy confirmed an intact right interstitial pregnancy, appearing as a hyperemic, cyanotic mass ~15 mm in

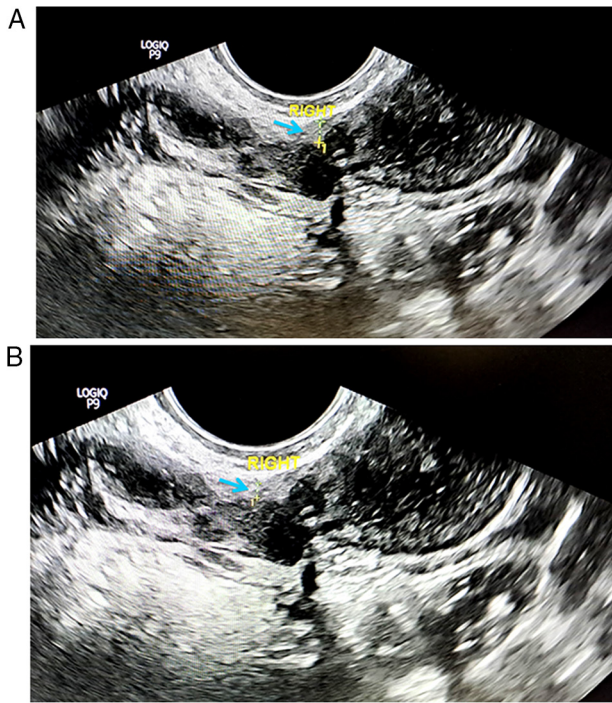


Figure 2. (A and B) Transvaginal ultrasonography demonstrating an eccentrically located interstitial gestational sac with asymmetric thinning of the surrounding myometrial mantle (<5 mm; blue arrow) and absence of surrounding endometrium. (A) Myometrial thickness, 0.34 cm. (B) Myometrial thickness, 0.21 cm.

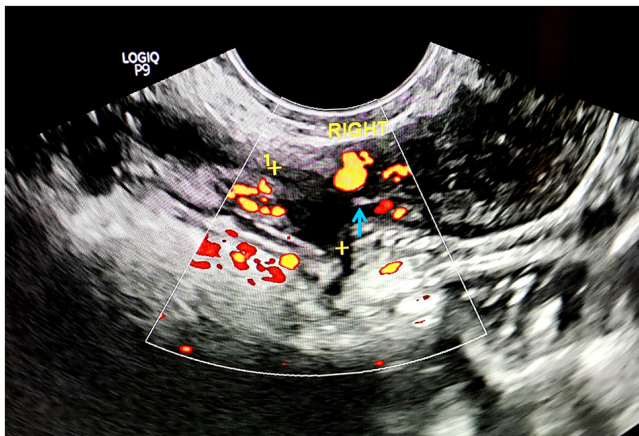


Figure 3. Color Doppler transvaginal ultrasonography demonstrating peripheral vascular flow surrounding the interstitial gestational sac. The interstitial line sign (blue arrow) is visible as an echogenic line extending from the endometrial cavity toward the gestational sac. The number '1' and the (+) symbols delineate the margins of the right interstitial mass.

diameter, located lateral to the right round ligament (Fig. 4). The left fallopian tube and both ovaries were normal, with no evidence of endometriosis or pelvic adhesions. The intra-operative administration of vasopressin at a dilution of 1:200 into the uterus achieved hemostasis through vasoconstriction (Fig. 5). The affected interstitial segment of the right fallopian tube was coagulated and excised using a bipolar sealing and cutting device (Fig. 6) and subsequently removed without complications (Fig. 7). Minor bleeding from the right cornu was controlled with bipolar coagulation, resulting in minimal

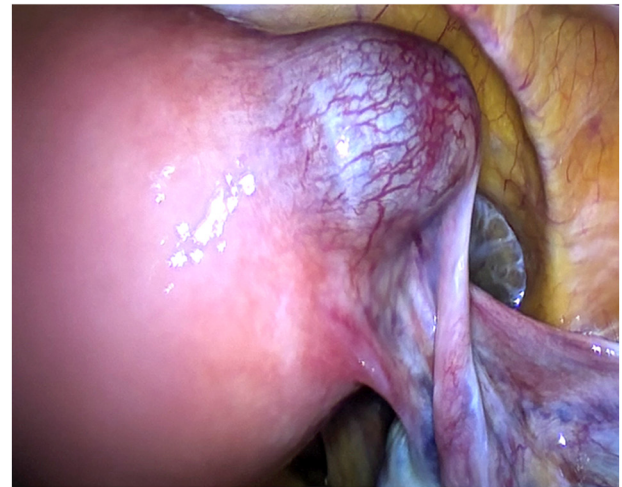


Figure 4. Laparoscopic view of the right interstitial pregnancy, appearing as a hyperemic and cyanotic mass located lateral to the right round ligament.

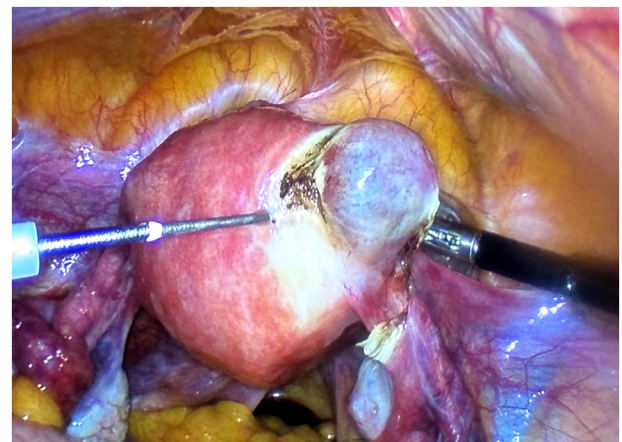


Figure 5. Laparoscopic intramyometrial injection of vasopressin for hemostatic control (dilution, 1:200; 1 ml vasopressin diluted in 200 ml 0.9% normal saline).

blood loss. The procedure was completed without breaching the endometrial cavity.

Post-operatively, the patient had an uneventful recovery and was discharged the following day with a hemoglobin level of 11.4 g/dl, a hematocrit of 35.3% and a declining serum β -hCG level of 388.19 mIU/ml. The complete resolution of β -hCG was achieved by the 8th post-operative day. No adjuvant methotrexate therapy was required.

Discussion

Ectopic pregnancy is defined as the implantation of a fertilized ovum outside the uterine cavity and can occur in a variety of locations, including the tubal ampullary, isthmic, fimbrial, interstitial, angular and cornual regions, as well as the ovary, abdomen, cervix, vagina, intraligamentous space, a rudimentary uterine horn, or as part of a heterotopic pregnancy (10-12). Interstitial pregnancy is a rare subtype, occurring when implantation takes place within the intramural (interstitial) segment of the fallopian tube (13). The surrounding disten-

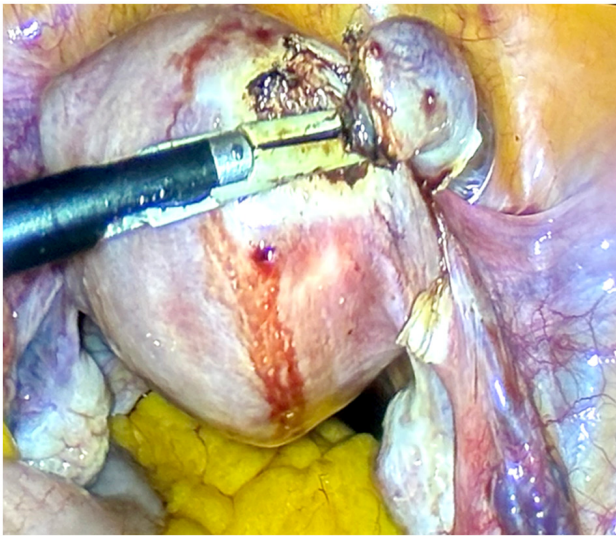


Figure 6. Laparoscopic resection of the interstitial portion of the right fallopian tube using a bipolar sealing and cutting device.



Figure 7. Final laparoscopic view following excision of the right interstitial pregnancy.

sibility of the myometrium allows for these pregnancies to advance further than other ectopic gestations before clinical symptoms arise (14). As a result, interstitial pregnancies carry a significantly higher risk of catastrophic hemorrhage if rupture occurs (15). The accurate and timely differentiation from angular pregnancy is essential, as ~80% of angular pregnancies can progress to viable term deliveries (16). Current clinical practice relies on the careful serial monitoring of serum β -hCG levels combined with high-resolution TVUS, with particular attention to precise anatomical localization, myometrial mantle thickness, the absence of surrounding endometrium and the presence of the 'interstitial line' sign (17-19). Interstitial pregnancies are typically identified by a gestational sac situated high and lateral within the uterine fundus, clearly separate from an empty endometrial cavity (17-19). Another key TVUS feature is the asymmetrically thinned myometrial mantle encasing the gestational sac, usually measuring <5 mm in thickness (17-19). The absence

of surrounding endometrium, defined as a lack of hyperechoic endometrial lining encasing the gestational sac, further supports the diagnosis of interstitial pregnancy (17-19). The 'interstitial line' sign, appearing as an echogenic linear structure extending from the endometrial echo complex toward an eccentrically located gestational sac and representing the intramural portion of the fallopian tube, provides additional diagnostic confidence. Together, these sonographic features have been shown to provide high diagnostic accuracy (17-19). In the case presented herein, TVUS revealed an empty uterine cavity (Fig. 1A) and a mixed-echogenicity mass eccentrically located in the right uterine cornu (Fig. 1B). Additional findings included asymmetric thinning of the myometrial mantle surrounding the gestational sac, measuring <5 mm (Fig. 2), the absence of surrounding endometrium and the visualization of the interstitial line sign (Figs. 1B and 3), all consistent with a right interstitial pregnancy.

Although the sonographic criteria and laparoscopic management of interstitial pregnancy are well-established the present case report highlights several clinically relevant features with potential implications for diagnosis and surgical management. First, diagnosis was achieved at a markedly early stage, when the ectopic lesion measured only 1.35 cm and serum β -hCG levels remained <1,000 mIU/ml. At this early stage, interstitial pregnancies may be particularly difficult to identify as both clinical symptoms and imaging findings can be subtle. Nevertheless, the simultaneous recognition of multiple sonographic markers, including the interstitial line sign, asymmetric myometrial thinning, the absence of the surrounding endometrium and peripheral vascularity, enabled a confident diagnosis prior to the occurrence of a rupture or significant hemorrhage.

An additional noteworthy aspect is the absence of the major risk factors that are commonly associated with interstitial pregnancy. The patient had no history of assisted reproductive technology, previous ectopic pregnancy, tubal surgery, salpingectomy, pelvic inflammatory disease, or congenital uterine anomalies. This highlights the importance of maintaining a high index of suspicion even in women considered to be at relatively low risk and demonstrates the diagnostic value of meticulous transvaginal ultrasonographic assessment when biochemical findings are inconclusive.

From a surgical perspective, the present case report illustrates an ultra-conservative fertility-preserving laparoscopic approach. Following vasopressin-assisted hemostasis, a limited excision of the affected interstitial segment was performed with minimal blood loss, preservation of the surrounding myometrium, and without entry into the endometrial cavity. Notably, myometrial suturing was not required because of the small size of the lesion, excellent intraoperative hemostasis, and limited myometrial disruption. In carefully selected patients, this conservative approach may minimize additional tissue trauma while preserving uterine architecture and reproductive potential.

Finally, the rapid post-operative decline in β -hCG levels and complete biochemical resolution within 8 days, without adjuvant methotrexate administration, further demonstrates the effectiveness of early diagnosis combined with targeted minimally invasive treatment. Therefore, the novelty of the present case report lies not in the isolated use of established diagnostic

or surgical techniques, but in the successful integration of very early ultrasound diagnosis, the absence of traditional risk factors and highly conservative fertility-preserving laparoscopic management in a small, unruptured interstitial pregnancy.

The management of interstitial pregnancy has evolved from radical procedures, such as hysterectomy, to more conservative approaches, including the systemic or local administration of methotrexate, image-guided interventions and minimally invasive laparoscopic techniques (cornuostomy or wedge resection), tailored to the hemodynamic stability of the patient, gestational age, serum β -hCG level and reproductive goals (6). Emergency laparotomy with cornual resection, or, in select cases, hysterectomy, remains the life-saving approach for patients who are hemodynamically unstable or those with rupture. However, current practice increasingly prioritizes fertility preservation, with laparoscopic cornuostomy or limited wedge resection performed by experienced surgeons to maintain uterine integrity and optimize future fertility potential (20,21). In the present case report, vasopressin was injected into the myometrium surrounding the interstitial gestational sac to reduce intraoperative bleeding during laparoscopic wedge resection.

Systemic methotrexate, administered via single- or multi-dose regimens, is an established non-surgical treatment for carefully selected, hemodynamically stable patients with interstitial ectopic pregnancy, particularly those with low or appropriately declining serum β -hCG levels and no evidence of rupture (22,23). Successful treatment is closely associated with lower initial β -hCG concentrations, smaller gestational sac size, and absence of embryonic cardiac activity, whereas the failure of medical therapy necessitates prompt surgical intervention due to the high risk of rupture (24,25). Nonetheless, reported success rates for systemic methotrexate in interstitial pregnancies are lower than those for tubal ectopic pregnancies, underscoring the need for meticulous clinical and biochemical monitoring (22-25). A recent retrospective cohort study indicated that subsequent intrauterine pregnancy and live-birth rates following methotrexate treatment are generally favorable and, in some cases, comparable to those reported after surgical management; however, the risk of recurrent ectopic pregnancy persists, and long-term fertility outcomes remain variable (26). Given the well-established teratogenicity of methotrexate, it is essential to confirm the complete resolution of the ectopic gestation and to avoid conception during and immediately following treatment, highlighting the importance of thorough counseling and structured follow-up (27). An ultrasound-guided local injection of methotrexate allows for high drug concentrations to be delivered directly into the gestational sac or trophoblastic tissue, achieving effective cytotoxicity with lower systemic exposure and fewer adverse effects compared with systemic therapy. This technique has been successfully applied to selected interstitial, cervical and cesarean-scar ectopic pregnancies, demonstrating high initial success rates, rapid declines in serum β -hCG levels and preservation of fertility, particularly when the ectopic pregnancy is detected early and both gestational size and β -hCG levels are favorable (28).

As regards reproductive outcomes, local methotrexate (with or without adjunctive mifepristone) is generally

considered fertility-sparing. Multiple studies involving cesarean-scar, cervical and interstitial ectopic pregnancies have reported successful subsequent intrauterine pregnancies and live births following conservative, image-guided medical therapy (28-31). However, long-term reproductive outcomes remain heterogeneous across studies, and the risk of recurrent ectopic pregnancy persists, highlighting the importance of careful patient selection, thorough counseling, and structured follow-up (26,27,29-31). Careful patient selection, thorough counseling, and structured follow-up are therefore essential (29). Interstitial ectopic pregnancies present a complex therapeutic challenge, requiring a careful balance between preserving fertility and ensuring patient safety. Conservative or medical management, such as systemic or local methotrexate, with or without adjunctive mifepristone, provides the advantage of maintaining uterine integrity, while optimizing the potential for future reproductive outcomes. However, these conservative approaches often require prolonged clinical and biochemical monitoring, carry a notable risk of treatment failure or delayed rupture, and may be complicated by persistent trophoblastic tissue or vascular abnormalities (30). In high-risk cases, combining local methotrexate injection with uterine artery embolization has emerged as an effective fertility-sparing strategy. This approach promotes targeted regression of trophoblastic tissue, minimizes intraoperative blood loss, and reduces the need for more invasive surgical interventions (31). By directly targeting the gestational tissue while simultaneously restricting its vascular supply, this combined approach may increase the likelihood of complete resolution while minimizing systemic methotrexate exposure and its associated adverse effects (28,31). Notably, it aims to preserve the surrounding myometrium and overall uterine architecture, an important consideration for women wishing to retain future reproductive potential (28,31). Case reports and small case series have described successful subsequent intrauterine pregnancies following treatment with local methotrexate, with or without adjunctive uterine artery embolization, suggesting that fertility may be preserved in appropriately selected patients (28,29,31). In addition, this minimally invasive strategy may represent a valuable option for patients who are poor surgical candidates or are considered to be at increased risk of hemorrhage (31).

In contrast to medical management, surgical excision, whether performed via minimally invasive or open techniques, provides definitive removal of ectopic gestational tissue, thereby eliminating the immediate risk of rupture. However, it may be associated with increased perioperative blood loss, the disruption of myometrial integrity, and post-operative scarring, which can negatively impact uterine function and subsequent pregnancy outcomes (32). Among surgical approaches, laparoscopy is widely considered the preferred option for managing interstitial ectopic pregnancy in hemodynamically stable patients, as it preserves uterine integrity, reduces postoperative hospitalization, and carries operative morbidity comparable to that of laparotomy (33). The contemporary laparoscopic management of interstitial ectopic pregnancy includes cornuostomy with the evacuation of the gestational products, targeted wedge resection of the interstitial segment with layered uterine wall reconstruction and the application of adjunctive hemostatic measures, such as local

Table I. Distinctive features and clinical relevance of the present case.

Feature	Present case	Clinical relevance	(Refs.)
Very early diagnosis	Interstitial pregnancy diagnosed when β -hCG levels remained <1,000 mIU/ml (931-996 mIU/ml) and lesion size was only 1.35 cm.	Demonstrates that meticulous TVUS assessment can establish the diagnosis before rupture, even at very low β -hCG levels.	(17-19)
Absence of major risk factors	No history of previous ectopic pregnancy, assisted reproductive technology, salpingectomy, pelvic inflammatory disease, tubal surgery, or uterine anomalies.	Highlights the diagnostic challenge and the need to maintain suspicion even in women who are apparently low-risk.	(1,4-6)
Multiple diagnostic sonographic criteria identified simultaneously	Empty uterine cavity, interstitial line sign, myometrial mantle <5 mm, absence of surrounding endometrium, and peripheral vascularity.	Allowed confident diagnosis of a very small interstitial pregnancy before clinical deterioration.	(17-19)
Fertility-preserving ultra-conservative surgery	Targeted laparoscopic excision of the interstitial segment with preservation of surrounding myometrium and avoidance of endometrial cavity entry.	Minimizes tissue trauma while maintaining definitive treatment.	(6,20,21, 33-35)
Omission of myometrial suturing	Hemostasis achieved with vasopressin-assisted vasoconstriction and bipolar coagulation without uterine wall reconstruction.	Illustrates a highly conservative surgical approach that may reduce additional myometrial injury in selected cases.	(32,34,35)
Minimal operative morbidity	Minimal blood loss, no intraoperative complications, discharge on postoperative day 1.	Supports the feasibility and safety of minimally invasive management when diagnosis is established early.	(6,20,21,33)
Rapid biochemical resolution	Complete β -hCG resolution within 8 days without adjuvant methotrexate.	Demonstrates the effectiveness of early definitive surgical treatment.	(6,20,33)
Overall distinctive contribution	Integration of ultra-early diagnosis, absence of classical risk factors, and highly conservative fertility-preserving laparoscopic management.	Provides a clinically relevant example of individualized management in a rare ectopic pregnancy.	(1,6,17-21, 33-35)

TVUS, transvaginal ultrasonography; β -hCG, β -human chorionic gonadotropin.

vasopressin injection, purse-string or cerclage suturing and preemptive hemostatic sutures, to minimize blood loss and preserve myometrial tissue (34). The careful pre-operative and intraoperative planning, informed by the detailed ultrasonographic assessment of the ectopic location, gestational size and the presence of hemoperitoneum, enables conservative excision with meticulous myometrial repair, thereby restoring uterine integrity and potentially reducing the risk of uterine rupture in subsequent pregnancies (35). A meta-analysis and published case series have reported favorable peri-operative outcomes following laparoscopic management of interstitial pregnancy, including shorter hospitalization, low intraoperative blood loss, acceptable complication rates, and satisfactory fertility outcomes when myometrial preservation is prioritized (6,20,21,33-35). However, long-term reproductive outcomes remain heterogeneous, and a history of cornual resection may increase obstetric risks in subsequent pregnancies (32,33). In emergency cases complicated by rupture and

hemodynamic instability, laparoscopy may still be feasible in specialized centers, though conversion to open surgery is occasionally necessary, highlighting the importance of prompt diagnosis and individualized clinical decision-making (25). In the case described herein, the unruptured right interstitial ectopic pregnancy was successfully treated with laparoscopic targeted wedge resection of the interstitial segment, achieving the complete removal of the ectopic gestational tissue, while preserving the surrounding myometrium and restoring normal uterine anatomy. The adjunctive local injection of vasopressin induced transient vasoconstriction, effectively minimizing intraoperative blood loss, improving visualization, and facilitating conservative excision. This approach enhanced surgical safety and supported optimal reproductive potential in appropriately selected patients. Furthermore, in selected cases of unruptured interstitial ectopic pregnancy, the omission of myometrial suturing following laparoscopic wedge resection may be associated with potential advantages.

Forgoing myometrial closure may reduce additional tissue manipulation, ischemia and foreign-body reactions related to suturing, thereby preserving native myometrial integrity and potentially minimizing scar formation. When adequate hemostasis is achieved, as facilitated in the present case report by vasopressin-induced local vasoconstriction, and the degree of myometrial disruption is limited, spontaneous healing of the myometrium may occur without adversely affecting uterine integrity. Additionally, this conservative approach may shorten the operative time, reduce the risk of suture-related complications such as hematoma or infection and support uterine preservation, while maintaining surgical safety in carefully selected patients under close postoperative monitoring. Given the rarity and clinical heterogeneity of interstitial pregnancy, published reviews and contemporary evidence emphasize that management should be individualized according to the patient's hemodynamic status, serum β -hCG level, gestational age, detailed ultrasonographic findings and reproductive goals (6,30,33). Therapeutic decisions need to consider multiple factors, including the hemodynamic stability of the patient, serum β -hCG levels, gestational age, detailed ultrasonographic findings and reproductive intentions. Management is therefore best undertaken in tertiary care centers equipped with minimally invasive surgical expertise, interventional radiology services, adequate blood bank support, and facilities for close postoperative and biochemical monitoring. Comprehensive pre-treatment counseling is essential, encompassing the discussion of the risks and benefits of available management options, the requirement for serial β -hCG and imaging surveillance and potential implications for future pregnancies, such as the need for enhanced antenatal monitoring, the risk of uterine wall defects and consideration of elective cesarean delivery when clinically indicated.

In summary, from both diagnostic and therapeutic standpoints, high-resolution TVUS remains the cornerstone for the diagnosis of interstitial pregnancy. Key sonographic features include the identification of the interstitial line sign, the assessment of myometrial mantle thickness and precise anatomical localization of the gestational sac. Contemporary management strategies encompass a broad spectrum of options, ranging from systemic or locally administered methotrexate and image-guided interventions to minimally invasive, fertility-preserving surgical techniques, with definitive surgical resection reserved for selected cases. Ongoing efforts to refine ultrasound-based diagnostic criteria, conduct prospective comparative studies evaluating local vs. systemic medical therapies and develop standardized, multidisciplinary management protocols, particularly those incorporating interventional radiology, are essential to optimize clinical outcomes while preserving reproductive potential.

In conclusion, the present case report highlights the importance of meticulous TVUS evaluation for the diagnosis of interstitial pregnancy at a very early stage, even in the absence of classical risk factors and despite relatively low and plateauing serum β -hCG levels. The early recognition of the characteristic sonographic findings enabled diagnosis prior to the occurrence of a rupture or significant hemorrhage, allowing timely intervention in a clinically stable patient.

The principal contribution of the present case report is not the description of another interstitial pregnancy per se, but the

demonstration that exceptionally early diagnosis can facilitate a highly conservative fertility-preserving surgical strategy. In the case described herein, a small unruptured interstitial pregnancy was successfully managed by targeted laparoscopic excision following local vasopressin administration, with preservation of the surrounding myometrium, the avoidance of endometrial cavity entry, the omission of myometrial suturing, minimal blood loss and rapid post-operative biochemical resolution without adjuvant methotrexate.

The present case report therefore underscores how the integration of early ultrasound diagnosis and individualized minimally invasive surgery may expand fertility-preserving treatment options for selected low-risk patients with interstitial pregnancy, while maintaining a high level of surgical safety and excellent short-term outcomes. A summary of the distinctive features of the present case and their clinical relevance in the context of the available literature is presented in Table I (1,4-6,17-21,33-35).

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

MV conceptualized and supervised the study, interpreted the findings, and critically revised and reviewed the manuscript. FNV was involved in the study design, literature review, writing of the manuscript, preparation of the original draft and table processing. VKV contributed to the study design, literature review and manuscript writing. MV, AF, VS and ES contributed to the clinical management of the patient, assisted with data acquisition, and participated in the literature review and manuscript preparation. MV, AF, VS and ES confirm the authenticity of all the raw data. All authors have read and agreed to the published version of the manuscript.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. Ethical review and approval of this report were not required due to the retrospective nature of the report. The patient's information has been de-identified. Written informed consent has been obtained from the patient to participate in the study.

Patient consent for publication

Written informed consent was obtained from the patient to publish the study and any related images. Additionally, the patient's information has been de-identified.

Competing interests

The authors declare that they have no competing interests.

Use of artificial intelligence tools

During the preparation of this work, AI tools were used to improve the readability and language of the manuscript or to generate images, and subsequently, the authors revised and edited the content produced by the AI tools as necessary, taking full responsibility for the ultimate content of the present manuscript.

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