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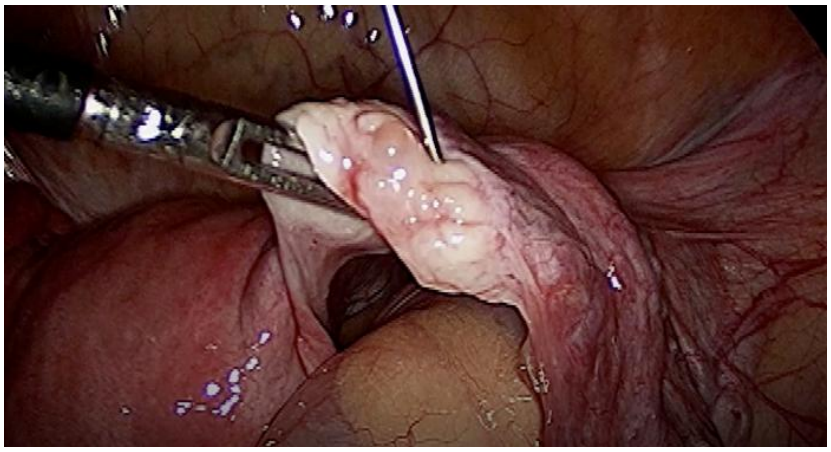

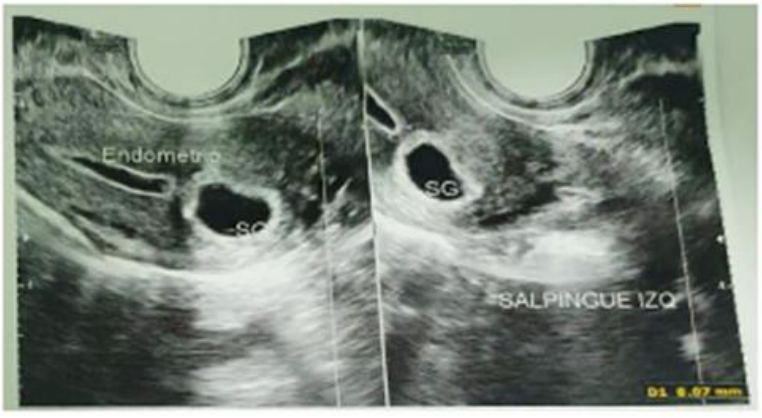

ISSUE 1 Volume 7 (March 2026)

Published by ISGE ISSN: 2736-5530

TheTrocar | Volume 7 · Issue 1 · Open Access Journal of ISGE

EDITORIAL

22nd Edition of TheTrocar

International Society for Gynecologic Endoscopy (ISGE) · 2025

We publish this edition of TheTrocar at a moment when the world is in the grip of profound and rapid change. Geopolitical tensions, shifting alliances, and the fracturing of long-standing multilateral norms remind us daily that the values of openness, collaboration, and shared knowledge are not givens — they must be actively defended and practised. The International Society for Gynecologic Endoscopy (ISGE) has always understood itself as a global community in the truest sense of that word: one that transcends borders, political affiliations, and economic disparities to place the advancement of women's health and surgical education at its centre.

It is precisely in times like these that the mission of an inclusive scientific society matters most. When even major global players increasingly turn inward, ISGE chooses to turn outward — to expand its reach, to deepen its partnerships, and to ensure that evidence-based knowledge in minimally invasive gynaecological surgery remains freely available to clinicians everywhere, whether they practise in well-resourced academic centres or in settings where access to continuing medical education is hard-won. TheTrocar, as our fully open-access journal, embodies this commitment with every article, review, and case report it publishes.

A Society in Motion: Restructuring for the Future

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ISGE is not standing still. Over the past year, our society has undergone significant internal restructuring — a process that is never painless but is always necessary for organisations that wish to remain relevant and effective. We have reviewed our governance structures, streamlined our committee framework, and invested in the digital infrastructure required to serve a membership that is increasingly global, mobile, and connected. Modernisation is not an end in itself; it is the means by which we protect and amplify the work that brought this society into existence more than three decades ago.

None of this is possible without you. Structural reform only acquires meaning when it is supported by an engaged community. We therefore call on every colleague who benefits from ISGE's educational resources to consider deepening their involvement — whether by joining a committee, attracting an industry sponsor, taking on a voluntary role within the editorial workflow of TheTrocar, or simply by encouraging a colleague to become a member. Every contribution, however modest it may seem, strengthens the fabric of the organisation.

Publish with Us — Open Science for All

TheTrocar is designed to be a gateway — not a gate. Our open-access model means that a gynaecological surgeon in Algiers, Accra, or Almaty can read the same peer-reviewed evidence as a colleague at a European university clinic, at no cost to the reader. We are equally committed to lowering the barriers to authorship. For ISGE members, publication in TheTrocar is entirely free of charge. For non-members, a modest article processing fee of USD 250 is applied; this fee directly underwrites the voluntary work of our editorial board and reviewers, who give their time and expertise without remuneration. We are sincerely grateful for the growing number of submissions

we have received and encourage every clinician, researcher, and trainee with a story to tell — a clinical series, a technique tip, a thought-provoking case — to submit their work to us.

We also warmly invite colleagues with expertise in gynaecological endoscopy, reproductive surgery, or related disciplines to join our growing panel of voluntary peer reviewers. Rigorous, constructive peer review is the cornerstone of scientific integrity, and the quality of our journal depends entirely on the generosity of those willing to share their critical expertise. If you are interested in contributing in this capacity, please contact our editorial office.

Algiers 2025 — The ISGE Family Gathers in North Africa

In May 2025, the ISGE annual congress will convene in Algiers, Algeria — a vibrant city and a powerful symbol of this society's commitment to making world-class surgical education accessible across all continents. North Africa has a rich and distinguished tradition in medicine and surgery, and we are proud to bring our global community to this region. We look forward to the scientific programme, the hands-on workshops, and, above all, to the conversations and connections that only an in-person gathering can foster. We hope to see as many of you as possible in Algiers and encourage early registration.

In the spirit of all that ISGE stands for, we close with the wish that has opened every editorial we have written: good health and continued progress — for our patients, for our colleagues, and for the global community of minimally invasive gynaecological surgery.

Good health and progress
For the Editorial Board

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Guenter Noé
Editor in Chief, TheTrocar
International Society for Gynecologic Endoscopy (ISGE)

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The frontpage shows: PRP Injection into ovary and cornual pregnancy

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Evaluating ultrasonographic and diagnostic laparoscopy findings and perioperative complications in women with chronic pelvic pain at two tertiary hospitals in Zimbabwe: A cross-sectional study

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DOI: 10.36205/trocar7.2026000
Received: 2026-01-04 - Accepted: 2026-02-24

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Abstract

Purpose: Chronic pelvic pain (CPP) is a common and debilitating gynaecological condition, for which diagnostic laparoscopy is the gold standard for diagnosis. In this study, the aetiology and perioperative complications among women undergoing diagnostic laparoscopy for CPP have been investigated.

Materials and Methods: A cross-sectional study was conducted at two tertiary hospitals in Harare, Zimbabwe, and included 108 women. In the retrospective arm (49 women), data were collected from hospital records, while in the prospective arm (59 women), data were collected prospectively. The findings were recorded and analysed using Stata version 12.0.

Results: Diagnostic laparoscopy confirmed pathological conditions in 81.6% of the women. The most frequent findings were ovarian pathologies (18.5%), endometriosis (15.7%) and adhesions (15.7%). Depression and anxiety were the psychological symptoms most commonly associated

with CPP. The perioperative complication rate was low (0.06%). Conclusion. Most cases of CPP at the two institutions have a physical cause. Laparoscopy is a safe method for evaluating CPP.

Key words: chronic pelvic pain, diagnostic laparoscopy, ovarian pathology, depression, perioperative complications.

Introduction:

Chronic pelvic pain (CPP) affects approximately 15% to 24% of women worldwide (1,2). A study in Zimbabwe revealed that 35% of women had various reproductive pathologies on diagnostic laparoscopy (3). CPP is defined as persistent pelvic pain lasting at least 6 months, severe enough to limit function, and unrelated to menstruation or pregnancy. CPP management costs in the USA are estimated at $100 billion (4). The pathophysiology of CPP is unclear, but it is more prevalent in women with histories of substance abuse, miscarriages, heavy menstrual periods, abdominal surgery, abuse, and depression (5). Several concomitant psychological and physical disorders have been associated with CPP, with the most prevalent being depression (25%–50%), anxiety (10%–20%), multiple psychological disorders (20%–30%), and somatic disorders (10%–20%) (6). CPP conditions often overlap with non-pelvic pain disorders and non-pain conditions, contributing to pain severity. Musculoskeletal pain and dysfunction are observed in 50%–90% of patients with CPP (7). CPP affects women's physical, psychological, and sexual health, as well as that of their partners (8). Management of chronic pain, and thus of CPP, requires a multidisciplinary approach (9). To date, research on CPP in Africa is limited. At the time of this current study (2014), diagnostic laparoscopy was widely regarded as the reference standard, particularly in low-resource settings with limited access to advanced imaging. Current practice recommends expert transvaginal ultrasound as a first-line for suspected endometriosis, with laparoscopy reserved for selected cases (10). In the study conducted in Zimbabwe, no cameras and monitors were used to document the magnified internal findings (3). This may have led to some diseases being overlooked. Given the availability of modern laparoscopy equipment, especially cameras and monitors for displaying magnified images, the causes of CPP were investigated, as well as the perioperative complications associated with diagnostic laparoscopy in a cohort in Zimbabwe.

Material and Methods:

This cross-sectional study was conducted at the Parirenyatwa Group of Hospitals and Sally Mugabe Hospital in Harare, Zimbabwe, from January 1 to October 31, 2014. In total, 108 women with CPP were enrolled, 49 in the retrospective arm and 59 in the prospective arm. Participants were at least 18 years old and provided informed consent. Pregnant women and those who did not provide consent were excluded.

Retrospective arm: Hospital records of the patients who underwent diagnostic laparoscopy from January 1, 2014, to October 31, 2014, were retrieved. Sociodemographic characteristics, as well as gynaecological, obstetric, surgical, medical data, psychological history, laparoscopic findings, and perioperative complications were extracted onto an Excel spreadsheet.

Prospective arm: Participants who underwent ultrasonographic evaluation and diagnostic laparoscopy for CPP were recruited from the gynaecology outpatient clinic or wards. Laparoscopy was performed under general anaesthesia. Gas was

insufflated using a Veress needle to 20–25 mmHg, which was used transiently only during Veress needle insufflation and primary port insertion, after which surgery was performed at pressures of 14-15 mmHg. Two additional 5-mm ports were placed in the right and left iliac fossae for pelvic and abdominal exploration. After the procedure, the pneumoperitoneum was released, and ports were removed under direct vision. The 10- and 5-mm ports were closed in two layers, with one layer closed using absorbable sutures. Intraoperative findings and complications were documented in an Excel spreadsheet. Participants were discharged and followed up within 2 weeks for any postoperative complications.

Case diagnosis: Pelvic inflammatory disease (PID) was diagnosed by the presence of tubal wall oedema, hyperaemia, exudation, or a pelvic mass, such as a tubo-ovarian abscess or perihepatic adhesions. Endometriosis was identified based on findings of classic blue-black "powder burn" lesions, non- classic clear or red "flame-like" lesions, peritoneal defects with endometriotic lesions, endometriomas, deeply infiltrating lesions, or histological confirmation. Ovarian cysts, uterine fibroids and pelvic congestion syndrome were confirmed by direct visualisation. CPP severity was assessed using an 11-point numeric rating scale of 0–10 (11). Participants were screened for depression or anxiety symptoms based on recommendations in the National Institute for Health and Clinical Excellence (NICE) guidelines (12).

Statistical analysis: Data were entered manually in an Excel spreadsheet before extracted onto Stata version 12.0 (Stata Corporation, College Station, TX, USA) for statistical analyses.

Ethical issues: Permission and ethical approval to conduct the study were granted by the Joint Research and Ethical Committee of the University of Zimbabwe Faculty of Medicine and Health Sciences and the Medical Research Council of Zimbabwe. Written informed consent was obtained from every participant.

Sociodemographic data	**Outcome**
Age	Years
Mean age	33.3
Age range	16–67
Parity	
Range	0–7
Median	2
Residence	(n) %
Urban	93 (86.10%)
Rural	14 (13%)
Other	1 (0.9%)
Level of education	n (%)
Tertiary	7 (6.5%)
Secondary	45 (41.7%)
Primary	7 (6.6%)
Missing data	49 (45.5%)
Marital status	n (%)
Married	83 (76.9%)
Single	17 (15.7%)

Divorced	4 (3.7%)
Widowed	4 (3.7%)
Occupation	n (%)
Employed	21 (19.4%)
Housewives	77 (69.4%)
Self-employed	11 (10.2%)
Missing data	1 (0.9%)

Table 1: Socio demographic data

Results:

Summary of sociodemographic and clinical data: The mean age of the study participants was 33.3 years (range, 16–67 years), with a median parity of 2 (range, 0–7). Most of the participants were housewives (69.4%) residing in urban areas (86.1%). Almost half (48.2%) were educated up to secondary and tertiary levels.

Nature of CPP and associated symptoms: Participants described their pain as either moderate or severe. Most experienced intermittent pain (90.7%), while more than half had subfertility (54.3%).

Summary of symptoms associated with CPP: Dyspareunia was associated with pain in 15.7% of the women. Depression and anxiety were reported in 54.6%, and 84.7% reported increased family expenditure due to medical care costs.

Past medical history: In the preceding month, almost one-seventh of the participants visited a healthcare provider more than three times (69.5%), while over two-thirds received analgesia (67.8%) or antibiotics (64.4%). A minority of women (10%) had a prior history of abdominal or pelvic surgery.

Summary of preoperative ultrasound findings: More than one-third of the women (34.3%) had normal preoperative sonography, while almost half (40.7%) had ovarian cysts.

Summary of diagnostic laparoscopic findings: Ovarian pathologies were the most common findings at laparoscopy, mainly ovarian cysts (18.5%), adhesions (15.7%), and endometriosis (15.7%). The frequency of chronic PID was low (9.3%). Combined pathologies were noted in 15.7% of the participants, mainly fibroids, adhesions, PID, and endometriosis.

Summary of complications from diagnostic laparoscopy: The overall complication rate of diagnostic laparoscopy was 6/108 (0.06%), with complications including intraoperative uterine perforation (2/108; 0.02%) and postoperative port site sepsis (4/108; 0.04%).

Associated symptom	Symptomatic (%)	Asymptomatic (%)
Abnormal vaginal discharge	25	75
Abnormal vaginal bleeding	19.4	80.6
Dyspareunia	15.7	84.3
Depression/ anxiety	54.6	45.4

symptoms in the past month		
At least 1 day off duty household chores in the past month	81.3	18.7

Table 2: Symptoms associated with CPP

Findings	Frequency n (%)
Ovarian cysts	44 (40.7%)
normal	37 (34.3%)
Uterine fibroids	7 (6.5%)
Adnexal mass	6 (5.6%)
Features of pelvic inflammatory disease	1 (0.9%)
Inconclusive	3 (2.8%)
Not done	10 (9.3%)

Table 3: Preoperative ultrasound findings

Discussion:

CPP is prevalent in reproductive-aged women and contributes to a significant proportion (20%) of gynaecological consultations in most health centres worldwide (13). In Egypt, 26.6% of gynaecological consultations were for CPP (14). However, data on the prevalence of CPP in Zimbabwe are lacking. A study conducted in Zimbabwe in 1991 found that 35% of women had reproductive pathologies on diagnostic laparoscopy (3). In this study, various pathologies were identified in 82% of women on diagnostic laparoscopy. We attribute this significantly higher rate to better laparoscopy equipment. Ovarian cysts were the most common finding on preoperative USS (40.7%), but only 18.5% were detected on diagnostic laparoscopy (18.5%). Most of the ovarian cysts detected on preoperative USS were possibly functional ovarian cysts Thus, repeat imaging before laparoscopy is vital. Most ovarian cysts identified on ultrasound were likely functional cysts, which explains the discrepancy between ultrasound and laparoscopic findings. It is also emphasised that ovarian cysts are often incidental and not necessarily causal in chronic pelvic pain. USS is the gold standard in the diagnosis of endometriosis (15). In this study, endometriosis was not diagnosed preoperatively, raising the issue of the quality of preoperative USS. Diagnostic laparoscopy identified endometriosis in 15.7% of women, similar to a study in India (16). However, this is low compared to current evidence showing that prevalence ranges from 15.4% to 71.4%, based on a comprehensive review of 69 studies (17). The evidence is variable due to heterogeneity in study design and selection bias. Our low prevalence may be due to limited camera resolution available at the time, absence of routine histological confirmation, under- recognition of subtle and deep infiltrating endometriosis, or operator-dependent diagnostic variability. Uterine fibroids were found in 6.5% and 3.4% of cases on USS and diagnostic laparoscopy, respectively. This percentage is lower than that reported in similar African studies (>60%) (18). This is possible because many fibroids in African women are intramural or submucosal and are not visible on USS (19). Small fibroids may not be detected with older ultrasound machines, and they are frequently

incidental findings rather than the cause of CPP. This finding demonstrates that USS is a sensitive modality in the initial evaluation of uterine fibroids in CPP. Similar studies have shown that diagnostic laparoscopy identified uterine fibroids in 6.1%–8% of cases (16,20). Even though pelvic pain is a symptom commonly associated with uterine fibroids, most women with fibroids are asymptomatic; thus, a full evaluation for CPP is crucial to identify the aetiology of the pain, even with detectable fibroids. PID was diagnosed in one participant (0.9%) on USS, but was detected in 9.3% of CPP cases on diagnostic laparoscopy. This highlights the limitation of USS in the diagnosis of PID. The prevalence of PID was similar to that of another study conducted in a different setting. However, a study conducted in India identified PID in 40% and 47% of cases on USS and diagnostic laparoscopy, respectively (16). Proper diagnosis and management of PID is crucial as it can cause significant sequela, such as infertility, pelvic adhesive disease, and CPP. Adhesions were found in 15.7% of patients on diagnostic laparoscopy, as in a study in India (21). However, another Indian study reported adhesions in 7% of cases (16). Intraperitoneal adhesions were the most common diagnosis in patients with CPP (22). The low incidence of previous abdominal surgery and PID among participants may justify these findings. Overall, diagnostic laparoscopy is an effective method for diagnosing adhesions in women with CPP. Pelvic congestion was diagnosed in only 2 participants (1.9%) during laparoscopy, with no cases identified on preoperative USS. Similarly, a study reported pelvic congestion in 5% and 10% of cases on USS and laparoscopy, respectively (16). This discrepancy may be attributed to ethnic differences or USS quality. Conventional methods often miss varices, making selective ovarian venography the preferred approach, while non-invasive techniques like magnetic resonance imaging and duplex ultrasound are gaining popularity (23).

Most participants reported moderate to severe pain, consistent with findings in other studies (14,24). Depression and anxiety are common among women with CPP and are linked to factors such as severe pain and subfertility (25). Anxiety was twice as prevalent as depression in this group. Most women reported a poor quality of life due to CPP, influenced by mental health issues, multiple hospital visits, and financial strain. CPP negatively impacts women's quality of life, with over 80% reporting financial burdens related to treatment (26,27). In our study, perioperative complications included intraoperative uterine perforation (2/108, 0.02%) and postoperative port site sepsis (4/108, 0.04%). A large study reported intraoperative and postoperative complications in 5.6% and 6.5% of women, respectively (28). Intestinal injuries were the most common (0.5%), indicating that laparoscopy is a reasonable method for managing CPP when performed by skilled practitioners.

Limitations:

A key limitation of this study is that it was originally conducted as part of postgraduate academic research in 2014, with an initial focus on institutional audit rather than immediate publication. settings, including limited funding, lack of structural mentorship and heavy clinical workloads. Although the dataset was later revisited and refined, these factors may have affected the timelines of reporting and broader contextual relevance of the findings. At the time of this current study (2014), diagnostic laparoscopy was widely regarded as the reference standard, particularly in low-resource setting with limited access to advanced imaging. Current practice recommends expert transvaginal ultrasound

as a first-line for suspected endometriosis, with laparoscopy reserved for selected cases. This study was partly retrospective and faced various challenges, such as data issues, recall bias and difficulty controlling confounding factors. Various practitioners conducted USS and laparoscopy, affecting the standardisation and quality of procedures. Furthermore, the study did not collect histological nor microbiological specimens and relied solely on subjective findings for diagnosing endometriosis and PID.

Strengths:

Despite the delayed submission of the research work, the findings remain highly relevant, providing valuable baseline data on diagnostic pathways, disease patterns, and surgical safety of laparoscopy for chronic pelvic pain in a sub-Saharan African context. The study combined retrospective and prospective arms to obtain a comprehensive analysis of CPP and its underlying conditions, with well-defined diagnostic criteria, thereby enhancing the reliability of findings. The use of an 11-point numeric rating scale to assess pain severity in standardised evaluations. Furthermore, a follow-up period was implemented to assess postoperative complications and to analyse surgical outcomes. Finally, modern laparoscopy equipment was used in the evaluations.

Recommendations:

Standardised diagnostic procedures are needed for the accurate identification of endometriosis and PID. Increasing access to diagnostic procedures such as laparoscopy for women in underserved areas is essential. Further studies into CPP and increasing awareness among healthcare providers and the public in low-income settings are also recommended.

Conclusion:

This study found that CPP is frequently caused by ovarian pathology, endometriosis, and pelvic adhesions. Most women (81.6%) had a physical cause identified during diagnostic laparoscopy, highlighting its utility in the evaluation of CPP. The perioperative complication rate for diagnostic laparoscopy was low.

Acknowledgements:

The authors would like to acknowledge the clinical staff members and theatre team who tirelessly invested time during the period of this study, as well as all the participants who willingly volunteered to be part of this study.

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TheTrocar Issue 1 Volume 7 / page 10- 12 ISSN: 2736-5530

Intraovarian Injection of Platelet-Rich Plasma in Assisted Reproduction: A Novel Technique.

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DOI: 10.36205/trocar7.2026001
Received: 2025-10-25 - Accepted: 2025-12-09

Abstract

Women presenting at an older reproductive age or with premature ovarian insufficiency pose significant challenges for fertility specialists. Among the available options - tailored stimulation protocols for poor responders, adjuvants such as growth hormone or micronutrients, and lifestyle measures - there is a growing need for more result-oriented treatments. Ovarian rejuvenation with platelet-rich plasma (PRP) may offer improved prospects in both age-related decline and premature ovarian failure. PRP is derived from autologous blood after removal of red and white cells and contains platelets enriched with cytokines and growth factors. In addition to its hemostatic function, PRP delivers the growth factor proteins: VEGF, PDGF, TGF-β and IGF-1, which are synergically implicated in angiogenesis, stromal remodeling and follicular activation (1). PRP has long been applied in dermatology, orthopedics and regenerative medicine. Its intraovarian use is based on the presence of stem-like cells within ovarian tissue. Recent data suggest that these stem cells may contribute to neo-oogenesis or enhance responsiveness to gonadotropin stimulation when exposed to growth-factor-rich environments (2).

Key words:
ART, Fertility Outcome, Platelet Rich Plasma, Poor Ovarian Reserve, Laparoscopy

Introduction:

PRP can be injected in the ovaries with an Ovum Pick Up (OPU) needle by Transvaginal ultrasound guidance or laparoscopically with a laparoscopic injection needle. Both are wide bore needles and chances of spillage is much more owing to the small sized ovaries in patients with poor ovarian reserve. The good results of suprapubic approach are highlighted by using a spinal needle suprapubicaly with the laparoscope in place and injecting at 2-3 places in the ovary under vision making sure there is no spillage.

Material and Methods:

Thirty milliliters of venous blood were collected in three 10 ml conical tubes. Samples were centrifuged at 150 × g for 10 min. The supernatants were pooled and centrifuged again at 3500 × g for 10 min. The concentrate was transferred into a cryovial, frozen in liquid nitrogen for 30 min, thawed for 5 min and re-frozen (figure 1). The preparation was gently warmed prior to injection. Double-spin protocols are widely considered superior for achieving higher platelet concentrations, which may enhance growth-factor delivery. Timing between activation and intraovarian injection appears critical, as growth-factor release is highest within hours of platelet activation (3).

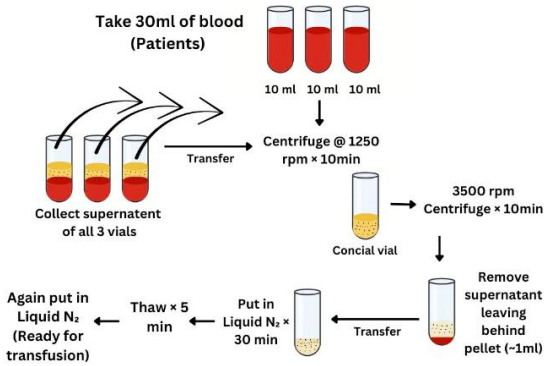

Figure 1: The sequence of the preparation of PRP.

Surgical Technique:

A five mm laparoscope and a four mm secondary trocar were introduced. The ovary was mobilized to the suprapubic midline. Using an 18-gauge spinal needle, approximately two ml PRP was injected into each ovary at 1–2 cortical sites. Patients were discharged within 4–6 h. The use of a spinal needle offers three advantages: 1) reduced cortical trauma compared to OPU needles, 2) minimized PRP spillage into the peritoneum and 3) improved targeting of the ovarian cortex, where primordial follicles are located. This approach is particularly valuable in small, atrophic or fibrotic ovaries (figure 2) (4).

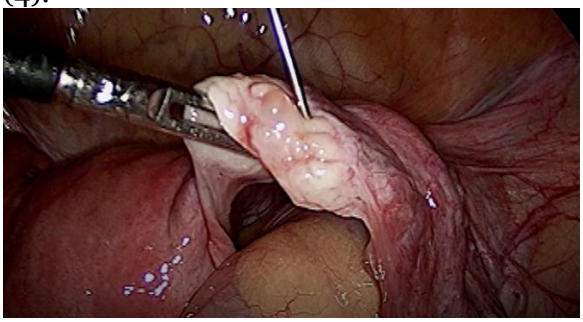

Figure 2: injection of the ovary with a spinal needle

Results:

This non-randomized interventional study involved 23 women with poor ovarian response and previous failed IVF attempts. 17 women underwent laparoscopic intraovarian PRP injection; six opted for oocyte donation. Those treated showed improved antral follicle count (AFC), oocyte and embryo quality, 11 positive β-hCG tests and seven ongoing pregnancies. Similar observational studies reported increases in AMH, reductions in basal FSH and improved embryo development after intraovarian PRP (5).

Discussion:

The results of this work support intraovarian PRP as a feasible intervention with potential benefit for poor responders. The distinctive element of our approach is the use of the 18G spinal needle. This modification improves cortical precision, reduces leakage and

minimizes trauma, thereby enhancing consistency and potentially clinical outcomes. Growth factors in PRP promote endothelial proliferation, improve stromal vascularity and create a more favorable environment for follicular growth. These paracrine effects may also improve granulosa cell function, mitochondrial activity and recruitment of dormant follicles. Similar observational studies reported increases in Anti Müllerian Hormone (AMH), reductions in basal FSH and improved embryo development after intraovarian PRP (6).

Conclusions:

Intraovarian PRP injected with a thinner 24/25-gauge spinal needle minimizes extravasation and leakage of PRP and has given good oocyte retrieval numbers and live birth rate. It has to be taken into account that this report represents a very small retrospective study.

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Editor's note: We are publishing this article because, in our view—and as confirmed by the reviewers—it contains noteworthy content. It should be noted that this is an intervention study that does not meet standard scientific criteria. Inclusion criteria and an ethics committee approval are not provided. However, the findings published here should be made available as a basis for further clinical studies.

TheTrocar Issue 1 Volume 7/ Page 13- 18 ISSN: 2736-5530

Advancing the Role of Bulkamid® in the Management of Female Stress and Mixed Urinary Incontinence. A Review of current literature.

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DOI: 10.36205/trocar7.2026002
Received:2025-12-09 - Accepted:2026-01-01

Abstract

Background: Stress urinary incontinence (SUI) and mixed urinary incontinence (MUI) are prevalent conditions among women, significantly impacting quality of life. While midurethral sling procedures remain the gold standard, concerns over mesh-related complications have driven interest in minimally invasive alternatives such as urethral bulking agents. Bulkamid®, a polyacrylamide hydrogel, is increasingly used as a first-line or adjunctive treatment.
Objectives: To evaluate the current evidence regarding the efficacy, safety, durability, reinjection rates, and comparative outcomes of Bulkamid® in the treatment of female SUI and MUI.
Evidence Acquisition: A comprehensive narrative review was conducted using data from randomized controlled trials, prospective cohort studies, systematic reviews, and long-term follow-up studies involving women treated with Bulkamid® for SUI or MUI. Sources were identified through PubMed and Cochrane Library searches.
Results: Subjective symptom improvement rates following Bulkamid® injection ranged from 60% to 80%, with objective cure rates of 40% to 60% at 12 months. Long-term durability has been demonstrated in follow-up periods extending up to 7 years. Reinjection was required in approximately 25%–30% of cases. The safety profile is favorable, with a low incidence of serious adverse events. Most complications are minor and transient, such as urinary retention or urinary tract infection. Compared with other urethral bulking agents and midurethral slings, Bulkamid® shows lower efficacy than slings but superior safety and tolerability.
Conclusions: Bulkamid® represents a viable, minimally invasive treatment option for select women with SUI or MUI, particularly those seeking to avoid surgical intervention. Its favorable safety profile and durability make it a reasonable alternative in appropriately selected patients. Further randomized head-to-head trials and cost-effectiveness analyses are warranted.

Keywords:
Urogynecology, urethral bulking agent, Bulkamid®, stress urinary incontinence, mixed urinary incontinence, minimally invasive therapy.

Introduction:

Female urinary incontinence, particularly stress urinary incontinence (SUI) and mixed urinary incontinence (MUI), represents a significant global health challenge, affecting up to 50% of women and leading to considerable psychosocial and economic burdens (1) SUI is typically caused by urethral hypermobility or intrinsic sphincter deficiency (ISD), while MUI involves overlapping symptoms of urgency and stress leakage, complicating both diagnosis and therapeutic approaches (2). While mid-urethral sling (MUS) procedures have been widely considered the gold standard for SUI management, increasing scrutiny over mesh-related complications - including erosion, chronic pelvic pain, and regulatory concerns - has fueled a resurgence of interest in urethral bulking agents (UBAs) as a safer, less invasive alternative (3). Among the available UBAs, Bulkamid®, a polyacrylamide hydrogel approved by the FDA in 2020, has emerged as a promising second-line treatment owing to its biocompatibility, ease of administration, and sustained symptom relief (4). This literature review critically synthesizes current evidence on the efficacy, safety, durability, and comparative performance of Bulkamid®, situating its role within the evolving landscape of SUI and MUI management.

Results:

Efficacy and Clinical Outcomes of Bulkamid®

Bulkamid® exerts its therapeutic effect by enhancing urethral coaptation through submucosal injections, thereby supporting the urethral sphincter during increases in intra-abdominal pressure. The majority of prospective studies report symptom improvement rates between 60% and 80%, with objective cure rates ranging from 40% to 60% at 12 months post-procedure (5). In a pivotal multicenter trial by Mohr et al., 135 women treated with Bulkamid® demonstrated a 66% improvement in symptoms and a 44% objective cure rate after one year (6). A meta-analysis by Hoe et al. (2021), encompassing 1,583 women across 17 studies, found short-term success rates between 29.8% and 89.7%, and long-term efficacy from 42% to 70%, establishing Bulkamid® as a reliable and consistent option across diverse populations (7). Critically, while Bulkamid® does not outperform MUS in terms of absolute cure rates (66.4% vs. 95% in some randomized trials), it presents a compelling balance between moderate efficacy and superior safety, particularly for women seeking non-surgical solutions (8).

Objective Outcome Measures and Patient Satisfaction

Multiple studies highlight improvements in quantifiable incontinence metrics, including: Pad weight reduction and significant improvements in International Consultation on Incontinence Questionnaire (ICIQ) scores (5). High levels of patient satisfaction, with VAS scores exceeding 80/100 in most trials, emphasizing the favorable subjective experience even when objective cure is incomplete (6-9). These findings suggest that Bulkamid® not only addresses the clinical burden of incontinence but also aligns with patients' quality-of-life expectations, an increasingly prioritized outcome in modern urogynecological care.

Safety Profile and Complication Rates

Unlike earlier-generation UBAs, which often comprised particulate materials associated with migration, granuloma formation, and erosion, Bulkamid® is a non-particulate, hydrophilic hydrogel that remains localized at the injection site. It demonstrates minimal immunogenicity, with rare reports of serious adverse events (4). Urinary tract infection (UTI) rates ranged from 1.6% to 40%, with acute urinary retention (AUR) reported in up to 20% of patients—though most cases were transient and resolved without intervention (10). Compared to tension-free vaginal tape (TVT), Bulkamid® had significantly lower reoperation (0% vs. 6%) and serious complication rates, including erosion,

hematoma, and chronic retention (11). These data reinforce Bulkamid®'s position as the safest available UBA, particularly for populations at elevated risk for surgical or mesh-related complications (12) .

Durability and Reinjection Rates

Durability of response is a key consideration in minimally invasive interventions. Although some patients require reinjection, studies consistently report that bulk volume remains stable over time, and the need for repeat procedures should be interpreted within the framework of individualized care rather than as treatment failure. Toozs-Hobson et al. (2021): Over a 7-year follow-up, 67.1% of women reported sustained symptom relief; 24.2% required one reinjection, and 6.5% needed two (12). Agerskov et al. (2011) and Lose et al. (2010) found reinjection rates between 22.5% and 26%, typically within the first 3–6 months (14,15). FDA SSED (2020) data reported a reinjection rate of ~30%, affirming real-world observations (16). Despite this variability, durable symptom control is achievable in the majority, especially when reinjection is part of an adaptive treatment strategy (17,18).

Discussion:

Overall, the literature supports Bulkamid® as a safe, minimally invasive, and moderately effective treatment option for women with SUI. Its favourable safety profile, stability, and patient satisfaction make it particularly useful for select populations, including those unfit for surgery or seeking alternatives to mesh-based procedures. The use of urethral bulking agents has re-emerged as a viable therapeutic option for women with stress urinary incontinence (SUI), particularly in those seeking minimally invasive approaches or who are poor candidates for surgery. Among available agents, Bulkamid®, a non-particulate polyacrylamide hydrogel (PAHG), has gained prominence due to its favourable safety profile, durability, and ease of administration. The literature consistently demonstrates that Bulkamid® provides meaningful symptom improvement, though often with lower objective cure rates than midurethral sling procedures. In terms of efficacy, Bulkamid® offers moderate to high rates of patient-reported improvement, though “cure” rates vary widely depending on study design, follow-up duration, and evaluation criteria. Patient selection remains a key determinant of success. Bulkamid® appears particularly effective in women with mild to moderate SUI, isolated urethral hypermobility or intrinsic sphincter deficiency (ISD), though reported outcomes in ISD populations remain mixed. Its role as a first-line therapy versus a secondary option after failed sling procedures continues to be explored. Recent studies suggest that Bulkamid® may serve as a salvage treatment for recurrent SUI following mesh complications or sling removal, with acceptable rates of symptom improvement. Another theme in the literature is the quality-of-life benefit associated with Bulkamid®. Even in cases where complete continence is not achieved, patients often report meaningful improvements in daily function and satisfaction. This highlights the importance of patient-centred outcome measures in evaluating bulking agents and supports the view that Bulkamid® can be a valuable component of the therapeutic arsenal, particularly when treatment goals emphasize improvement rather than cure.

Conclusions:

Bulkamid® represents a clinically validated, patient-centered and minimally invasive option for women with SUI or MUI, offering durable efficacy, high safety and excellent tolerability. Its superiority over other UBAs, in terms of biocompatibility and adverse event profile, positions it as a first-line non-surgical therapy for selected patients. While not a replacement for mid-urethral slings in all cases, its role is increasingly recognized in personalized, guideline-driven urologic care. With further comparative trials and

evidence- based guideline updates, Bulkamid® is poised to reshape the landscape of female incontinence treatment.

Future Directions

To optimize the clinical positioning of Bulkamid®, the literature emphasizes several research imperatives:

- Standardization of outcome definitions to facilitate comparative studies.
- Head-to-head RCTs among UBAs to establish definitive efficacy hierarchies.
- Development of predictive biomarkers for response and reinjection need.
- Longitudinal studies on cost-effectiveness, particularly in elderly populations.

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Pictures and Tables

The systematic review by Hoe et al. provides a robust comparative framework across major UBAs (7):

Agent	Long-Term Success	Erosion Risk	Migration Risk	AUR Risk	De Novo Urgency
Bulkamid®	42–70%	None	None	0–20%	0–10%
Macroplastique®	21–80%	Reported	Low	Up to 73%	Up to 30%
Coaptite®	60–75%	Reported	Moderate	~34%	Moderate
Durasphere®	21–80%	Rare	High (1 case)	Up to 17%	~25%
Urolastic®	Unclear	Up to 25%	Low	Moderate	Moderate

Table 1: Only Bulkamid® demonstrated zero instances of erosion or migration, making it the most favorable option in safety-critical patient groups (7,8).

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Giant Leiomyoma of the Broad Ligament with Parasitic Myoma: Laparoscopic Management and Literature Review

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DOI: 10.36205/trocar7.2026003
Received: 2025-10-28 - Accepted: 2025-12-16

Abstract

Uterine leiomyomas are the most frequent benign tumors of the female genital tract. However, their localization in the broad ligament is rare, and when they reach giant dimensions, these represent a diagnostic and surgical challenge. The case of a 51-year-old woman with abnormal uterine bleeding over a long period in time, refractory to medical treatment is presented. Pelvic ultrasound revealed a large uterine mass measuring 18.6 × 8.4 × 11.8 cm, hindering adequate visualization of the uterus and adnexa. A total laparoscopic hysterectomy was performed, during which a giant fibroid occupying the left broad ligament and a parasitic leiomyoma attached to the right pelvic wall were identified and successfully removed, with an estimated blood loss of 1,000 ml. Histopathology confirmed conventional uterine leiomyomatosis with degenerative changes and associated adenomyosis. The patient evolved favourably and was discharged 48 hours after surgery without complications. This case highlights the rarity of giant leiomyomas in the broad ligament, their potential to mimic adnexal or retroperitoneal tumors, and the feasibility of laparoscopic management as a safe and effective alternative in expert hands, even in highly complex scenarios.

Keywords:
uterine fibroid, broad ligament, laparoscopic hysterectomy, giant leiomyoma, parasitic myoma

Introduction:

Uterine leiomyomas are the most common benign tumors of the female genital tract and develop from the smooth muscle of the myometrium. It is estimated that between 20% and 30% of women of reproductive age will develop this pathology, although the prevalence may vary depending on age, race and hormonal factors (1). Most leiomyomas are intrauterine. However, a small percentage are located outside the uterus and are considered extrauterine tumors. Among these, the ones that develop in the broad ligament are the most common, although their overall frequency is less than 1% of all cases of myomatosis (2). The broad ligament is a peritoneal fold

that contains vital structures such as the ureters and uterine and ovarian vessels. Therefore, the growth of a leiomyoma in this location can alter normal pelvic anatomy and cause nonspecific symptoms. Clinically, these lesions can mimic adnexal tumors, ovarian cysts, or even retroperitoneal neoplasms (3). In addition, when leiomyomas reach large dimensions or present degenerative changes (such as necrosis or cystic degeneration), the clinical and imaging diagnosis becomes even more challenging (4). Diagnostic imaging, especially ultrasound and CT, can guide suspicion. However, it often fails to define the tumour's origin with certainty. Magnetic resonance imaging is the most effective technique for characterizing soft tissue lesions and differentiating between leiomyomas and malignant tumors, although it is not always universally available (5). Given these limitations, definitive confirmation is established intraoperatively and with histopathological diagnosis. The rarity of giant leiomyomas of the broad ligament and their tendency to be confused with malignant tumors make case reports of great scientific value. The latter contribute to broadening our understanding of the clinical manifestations, diagnostic options, and therapeutic possibilities concerning these leiomyomas. This paper describes a case of giant leiomyoma of the broad ligament with parasitic myoma, successfully managed by total laparoscopic hysterectomy, in accordance with the most recent evidence.

Case Report:

A 51-year-old female patient with no significant medical history presented for consultation with long-standing abnormal uterine bleeding, refractory to conservative medical management and significantly impacting her quality of life. A pelvic ultrasound (Figure 1) revealed the presence of a solid uterine mass measuring 18.6 × 8.4 × 11.8 cm, which prevented adequate visualization of the rest of the uterus, endometrium, and adnexa.

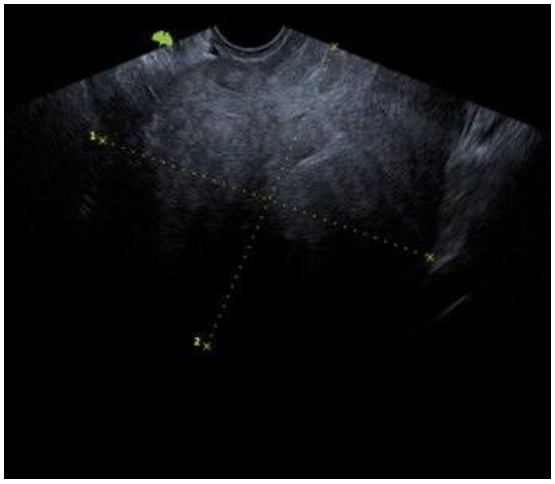

Figure 1: Pelvic Ultrasound reveals a large intraabdominal mass

Given these findings and the persistence of symptoms, a total laparoscopic hysterectomy was performed. During the procedure, classified as highly complex, a large uterine fibroid was identified that completely occupied the left broad ligament, as well as a parasitic myoma located on the right pelvic wall. A myomectomy of the parasitic tumor was performed, followed by a total hysterectomy. The surgical specimen was removed by morcellation (Figure 2-7), weighing a total of 1,349 grams (Figure 8). The estimated intraoperative blood loss was 1,000 ml, with no additional complications.

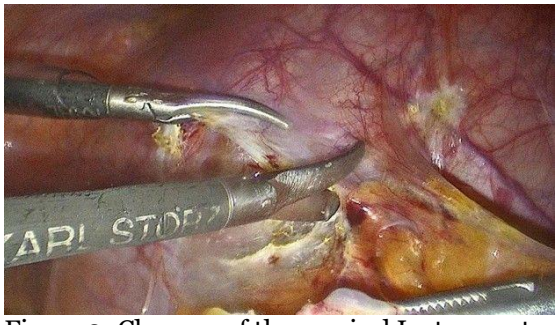

Figure 2: Close up of the surgical Instruments opening the peritoneum

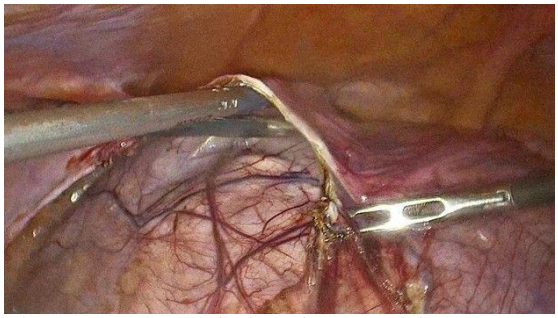

Figure 3: Decapsulating the parasitic leiomyoma

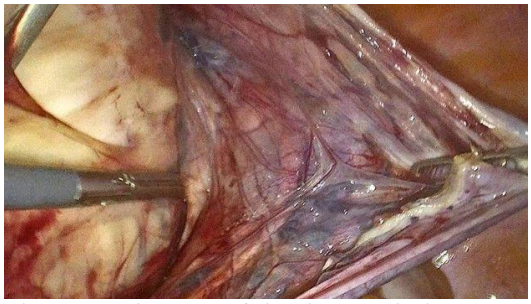

Figure 4: Close up of the decapsulation of the leiomyoma

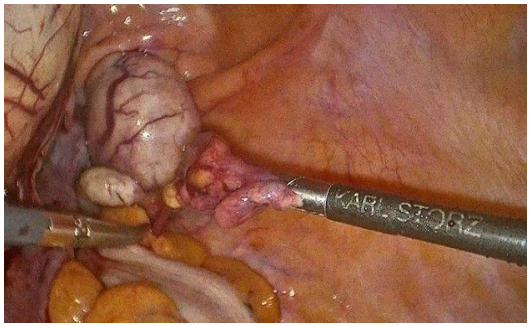

Figure 5: Starting the hysterectomy

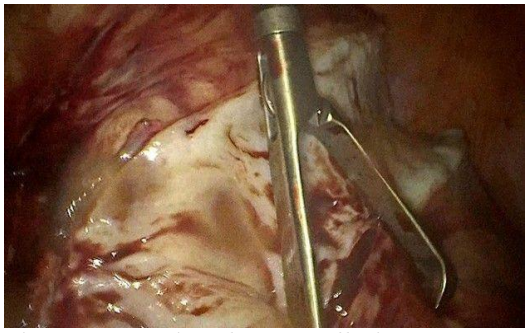

Figure 6: Starting the morcellation.

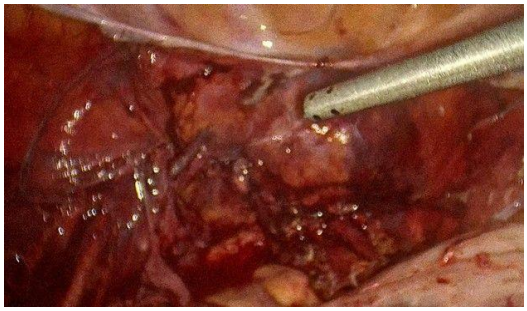

Figure 7: Finishing the hysterectomy.

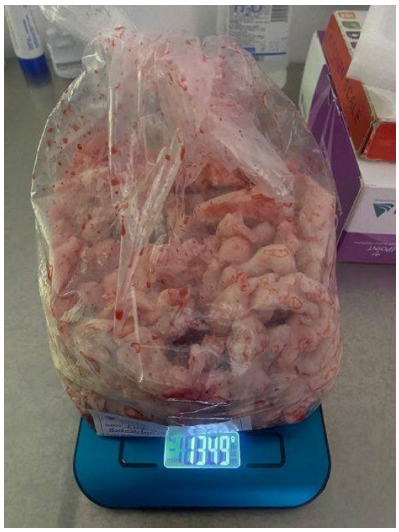

Figure 8: The end result after morcellation

The histopathological results reported: conventional histological uterine myomatosis with degenerative changes and associated adenomyosis. The patient had a favourable postoperative course and was discharged 48 hours later without complications. This case highlights the rarity of giant broad ligament leiomyomas and the importance of laparoscopic hysterectomy as a feasible alternative, even in highly complex surgical settings.

Discussion:

The presented case adds to the existing literature highlighting the diagnostic difficulty of broad ligament leiomyomas due to their low frequency and the fact that their clinical and imaging characteristics are often confused with those of adnexal tumors, particularly malignant ovarian masses (6,7). In our case, ultrasound did not allow clear visualization of the uterus nor the adnexa, which is consistent with previous reports where the large size of the mass obscures key pelvic structures. An important characteristic is that broad ligament leiomyomas can be classified as true (originating in the ligament's own tissue) or false (subserosal uterine fibroids growing between the ligament layers) (8). This distinction, although difficult to establish before surgery, has implications for the surgical technique and the possibility of complications, mainly due to the proximity of the ureters and pelvic

vessels. In the literature, most of these cases have been treated by laparotomy, which allows a wide approach and control of vascular structures, but at the cost of greater morbidity and prolonged recovery (9,10). However, in recent years, successful laparoscopic approaches have been described in selected cases, even in large tumors, thanks to the improvement in energy technology, the capacity for safe morcellation and the accumulated experience in minimally invasive surgery (11). The case presented confirms this possibility, achieving complete resection, controlled bleeding and a short hospital recovery, despite being a highly complex surgery. Another notable aspect is the presence of a parasitic myoma, a finding that, although rare, has already been described and represents an additional challenge in treatment. These tumors may be vascularized by neighbouring structures, which increases the risk of bleeding and makes dissection difficult. Furthermore, the histopathological results did confirm degenerative changes, a common finding in large masses, which explains their atypical radiological appearance and the similarity to malignant lesions (12). Overall, the literature review reinforces that giant leiomyomas of the broad ligament should be considered in the differential diagnosis of complex pelvic masses. Adequate surgical planning, accurate identification of critical anatomical structures, and experience in minimally invasive surgery are the pillars for successful and safe management of these patients.

Conclusions:

Giant leiomyomas of the broad ligament represent a rare entity that is often confused with malignant adnexal tumors, especially when they present degenerative changes. The case presented demonstrates how, through appropriate surgical planning and the use of advanced laparoscopic techniques, these can be treated safely and effectively. The reviewed literature reinforces this statement. Although laparotomy remains the most reported option, laparoscopy is a feasible option in expert hands, offering advantages in recovery and lower morbidity. This case provides further evidence supporting the role of minimally invasive surgery in the management of complex broad ligament masses.

Remark of the editor:

In view of international regulations concerning the spillage of tissue fragments at power morcellation and their possible impact on the long term follow up of the individual patient it is necessary to perform mechanical morcellation in a specifically designed bag. If this reveals impossible laparotomy is advised.

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The Trocar Issue 1 Volume 7 / Page 24-34 ISSN: 2736-5530

Artificial Intelligence in Gynaecologic Robotic Surgery: A Literature Review of Applications and Clinical Potential.

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DOI: 10.36205/trocar7.2026004
Received: 04/07/2025 - Accepted: 28/08/2025

Abstract

Artificial intelligence (AI) is rapidly transforming gynecologic robotic surgery by enhancing precision, visualization, and intraoperative decision-making. While robotic surgery improves dexterity and minimizes tremors, it lacks tactile feedback and standard performance assessment. Integrating AI helps overcome these limitations, potentially improving both surgical outcomes and training. This comprehensive literature review analyses studies from 2020 to 2025 on clinical applications of AI in gynaecologic robotic surgery, identified through searches of PubMed, Scopus, and IEEE Xplore. Applications discussed include AI-assisted autonomy (e.g., automated suturing and camera control), augmented reality for real-time imaging, machine learning–based workflow and gesture recognition. AI-powered tactile feedback systems begin to address the absence of haptic sensation, improving tissue differentiation. AI also shows promise in postoperative recovery by enabling personalized rehabilitation and early complication detection. These advances support safer, more efficient procedures and provide objective metrics for surgical training. However, challenges remain involving large data requirements, ethics, and clinician accountability. Despite this, AI integration promises remarkable improvements in surgical precision, outcomes, and education in gynecologic robotic surgery.

Keywords: Augmented reality, Artificial intelligence, Gynecological Robotic surgery, Machine learning, Robotic surgery, Surgical assessment, Surgical Autonomy, Tactile Feedback, Workflow Recognition

Introduction:

AI has witnessed tremendous growth in the healthcare sector, owing to the development of machine learning algorithms and the availability of extensive medical databases. These technologies have revolutionized how we understand, diagnose, and treat diseases. AI is capable of analysing vast and complex datasets using advanced computational architectures (1). AI integration into robotic surgery is poised to transform gynecologic surgical practices. Robotic surgery, employing computer-controlled arms, enhances surgical dexterity, visualization, and minimizes hand tremor compared to traditional laparoscopy. These

systems are widely adopted across specialties including gynecology, oncology, orthopaedics, and general surgery. AI has further enriched the operating experience by automating procedural tasks, providing better surgical field visualization, and providing real-time surgical assessment and feedback. The advantages of incorporating AI in robotic surgery encompass enhanced surgical accuracy, reduced surgeon fatigue, and increased patient safety. However, barriers to widespread adoption persist, including concerns related to cost-effectiveness, accessibility, the learning curve and training requirements, and ethical concerns surrounding AI-based decision-making in surgery. This paper is a detailed survey of AI-driven robotic systems, highlighting their advantages, limitations, and the future of AI in Robotic surgery (2).

Material and Methods

This narrative review was conducted by searching electronic databases including PubMed, Google Scholar, EMBASE, Web of Science, Scopus and IEEE Xplore from 2020 to 2025. Search terms incorporated Boolean operators and keywords such as: "Robotic Surgery" AND "Gynecology", "Artificial Intelligence" AND "Robotic Surgery", "Deep Learning", "Machine Learning", "Autonomous Camera Positioning","Augmented Reality AND Gynecological Surgery". Inclusion criteria were original research articles, reviews, and relevant conference papers published in English addressing AI applications in gynaecologic robotic surgery. Studies were excluded if they lacked clinical applicability or focused solely on technical engineering aspects without surgical context. Representative studies were selected. 31 articles underwent full-text assessment. Although a formal systematic review protocol was not followed, efforts were made to ensure comprehensive coverage of recent advances.

Background

Robots have been utilized in surgical procedures for over 35 years, with rapid advancements occurring particularly in the last two decades. The first medical robot, the Programmable Universal Machine for Assembly (PUMA 200), was employed in 1985 for neurosurgical biopsies. Initially developed to enable remote operations, robotic platforms allowed surgeons to treat patients from distant locations, such as military battlefields. Over time, these robotic systems became increasingly refined, offering enhanced precision, control, and accuracy. A major breakthrough in robotic surgery occurred with the FDA approval of the Da Vinci Surgical System in 2000. Originally designed with three robotic arms and later upgraded to four in 2002, this system integrated Automated Endoscopic System for Optimal Positioning (AESOP) for improved camera control alongside surgical arms capable of seven degrees of movement The addition of a 3D camera in 2006 and single-port access tools in 2011 further addressed many of the limitations inherent in laparoscopic surgery, enhancing surgical dexterity and visualization (3). Today, robotic-assisted surgery is widely used in gynecology for both benign and malignant conditions, including hysterectomy, myomectomy, and pelvic exenteration.

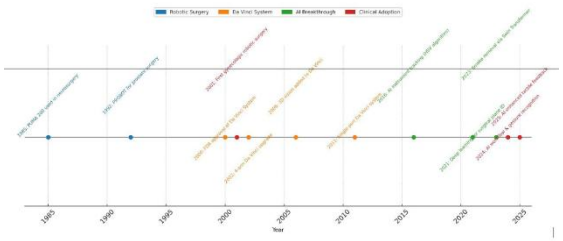

Figure 1: Timeline of Milestones in Robotic Surgery & AI Integration

Discussion

Integration of AI in robotic surgery

The integration of artificial intelligence (AI) and machine learning (ML) has further propelled advancements in robotic surgery by enabling automation, real-time analytics, and enhanced intraoperative decision-making. First conceptualized in 1956, AI now broadly encompasses intelligent technologies capable of

simulating human cognition, while ML enables these systems to learn and adapt from large datasets. AI systems in robotic surgery are being developed by focusing on the collection, preparation, and annotation of high-quality, multimodal data from real surgical procedures. This process involves capturing detailed video data, automating the extraction of relevant events, recording surgeon movements in 3D and annotating video data to create datasets essential for developing reliable AI models for robotic surgeries (4). Levin et al in his study "Introducing surgical intelligence in gynecology: automated identification of key steps in hysterectomy" demonstrated practical feasibility and high accuracy of incorporating AI-driven step identification into robotic gynecological surgeries (5).

Intraoperative AI based assistance in Robotic Gynaecologic surgery

There is significant potential to enhance the accuracy, effectiveness, and accessibility of robotic surgery through the incorporation of AI (Table 1).

Application Domain	AI Use-Case Example	Technology Used
Robotic Autonomy	Automated suturing, tissue dissection	Computer Vision, ML, Deep Learning
Visualization Enhancement	Smoke removal, tissue recognition	CNN, Swin Transformer, Image Preprocessing
Surgical Assessment	Workflow recognition, gesture recognition	CNN, RNN, BiLSTM
Augmented Reality & Haptics	Real-time anatomical overlays, tactile feedback	Mixed Reality, AI-integrated sensors
Postoperative Prediction	ERAS customization, complication prediction	Predictive Analytics, ML Algorithms

Table 1: AI Applications in Gynecologic Robotic Surgery

Broadly, artificial AI enabled intraoperative improvements fall into three groups: robotic autonomy, surgical field enhancement, and surgical assessment/feedback.

Robotic autonomy

The ultimate goal for robots is to become increasingly autonomous. The International Organization for Standardization (ISO 8373:2012) defines autonomy as: "an ability to perform intended tasks based on current state and sensing without human intervention". Thanks to substantial advances in machine learning (ML), deep learning (DL), computer vision (CV), and natural language processing (NLP) over recent decades, robotic autonomy is increasingly becoming a practical reality. By automating repetitive tasks, AI reduces cognitive load, allowing surgeons to maintain focus, during critical phases of surgery. AI algorithms analyse real-time data during surgery to anticipate tissue activity and dynamically adjust robotic movements accordingly (2). A global consensus defines six levels of surgical autonomy, ranging from fully manual (Level 0) to complete autonomy (Level 5).

In gynecologic surgery, research focuses on automating subtasks such as camera control and tissue dissection, particularly in robotic hysterectomy.

Level	Description	Human Involvement
0	No autonomy	Fully manual
1	Robotic assistance	Surgeon-controlled with aids
2	Task autonomy (e.g., camera positioning)	Surgeon supervises specific tasks
3	Conditional autonomy	Robot performs with prompts
4	High-level autonomy	Robot performs tasks independently
5	Full autonomy	No human intervention

Table 2: Anatomical levels

Tissue dissection:

in robotic hysterectomy, the uterus must be dissected at three levels of connective vascular pedicles. Autonomous tissue dissection enables more precise excision with a reduced risk of inadvertent injury to vital structures. *Suturing*: suturing is a repetitive but essential component of procedures such as myomectomy and hysterectomy, often time-consuming and physically demanding. Its repetitive nature and clearly defined procedural constraints make it an ideal candidate for automation.

Autonomous camera positioning:

with tele-robotic surgical systems, surgeons must periodically halt the procedure to manually adjust camera positioning. At times, one or both instruments may move outside the camera's field of view, potentially leading

to delays and errors. Amini Khoiy K et al developed and validated a marker-free, Hue Saturation Value (HSV)-based segmentation algorithm for real-time surgical instrument tip tracking, enabling autonomous cameraman robot control in laparoscopic surgery with high accuracy and low latency, demonstrating promising results for future practical applications (6). In robotic hysterectomy, precision is crucial due to the proximity of vital structures. AI-driven systems now support real-time recognition of surgical phases, automated instrument tracking, and increasingly autonomous task execution. Progress in real-time decision-making and error management suggests that fully autonomous procedures may soon be possible, offering greater precision and safety (7).

Surgical field enhancement

Accessing deep anatomical spaces in gynecologic surgery presents significant risk. AI-enhanced robotic systems, combined with real-time image processing, improve identification of critical structures and instruments. Tools such as AI-driven mixed reality platforms allow preoperative mapping (e.g., using MRI data for uterine fibroids), personalized surgical planning, and intraoperative 3D visualization, thereby enhancing safety and outcomes. Specifically, AI-based online pre-processing systems have been developed to deblur and colour-correct live camera feeds, thus enhancing surgical visualization (2). Gynecological procedures such as hysterectomy and myomectomy often involve electrosurgical devices that generate substantial amounts of smoke, which can obscure the surgical field. Consequently, surgeons may need to periodically pause the procedure to clear the smoke, disrupting workflow and prolonging operative time. To address this issue, Wang et al. proposed a method combining Convolutional Neural Networks (CNN) and Shifted Windows (Swin) transformers to effectively remove smoke from the surgical view, thereby achieving smoke-free, clear intraoperative visualization (8). Beyond improving the operative view, AI also aids surgeons in recognizing and differentiating native tissue structures. The success of any gynecologic surgery heavily relies on accurately identifying surgical avascular planes such as the vesicouterine, pararectal, paravaginal, presacral, and retropubic spaces. Precise delineation of these planes is critical to prevent inadvertent injury to vital arteries, veins, and nerves. Kumazu et al developed and validated a deep learning-based AI model that automatically segments loose connective tissue fibers to define safe dissection planes during robot-assisted gastrectomy to accurately define surgical planes, thereby minimizing the risk of inadvertent injury. As in gastrectomy, this technology can serve as a visual co-pilot for the surgeon, supporting intraoperative decisions in minimally invasive gynecologic procedures (9). In gynecologic oncologic surgeries, AI-driven technologies like Full-Field Optical Coherence Tomography (FF-OCT) and Dynamic Cell Imaging (DCI) have been developed to provide high- resolution tumor margin assessments in under five minutes. These advances increase surgical accuracy and reduce unnecessary tissue removal. A significant challenge in gynecologic oncology is cancer recurrence, which can be markedly reduced through this enhanced precision that ensures clear surgical margins during tumor excision (10).

Augmented reality and tactile feedback

Alongside advances in autonomy, AI also strengthens the surgeon's ability to visualize and navigate complex anatomy. Augmented Reality (AR) is increasingly applied in robotic gynecologic surgeries such as myomectomy, polypectomy, and adenomyomectomy to enhance precision in localizing intrauterine structures, a task traditionally reliant on tactile palpation. Since imaging modalities like MRI and ultrasonography cannot often fully distinguish pathological tissues from normal ones, AR integrated with robotic systems addresses the challenge in endoscopic surgery, reducing the risk of incomplete removal of fibroids or polyps (11). For instance, Liu F et al. developed a

mixed reality system combining AI-driven automatic segmentation and 3D reconstruction of pelvic MRI data to accurately map uterine fibroids and their vascular anatomy. This supports personalized preoperative planning, tactile-feedback- based surgical simulation, and real-time intraoperative 3D visualization (12). Similarly, Hofman et al. demonstrated a pioneering AI-assisted augmented reality system that manages surgical instrument occlusion with deep learning models, enhancing the seamless integration of AR during robotic surgery (13). Addressing the critical deficit of tactile sensation in minimally invasive procedures, AI enhanced tactile intelligence systems have been introduced. Doria et al. explored haptic interfaces equipped with AI integrated piezoelectric sensors in teleoperated robotic myomectomy, these facilitate localization of submucosal or intramural lesions and differentiate tissue properties through enhanced haptic feedback (14). This fusion of AR, AI, and advanced haptics enables safer, more accurate robotic gynecologic surgeries by compensating for the lack of direct palpation and improving intraoperative tissue discrimination.

Surgical assessment and feedback

Traditionally, surgical performance was evaluated using clinical outcomes such as histopathology, morbidity, and mortality. Recent advances, however, have established intraoperative performance analysis by AI as an objective tool for evaluating skills and guiding targeted interventions.

Workflow Recognition

AI driven models are increasingly used for automated analysis of surgical workflows using minimally invasive surgery video recordings. Technologies like Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) enable accurate, step-by-step recognition of procedural stages, capturing both sequence and duration of each phase. This spatiotemporal analysis helps detect deviations and identify prolonged or challenging steps that may indicate complications, prompting timely alerts or guidance for the team. For standardized procedures such as hysterectomy, workflow evaluation incorporates data on camera movements and energy usage, collected via platforms like the Intuitive Data Recorder. Recent developments, such as Objective Performance Indicators (OPIs), enable structured, quantitative assessment of each surgical step, supporting the creation of training curricula and monitoring trainee progress while highlighting situations requiring additional attention or skill development (15–17).

Gesture Recognition

Automatic recognition of fine-grained surgical gestures has become essential for autonomous robotic surgery systems and training platforms. AI models, notably Bidirectional Long Short- Term Memory (BiLSTM) networks, analyse gestures in tasks like suturing, demonstrating increased accuracy and efficiency over conventional assessment methods. This technology enhances both real-time feedback and interactive training environments, supporting surgeon skill evaluation and decision-making. The integration of gesture recognition into surgical education and robotic assistance promises to further improve procedural safety, precision, and learning outcomes (18).

AI Based postoperative recovery management

AI and machine learning (ML) are transforming Enhanced Recovery After Surgery (ERAS) protocols by enabling data-driven, individualized patient care. These technologies analyse large volumes of preoperative, intraoperative, and postoperative data to provide real-time risk predictions, allowing clinicians to proactively identify patients at higher risk for complications and adjust interventions accordingly. AI/ML models personalize ERAS elements such as fluid management, pain control, and nutritional support by considering each patient's demographics,

medical history, genetics, and real-time physiological data. Outcome prediction is another key benefit: AI/ML algorithms identify patterns and risk factors in complex datasets, predicting important outcomes like length of hospital stay, likelihood of readmission, or postoperative complications. These insights support timely, targeted interventions and efficient resource allocation, ensuring intensive support to be focused on those who need it most. Overall, the integration of AI and ML into ERAS protocols promises safer recoveries and reduced hospital stays. However, their success depends on overcoming challenges in data access, privacy, and the need for collaboration between clinicians and data scientists, ensuring that AI serves as a supportive tool and not a replacement for human expertise (19). Although there is currently a lack of large, high-quality Randomized Controlled Trials (RCTs) that directly compare patient outcome in AI augmented robotic surgery to robotic surgery without advanced AI in gynecology. Most available RCTs and meta-analyses in the field compare robotic surgery (which may involve some basic AI functions) to conventional laparoscopy or open surgery.

AI is surgical training

AI will have a transformative impact on the training of junior surgeons in the field of gynecological endoscopy. AI enhanced educational tools and feedback systems offer several advantages over traditional training, enabling more efficient skill acquisition and fostering individualized growth. AI powered video analysis platforms can objectively assess surgical performance, track progress over time, and deliver immediate, targeted feedback. Ma et al. (2023) reported that the use of AI based video feedback led to substantial improvements in needle handling skills, particularly among underperforming trainees. This study highlights the ability of AI tools to identify specific areas of weakness and deliver actionable feedback that accelerates learning curves (20). Similarly, Laca et al. (2023) found that AI guided feedback during robotic suturing tasks was especially valuable for novice trainees, who benefited significantly from personalized recommendations. Their findings underscore the importance of adaptive, data-driven feedback in optimizing skill development and building confidence among junior surgeons (21). Another tool developed to enhance simulation-based training is the Virtual Operative Assistant (VOA). It provides junior surgeons with objective, automated feedback on their performance in simulated endoscopic procedures, accelerating skill acquisition by identifying areas for improvement based on expert proficiency benchmarks (22).

Limitations of AI

Despite its promise, AI's application in gynecologic robotic surgery faces several key limitations. The accuracy of AI systems depends on large, high-quality, and diverse datasets, biased or incomplete data can undermine generalizability and perpetuate healthcare disparities. Many AI models lack robust external validation, limiting their reliability across different clinical environments. Furthermore, the complexity and "black box" nature of sophisticated algorithms hinder transparency, making it difficult for clinicians to interpret or trust AI generated recommendations. This lack of explainability can reduce clinician confidence and complicate patient communication. Finally, limited clinician familiarity with AI technologies poses a challenge to effective integration into surgical practice, emphasizing the need for better educational resources and intuitive interfaces (23–25).

Financial implications

The cost of implementing AI in gynecological robotic surgery is substantial and multifaceted, involving not just the acquisition of robotic systems but also ongoing expenditures on AI software, compliance, training, and maintenance (26–28). However, compared to standard laparoscopic or open surgical techniques, the adoption of robotic AI platforms has yet

to consistently demonstrate clear cost-effectiveness in all settings. Traditional approaches generally involve lower capital and operating costs and may deliver comparable outcomes for certain procedures, especially where experienced surgical teams are available.

Social, ethical and legal challenges

Item	Typical Cost Estimate
Robotic-AI system (per unit)	$1.5–$2.5 million
AI custom software (complex application)	>$10 million
Annual infrastructure & upgrades	$100,000–$1 million
Staff training (per employee)	$5,000–$10,000
Maintenance (annual)	15–25% of acquisition cost
Per-use instruments/accessories	$1,866 per case
Compliance/security (annual)	Up to $1 million

Table 3: Cost of Systems

Accountability:

The introduction of AI shifts traditional accountability models in surgery. Although the final treatment decision often rests with the human surgeon, when outcomes are influenced by AI recommendations, questions arise: Who is responsible if a patient is harmed, the device manufacturer, the software developer, or the clinician? Current frameworks tend to place ultimate responsibility on the physician, yet clinicians may not fully control or comprehend the AI's internal logic. This shared or distributed accountability has profound implications for medical liability and patient safety. Example: in one instance, an AI driven recommendation to alter the surgical technique based on intraoperative data was followed by the surgeon, but led to an unexpected complication. Because the surgeon lacked access to the precise rationale behind the AI's recommendation, assigning fault became complex and legally contentious. Addressing these social and legal challenges will be as crucial as the technical advances. Careful regulation and ethical oversight will determine how AI ultimately shapes the future of gynecologic robotic surgery (23).

Explainability and Trust in AI Predictions:

Surgeons must be able to interpret and trust AI outputs, especially in high-risk clinical environments. A lack of transparency can erode confidence, inhibit adoption, and even endanger patient safety. Explainable AI methods, such as local interpretability tools or dashboards displaying variable importance, help demystify AI recommendations and empower clinicians to question or override them when necessary. Models equipped with interpretable features enable surgeons to validate suggestions and build informed trust in AI-driven assistance (25). In a recent surgical AI study, the model's output was accompanied by explanations showing how tumor size, surgical type, and patient comorbidities contributed to predicted complexity. This transparency was valued by surgeons, who could then tailor their intraoperative approach accordingly (29).

Global Regulatory Frameworks:

AI use in healthcare, and specifically in surgical robotics, is subject to rapidly evolving global regulatory oversight. AI-powered surgical devices are usually classified as high-risk medical devices due to their direct impact on patient health and safety. The U.S. FDA regulates AI enabled medical devices through draft guidance requiring clinical trials to ensure safety and efficacy before approval. Devices must be designed to reduce risks from software errors, user mistakes, and faulty data. Manufacturers are obliged to provide maintenance and update information to users and report device malfunctions to the FDA within 30 days. Meanwhile, the UK's MHRA emphasizes using established frameworks to guarantee AI medical devices are safe, effective, and suitable for all intended populations. It also highlights the need for transparent, interpretable AI models that are robust, testable, or thoroughly validated (30).

Limitations of the study

This review synthesizes the current landscape of AI applications in gynecologic robotic surgery, but it is subject to several important limitations. First, most of the available evidence derives from early-stage studies, technical feasibility reports, and retrospective analyses, with relatively few large-scale randomized controlled trials directly assessing clinical outcomes. Consequently, the generalizability of many findings is limited, and the long-term impact of AI systems on patient outcomes and surgical training remains to be fully established. Additionally, the rapidly evolving nature of AI technologies means that some innovations described may become outdated or surpassed by newer algorithms and platforms in the near future. Another constraint is the heterogeneity in reporting standards, endpoints, and evaluation metrics across studies, which complicates direct comparison and meta-analysis. Ethical, legal, and data privacy considerations, though touched upon, are evolving and were not exhaustively assessed in this review. Finally, the literature search was limited to English- language articles published between 2020 and 2025, potentially excluding relevant earlier work or non-English studies. These limitations highlight the need for ongoing, high-quality clinical research and international consensus to optimize the safe, effective, and equitable integration of AI into gynecologic robotic surgery.

Conclusions:

AI is increasingly integrated into gynecologic robotic surgery, offering substantial advancements in surgical precision, visualization, and workflow optimization. AI driven automation of repetitive tasks such as suturing and camera control reduces surgeon fatigue and enhances procedural consistency. Augmented reality combined with AI facilitates improved intraoperative visualization and lesion localization, addressing challenges posed by limited tactile feedback in minimally invasive surgery. Furthermore, AI enabled tactile intelligence and haptic feedback systems compensate for the loss of direct palpation, improving tissue discrimination and surgical safety. Machine learning based workflow and gesture recognition provides objective performance metrics that support surgical training and quality improvement. Despite these promising advancements, challenges remain in managing large datasets, ensuring ethical use, and integrating AI seamlessly across diverse clinical environments. Questions about standardization, long-term patient outcomes, and accountability hinder full adoption. Future research should emphasize robust clinical validation through large-scale trials, development of explainable AI models to build clinician trust, and establishment of regulatory frameworks that ensure patient safety without impeding innovation. Multidisciplinary collaboration is essential to overcome existing barriers and harness AI's full potential in gynecologic robotic surgery. Ultimately, AI integration heralds a new era of safer, more efficient, and patient-centred robotic gynecologic surgery, promising meaningful improvements in clinical practice. Advances. in AI have already enhanced precision and training in gynecologic robotic surgery. While challenges remain, ongoing research and clear clinical standards will determine the success of these technologies in the operating room.

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TheTrocar Issue 1 Volume 7 / Page 35- 41 ISSN: 2736-5530

Uterine Artery Ligation at the Isthmus: A Simplified Technique for effective Haemostasis in Laparoscopic Myomectomy.

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DOI: 10.36205/trocar7.2026005
Received: 2025-11-26 - Accepted: 2025-12-25

Abstract

Introduction: Uterine artery ligation prior to myomectomy is a crucial surgical step that significantly minimizes intraoperative blood loss and enhances operative safety. In laparoscopic myomectomy this can be achieved by uterine artery ligation. Conventionally this is achieved through retroperitoneal dissection and ligation of the artery at its origin from the internal iliac artery. However, in certain situations like a large impacted uterine myoma, limited uterine mobility and lack of experience in retroperitoneal dissection, this approach may not be feasible. The objective of this report is to describe an alternate and simplified method of uterine artery ligation at the level of the internal os (isthmus), which provides effective haemostasis without the need for retroperitoneal dissection. This technique thus offers a practical, safe, and efficient alternative in challenging cases, expanding the applicability of uterine artery ligation in minimally invasive myomectomy.

Study Objective: To describe and evaluate an alternative technique of uterine artery ligation at the isthmus in laparoscopic myomectomy, particularly for cases where retroperitoneal dissection and ligation at the artery's origin is not feasible due to large uterine fibroid or lack of expertise.

Key words: Haemostasis, uterine artery occlusion, laparoscopy, fibroid, blood loss reduction.

Introduction:

Uterine fibroids or leiomyomas are benign smooth muscle tumours of the uterus and represent the most common pelvic neoplasm in women of reproductive age, with a varying incidence of 20-40% in women over 30 years of age (1). Clinically fibroids may remain asymptomatic or present with symptoms like menorrhagia, dysmenorrhea, pelvic pain, pressure symptoms on bladder or bowel, infertility or adverse pregnancy outcomes (2). Effective haemostatic strategies in laparoscopic myomectomy are essential to ensure surgical efficacy and patient safety. Uterine artery ligation has proven to be a valuable technique to achieve significant and sustained reduction in uterine perfusion before myoma enucleation (3). The rationale for performing uterine artery ligation during laparoscopic myomectomy is grounded in its ability to reduce uterine blood flow without compromising uterine viability or future fertility. Conventionally ligation of the artery is done at its origin from the internal iliac artery (4). However, in our case where a large uterine fibroid obscured access to the retroperitoneal space we ligated the uterine arteries at the level of the isthmus, which offered a practical and effective means of achieving haemostasis.

Case Report:

A 32-year-old nulligravida presented with complaints of menorrhagia and pelvic pain persisting for the past three months. Her symptoms were not relieved by medication. On general examination, she appeared pale with stable vital signs. Abdominal examination revealed a firm, globular mass arising from the pelvis, corresponding to a uterine size of approximately 18 weeks' gestation. Pelvic ultrasonography demonstrated a uterus measuring 8x7x6 cm, containing a fundal intramural fibroid measuring 12 cm in diameter. Preoperative evaluation revealed anaemia secondary to chronic blood loss. The patient was optimised with iron supplementation and scheduled for laparoscopic myomectomy. Under general anesthesia a ten mm supra umbilical port and four five mm accessory ports were inserted, a uterine manipulator was inserted vaginally. Upon laparoscopic entry, the pelvic space was markedly reduced due to the large impacted fundal fibroid, which completely filled the pelvis and caused negligible uterine mobility (Fig.1)

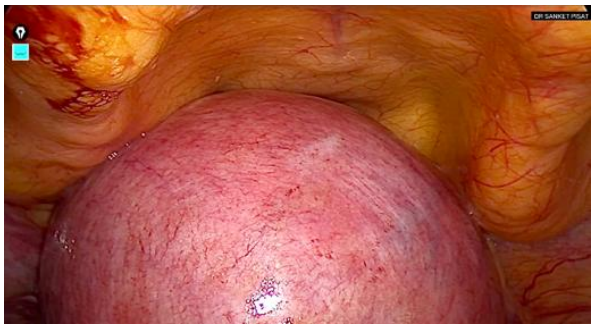

Figure 1: Impacted pelvic mass.

The retroperitoneal space was inaccessible precluding safe identification and dissection of the uterine artery at its origin due to an inaccessible retroperitoneal space because of size and weight of the myoma (Fig.2).

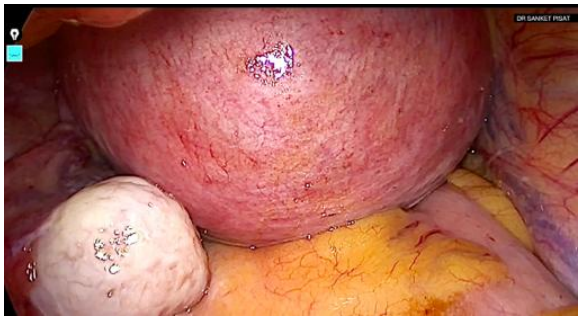

Figure 2: Inaccessible retroperitoneal Space due to size and weight myoma

Given the anticipated risk of excessive intraoperative bleeding, bilateral uterine artery ligation at the level of the isthmus was planned and executed. The uterine mass was displaced cephalad to expose the uterine isthmus where adequate operative space was preserved. The uterine artery was identified by its prominent pulsations. Using the round ligament, uterovesical peritoneal fold and uterine artery as landmarks area of dissection was chosen (Fig.3).

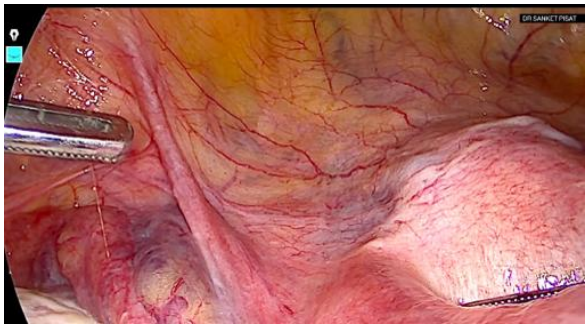

Figure 3: Identifying the area of dissection using the round ligament and the uterovesical peritoneal fold as landmarks.

The uterovesical peritoneal fold was incised and the bladder was carefully dissected and reflected inferiorly. At the level of the isthmus the ureter lies in close proximity to the uterine artery with the ureter lying 1.5 cm lateral to the uterine cervix (5). In order to increase this distance and safeguard the ureter during uterine artery ligation, it is important to apply traction either by pushing the uterine body away with a vaginal manipulator or by pulling it with a myoma screw. Furthermore, inferior mobilization of the bladder from the cervical surface results in lateral displacement of the ureters (Fig-4).

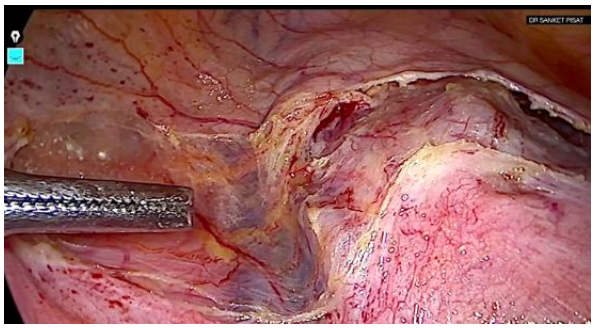

Figure 4: Uterovesical peritoneal fold incised and bladder dissected inferiorly, exposing the uterine artery and vein.

Adequate exposure at the isthmus is achieved by performing dissection both anteriorly and posteriorly. Anteriorly, the uterovesical peritoneal fold is incised and the bladder is mobilized inferiorly, while posteriorly the peritoneum over the uterosacral area is opened. This dual-plane dissection allows the ureter to fall laterally and inferiorly, thereby increasing the safety margin during ligation left and right uterine arteries seen pulsating at the level of internal os of cervix were identified and exposed. Blunt dissection was done between the uterine artery and vein to allow passage of suture under the artery without puncturing the vein (Fig 5).

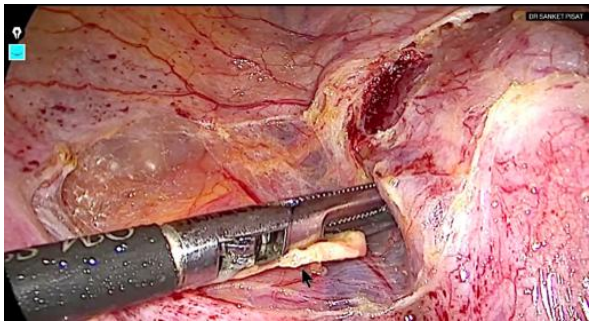

Figure 5: Blunt dissection done between the uterine artery and vein.

A delayed absorbable suture polyglactin 910 (Vicryl no.1, code 2347, Johnson & Johnson, USA) was carefully passed under the artery remaining superficial to the myometrium and avoiding the uterine vein (fig 6)

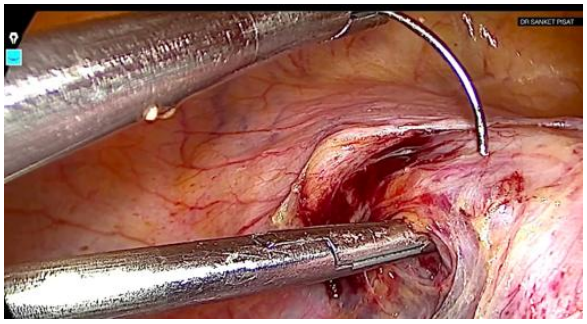

Figure 6: The needle is carefully passed under the left uterine artery while avoiding injury to the uterine vein

A regular knot was taken on the left (Fig 7)

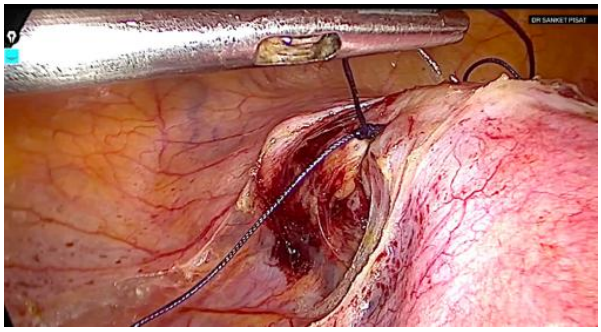

Figure 7: Left uterine artery ligated with a regular knot and a reversible uterine artery ligature (shoelace knot)

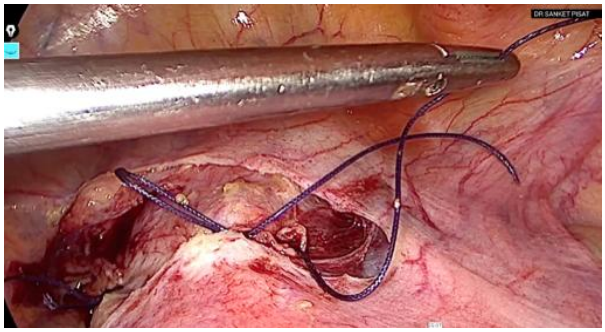

Figure 8: - Right uterine artery ligated with a reversible shoelace knot.

The shoelace reversible knot has been shown to remain securely in place when applied around a well-dissected, isolated uterine pedicle at the origin of the uterine artery. However, in our experience so far when ligation is performed at the isthmus, as in our case, the vascular bundle is broader and less discrete, making the shoelace knot more prone to slippage. To ensure reliable haemostatic control in this location, we therefore opted for a permanent ligation on the left side.

At the same time, because this was a fertility-enhancing procedure, the aim was to restore uterine perfusion as much as possible postoperatively. For this reason, a shoelace reversible knot was applied on the right uterine artery, which was opened after myomectomy allowing at least unilateral re-establishment of blood flow after surgery. This approach balanced the need for secure intraoperative haemostasis with the patient's reproductive goals. After successful ligation, the proximal portion of the uterine artery exhibited increased pulsatility, indicating a compensatory attempt to re-establish distal perfusion. Subsequently diluted vasopressin was injected into the myometrium

surrounding the fibroid to further minimize capillary oozing and facilitate enucleation under a nearly bloodless field. A linear serosal incision was then taken over the most prominent part of the fibroid, fibroid capsule identified and dissected sharply. The fibroid was enucleated by traction and counter traction. The fibroid bed was inspected for any residual bleeding, which was minimal due to prior uterine artery ligation. The myometrial defect was closed in two layers with polyglactin sutures and haemostasis was confirmed. The excised fibroid was retrieved by contained in bag morcellation. The total intraoperative blood loss was 50 cc and no transfusion was required. The patient had an uneventful postoperative recovery, tolerated oral intake the same evening and was discharged on the second postoperative day. At three months follow up she reported normal menstrual cycles and resolution of pelvic pain, with no evidence of recurrence or postoperative complications.

Discussion:

Intraoperative bleeding remains one of the most significant challenges during laparoscopic myomectomy. Among various haemostatic measures, uterine artery ligation has proven to be an effective and reliable technique to achieve sustained reduction in uterine blood flow. By devascularizing the uterus before myoma enucleation, it not only minimizes intraoperative bleeding but also improves surgical field clarity, reduces operative time and decreases the need for transfusion or repeated vasopressin injections. Bilateral uterine artery ligation offers additional advantages over unilateral occlusion, as it provides symmetrical and more complete reduction of uterine perfusion (7). Traditionally, the uterine artery is ligated at its origin from the internal iliac artery via three possible routes, anterior, lateral or posterior approach (8). The anterior approach is through the peritoneum over the obliterated umbilical ligament which is incised and the uterine artery is identified where it crosses over the ureter. The lateral approach describes the access to the uterine origin by incising the peritoneum between the round ligament, the infundibulopelvic ligament and the external iliac vessels. The posterior approach explains the dissection from the ovarian fossa using the ureter and the obliterated umbilical ligament as landmarks. Each of these methods demands meticulous dissection, experience and skill.

While vasopressin injection is commonly used for transient haemostasis, it has several limitations. Its effect is short lived and dependent on diffusion within the myometrium. Overdosage or inadvertent intravascular injection may cause systemic adverse effects such as hypertension, bradycardia, arrhythmia or even cardiac arrest. These systemic adverse effects can be avoided by using the visual vasopressor injection needle which has a transparent window close to the tip of the needle, allowing the surgeon to immediately see blood in this window during surgery, in case of accidental

vessel puncture and immediately withdrawing and repositioning it (9). Moreover, in large or degenerated fibroids, vasopressin distribution maybe uneven, resulting in incomplete haemostasis. The uterine artery itself exhibits considerable anatomical variation, both in its origin and branching pattern. It may arise from the internal iliac, umbilical, inferior gluteal, or even the vaginal artery and its course relative to the ureter can vary (10). These variations coupled with limited pelvic space or a large impacted fibroid may render retroperitoneal identification technically challenging or unsafe. In such scenarios, uterine artery ligation at the level of the isthmus serves as a valuable and simplified alternative. This approach avoids the need for extensive retroperitoneal dissection while providing the same haemostatic benefit. This technique is particularly advantageous when large fibroids obscure the pelvic space or restrict uterine mobility. The isthmic approach ensures effective control of uterine perfusion, reduces intraoperative blood loss, and maintains procedural safety even in complex anatomical situations. Concerns have been raised regarding the potential impact of bilateral uterine artery ligation on fertility and uterine function. However multiple studies have demonstrated that collateral revascularization of the uterus occurs within weeks after ligation, preserving endometrial receptivity and ovarian perfusion (11). In our technique also due to isolated uterine artery ligation ovarian reserve is preserved. Clinical evidence indicates that fertility outcomes remain unaffected, making bilateral uterine artery ligation a safe procedure in women desiring future conception. The argument that a reversible bilateral artery ligation may be better still continues and needs further research and evidence.

Conclusions:

Uterine artery ligation is a pivotal step in minimising intraoperative blood loss during laparoscopic myomectomy. While ligation at the artery's origin remains the conventional technique, it may not always be feasible in cases with large or impacted fibroids that restrict retroperitoneal access. In such situations, bilateral uterine artery ligation at the level of isthmus offers a safe, simple and effective alternative that ensures excellent haemostasis without compromising uterine integrity or fertility. This approach reduces operative difficulty, avoids the risks associated with deep pelvic dissection and. Vasopressin use and broadens the applicability of laparoscopic myomectomy even in complex surgical scenarios.

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TheTrocar Issue 1 Volume 7 / Page 42-47 ISSN: 2736-5530

Hysteroscopic Resolution of a Failed Pregnancy in the Cornual Region of the Uterus Associated with Uterine Synechiae: Case Report

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DOI10.36205/trocar7.2026006
Received: 2025-10-24 - Accepted: 2025-11-16

Abstract

Pregnancy in the cornual region has been considered a type of ectopic pregnancy, accounting for 2%–5% of such cases. This location, currently recognized as eutopic, is considered by some reports to be a risk factor associated with serious complications: uterine rupture and difficult-to-control hemorrhage. Currently, pregnancies in the cornual region are subclassified into three types: (a) cornual, (b) interstitial, and (c) angular. Early diagnosis is key to the conservative management of this type of pregnancy, as a late diagnosis increases the possibility of rupture and hemorrhage, which would result in a high probability of requiring a hysterectomy. Conservative treatment is performed through careful case selection, with the use of methotrexate, mifepristone and other drugs. Minimally invasive surgery has also been used, either initially or as a complementary procedure. This article details a very specific case of a pregnancy in the cornual region treated with methotrexate. Because the ß-hCG levels never became negative at five-month follow-up, and the ultrasound exams continued to report the presence of a gestational sac in the cornual region, it was decided to perform an operative hysteroscopy.

Key words:
Ectopic pregnancy, cornual region, synechia, hysteroscopy, Mullerian malformation

Study Objective:

To present the clinical case of a rare pathology, in which resolution was achieved using a minimally invasive approach.

Design: Case report

Introduction:

Ectopic pregnancy (EP) is defined as the implantation of a blastocyst that develops outside the endometrial cavity. Pregnancies in the cornual and interstitial regions represent 2% to 5% of EP. By definition, EP refers to implantation and development of a gestational sac in the proximal and lateral regions of the uterus, also known as uterine horns. These carry a high risk of rupture, hemorrhage, and even death (1). All EP occurring in the cornual region of the uterus have been considered as "cornual" ectopic pregnancies. It is important to note that three terms are currently used to describe this type of pregnancy: (a) cornual, (b) interstitial, and (c) angular. The findings in imaging studies, management, and results may be different (1,2). According to the medical literature, imaging specialists and gynecologists often do not distinguish between interstitial and cornual pregnancy, using both terms interchangeably (2). Currently, it is recommended to classify as a cornual ectopic pregnancy, a pregnancy that implants in a rudimentary “horn” of a uterus with some type of Müllerian malformation (unicorn uterus, bicornuate uterus, septate uterus) (3). Ultrasound criteria for diagnosing an ectopic pregnancy in the cornual region include: an empty endometrial cavity, an eccentrically located gestational sac (approximately 1 cm from the lateral uterine wall), and a thin layer (<5 mm) of myometrium surrounding the sac. This type of pregnancy carries a significant risk of rupture due to the lack of myometrial support surrounding the gestational sac (1,2,3). An interstitial EP is the one in which the blastocyst implants in the interstitial portion of the fallopian tube and near the uterine myometrium, located laterally to the round ligament, and surrounded by less than 5 mm of myometrium, and presents an ultrasound sign of an interstitial line that appears in the first trimester of pregnancy. The interstitial region is susceptible to rupture due to an increase in distension and hypervascularity. For this reason, it is imperative that the EP is diagnosed early, in the first trimester of pregnancy, for conservative treatments (1,2,3). An angular pregnancy is a third type of pregnancy implanted in the cornual region of an anatomically "normal" uterus. It is implanted medial to the round ligament, in the lateral angle of the endometrial cavity and medial to the uterotubal junction. This type of pregnancy can reach term. The thickness of the myometrial layer is > 5 mm, and there is no sign of an interstitial line. Approximately 29% of angular pregnancies in the cornual region end in a uterine rupture, although a recent prospective study that included 42 cases, the authors found that 80% of these pregnancies reached term and 20% ended in early abortions. In addition, they reported no complications of uterine rupture, maternal death, abnormal placentation, or need for hysterectomy (3,4,5). Another reason why an angular pregnancy is considered a type of EP in other publications is the difficulty in differentiating an interstitial pregnancy from an angular pregnancy, especially during the first trimester. It also presents symptoms similar to a typical ectopic pregnancy (4). The angular pregnancy is a poorly recognized entity, with approximately 100 cases reported in the literature. Complications are reported, with an estimated 28.5% of cases ending in uterine rupture, and 20% in spontaneous abortion. Although the angular pregnancy could be considered a potentially viable intrauterine pregnancy, the risk of uterine rupture is not negligible and could lead to massive hemorrhage, with a maternal mortality rate of 5% (3,4). However, one of the best practice recommendations of the European Society of Human Reproduction and Embryology (ESHRE) published in 2020 recommends that the term "angular pregnancy" should be abandoned (6). In all three types of pregnancy in the cornual region, early diagnosis in the first trimester is key to more appropriate management and to avoid complications related to rupture and hemorrhage, which could even lead to mortality. The diagnosis, as with other types of EP, is based on studies and imaging - ultrasound, clinical suspicion, and human

chorionic gonadotropin hormone levels (3,4). The use of 2-D and 3-D transvaginal ultrasound and the experience of the imaging specialist are crucial for the correct diagnosis of the three types of pregnancies located in the cornual region. When there is insufficient experience or the result is ambiguous, the use of other diagnostic methods such as magnetic resonance imaging is recommended (3,4). Currently, conservative medical and surgical approaches are used to achieve the best outcomes for the three types of EPs in the cornual region of the uterus. Of the conservative approaches, pharmacological treatment based on local or systemic methotrexate has been effective in the majority of reported cases in patients who meet criteria for its application. Tanaka et al. were the first to describe the use of methotrexate for the medical and pharmacological treatment of ectopic pregnancy in the cornual region (7). Hysteroscopic resection of cornual pregnancy is a minimally invasive technique, an alternative approach that allows for the visualization and removal of all pregnancy products without affecting the rest of the uterus. The first report of hysteroscopic resolution of cornual ectopic pregnancy is attributed to Meyer et al., who described the hysteroscopic technique using a laparoscopic approach (7,8).

Case Report:

A 33-year-old patient with a diagnosis of uncomplicated EP in the left cornual region (7 weeks by last menstrual period) was treated medically with a single systemic dose of methotrexate (X mg/kg body weight), showing a good initial response.

Measurements and main results:

However, during the five-month follow-up, β-hCG never became negative and transvaginal ultrasound reports continued to report the presence of a gestational sac in the left cornual region. Notably, one month after methotrexate administration, the patient resumed regular menstrual bleeding of normal volume (Table 1: Record of the evolution of the β-hCG in the follow-up carried out at five months).

Quantitative Beta Tracking	**2450 mIU/ml initial beta hCG**
1st control 4th day post methotrexate	1250 mIU/ml
Control at 10 days	840 mIU/ml
Control at 30 days	620 mIU/ml
Control at 45 days	255 mIU/ml
Control at 80 days	230 mIU/ml
Control at 120 days	200 mIU/ml
Control at 145 days	199 mIU/ml

Table 1: Evolution of β-hCG/five monts

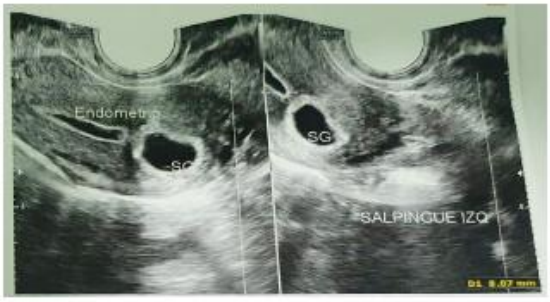

Figure1: Transvaginal ultrasound at 5 months after treatment with methotrexate continued to report the presence of a gestational sac in the cornual region.

It was decided to perform a diagnostic-surgical hysteroscopy, for which a Bettocchi-type hysteroscope (Karl Storz SE & Co KG,Tuttlingen, Germany) was used, with saline solution as a distention medium. An occlusion of the left cornual region was observed, with a fibrous adhesion lateral to the left ostium. A structure corresponding to a degenerated gestational sac was seen. A cold section of the aforementioned adhesion was performed, and the gestational sac was subsequently removed with 5 Fr grasper forceps, which emerged intact.

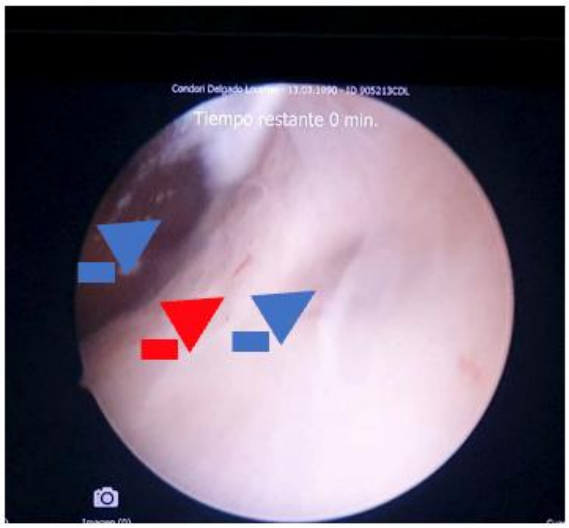

Figure 2: Left cornual region occluded by fibrous uterine synechiae, the blue arrow indicates entry into the cornual region. The red arrow indicates fibrous synechiae that almost completely occluded the left cornual region. The blue arrow indicates the uterine cavity

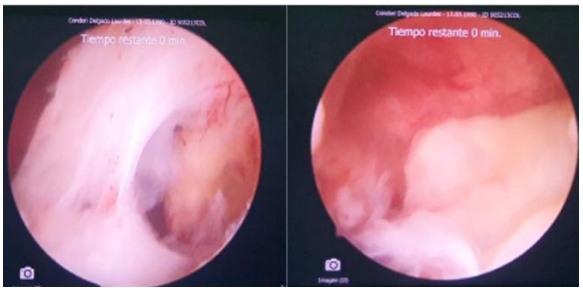

Figure 3: After blunt entry maneuvers, it is possible to visualize the structure corresponding to a degenerated gestational sac that is located lateral and close to the left osteum. After the cold section of the synechia, it is possible to reach the gestational sac.

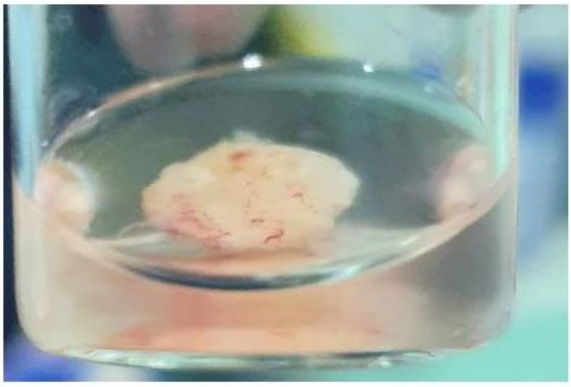

Figure 4: Complete extraction of the gestational sac is achieved
through blunt maneuvers, grasping and retraction under
hysteroscopic visualization of the gestational sac

It was speculated that the fibrous uterine synechiae might resemble a rudimentary uterine horn in an anatomical configuration and therefore be clinically and sonographically indicative of a cornual pregnancy. One week after hysteroscopy, a new β-hCG quantification was performed, showing a value of 2 mIU/ml (negative). Traditionally, treatment of an EP in the cornual region involved hysterectomy or cornual excision via laparoscopy or laparotomy. Currently, it is considered that, depending on the individualization of each particular case, a conservative treatment can be offered based on the systemic application of methotrexate, with a success rate of between 89% and 98%. It has been reported that at least one in seven patients with cornual ectopic pregnancy treated with methotrexate may require additional surgery. Hysteroscopic resection of pregnancy in the cornual region is an alternative minimally invasive approach that allows direct visualization and removal of all products of gestation, without affecting the rest of the uterus. The first hysteroscopic resection of this type was reported by Meyer et al. (1989), performed after laparoscopic confirmation. Sanz et al. (2002) further expanded the concept using hysteroscopy under ultrasound guidance and Pal et al. performed a hysteroscopic resection of the gestational sac and subsequently removed the excised products of pregnancy by suction under combined ultrasound and laparoscopic guidance (8,9,10,11,12). More recent reports of successful hysteroscopic resection of pregnancy are indicative of the potential of this technique as an alternative with a reduced impact on future fertility and maternal outcomes (9,10). In selected cases, hysteroscopic excision may serve as an alternative or complementary treatment for cornual ectopic pregnancy. To our knowledge, and based on a review of the medical literature, this is the first reported

case of hysteroscopic resolution performed without the use of energy (resector), using only a 5 Fr grasper. Likewise, laparoscopic or ultrasound guidance were not necessary. The histopathological report of the operative specimen was reported as fibrosed first trimester villi, hyalinized gestational sac. In the ultrasound follow-up after hysteroscopy, a gynecological ultrasound reported no evidence of endometrial alterations of 10 mm. Ten months after the intervention, the patient achieved a new spontaneous pregnancy with eutopic intrauterine implantation. The gestation is uneventful.

Conclusions:

In this case, an EP in the cornual region was associated with a fibrous synechia, adhesion, that almost completely occluded the left side. Despite an initially good response to the application of methotrexate, ß-hCG never became negative in the five-month follow-up, and ultrasound studies continued to report the presence of a gestational sac in the cornual region. Hysteroscopy is a minimally invasive alternative for selected cases of ectopic pregnancy in the cornual region and serves as a useful complementary tool to conservative treatment with methotrexate.

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The Trocar Issue 1 Volume 7 / Page 48-52 ISSN: 2736-5530

Prolapsed Giant Cervical Fibroid Mimicking Uterine Inversion: A Diagnostic Dilemma (Rare Case Report)

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DOI: 10.36205/trocar7.2026007
Received: 2025-07-16 - Accepted: 2025-08-04

Abstract

Background:
Prolapsed cervical fibroids are rare and can mimic uterine inversion or even genital malignancy. When a large fibroid prolapses through the cervical canal or vagina, it may obscure the uterine fundus, complicating clinical diagnosis.

Case Presentation:
The case of a 48-year-old woman with a large prolapsed cervical fibroid occupying the vagina, raising a suspicion of uterine inversion is presented. Diagnosis was confirmed intraoperatively. Surgical management included vaginal myomectomy followed by total abdominal hysterectomy due to distorted anatomy and persistent bleeding.

Conclusion:
Prolapsed giant cervical fibroids are rare and may present with diagnostic confusion, particularly with uterine inversion. Accurate diagnosis and prompt surgical management are critical to prevent complications.

Keywords: Prolapsed fibroid, Cervical fibroid, Uterine inversion, Diagnostic dilemma, Vaginal mass

Introduction

Cervical fibroids represent less than 1% of all uterine fibroids. While submucosal and subserosal fibroids are more common, prolapse of a cervical fibroid into the vaginal canal is exceedingly rare (1). Large prolapsed fibroids can create diagnostic confusion, especially when accompanied by hemodynamic instability or traction on the uterus, mimicking acute or chronic uterine inversion or genital malignancy (2). Differentiating between these entities is crucial, as management varies significantly.

Case Report

A 48-year-old parous woman presented to the emergency room of the Obstetrics and Gynecology Department of the tertiary care hospital with complaints of something coming out per vaginam for 20 days, progressively increasing in size, and increasing difficulty in walking and urination. She experienced the mass 20 days back after she tried to lift a heavy pot from the ground. She had a history of two vaginal deliveries, both uneventful. She gave a history of regular menses, every 30 days, lasting for 5-6 days with moderate flow, the last menses one month prior. She had no prior history of fibroid diagnosis or uterine surgery.

On Examination:

General condition: The patient was conscious, oriented to time, place, and person. Pulse-110/min, BP 118/70 mmHg, pallor present. Abdominal exam: soft, non-tender on palpation. Local exam: a large, necrotic, irregular, solid, infected foul-smelling mass (+/-20×15 cm) with degenerative changes was seen protruding from the introitus. The cervical os could not be identified (Fig 1).

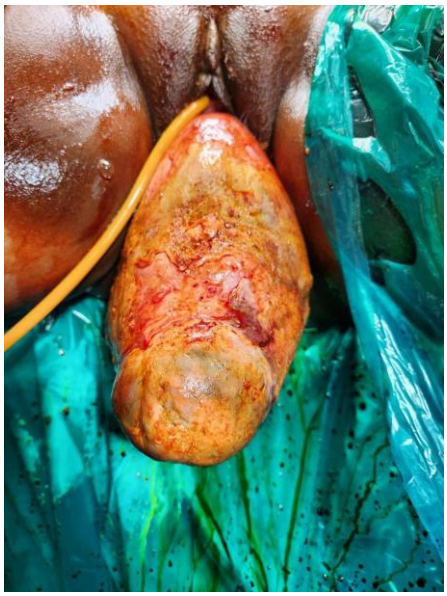

Figure: 1 Findings as seen on local examination

Bimanual exam was inconclusive: uterine fundus not palpable on abdominal or vaginal exam.

The patient had been referred to a Cancer Specialty center in Mumbai to rule out malignancy, considering the exponential growth of the mass within three weeks. After ruling out malignancy on histopathology and immunohistochemistry, the patient was then referred to our tertiary care center for definitive management.

Investigations: Patient's blood tests including tumor markers were within normal limits.

Pelvic Ultrasound: The cervix is bulky in size with a large 9.7 x 4.4 cm intraluminal lesion within it heterogenous in density. The uterus is normal in size and echotexture. Suggestive of a large cervical mass possibly neoplastic.

Pelvic MRI: Suggestive of a large pedunculated mass arising from the anterior lip of cervix with prolapse into the vaginal canal measuring approximately 5.4x9.7x15.9 cm – pedunculated cervical fibroid. The uterus is displaced posteriorly and is retroverted, the uterine body is unremarkable. No associated hematometra nor hydrometra is found. No obvious infiltration of the vaginal walls. No involvement of the urinary bladder, rectum, or sigmoid colon. There is no hydroureter. No suspicious locoregional lymphadenopathy or distinct metastatic disease is seen.

Histopathology (biopsy from the mass): Suggestive of spindle cell tumor of smooth muscle origin (leiomyomatous type) with focal atypia.

Immunohistochemistry from the mass: The tumor cells are diffusely positive for SMA, desmin and h-caldesmon while negative for S100 and SOX10. Tumor shows retained expression of ATRX protein. P53

shows wild type staining pattern. MIB1/Ki67highlights approximately 5-8% of tumor cell nuclei.

CT Thorax: Fibrobronchiectatic changes are seen in the inferior segment of the right middle lobe, No evidence of metastasis

Management:

The patient was stabilized with broad-spectrum IV antibiotics, analgesics and with Betadine dressing of the protruding mass. The patient was planned for exploratory laparotomy with vaginal mass debulking with hysterectomy (abdominal/vaginal route). The patient and the relatives did receive an explanation regarding the risks and possible complications of the procedure. Examination under anesthesia (EUA) was done in lithotomy position covered by all aseptic precautions, the mass was confirmed to be arising from the anterior part of the cervical region. A laparotomy was performed to evaluate the pelvic anatomy, which revealed a large necrotic fibroid (+/- 20 x 15 cm) attached to the anterior cervical lip. No uterine inversion was noted. The uterus was enlarged and displaced inferiorly, the fallopian tubes were oedematous on both sides, the ovaries were normal bilaterally. Due to the weight of the cervical mass, proper visualization of the uterovesical fold was not possible, making the dissection extremely challenging. A debulking of the prolapsed cervical fibroid was done from the vaginal end, relieving the pressure from the uterus. A vaginal myomectomy was attempted but the mass was necrotic and bulky and hence could not be separated from the cervix. Therefore, the prolapsed mass was then pushed into the vagina and the uterine fundus was identified separately during abdominal exploration. An abdominal approach for hysterectomy was decided upon, which was performed including bilateral salpingectomy. Both ovaries were preserved. A peritoneal wash was performed. Bladder integrity was confirmed by the urologists through cystoscopy.

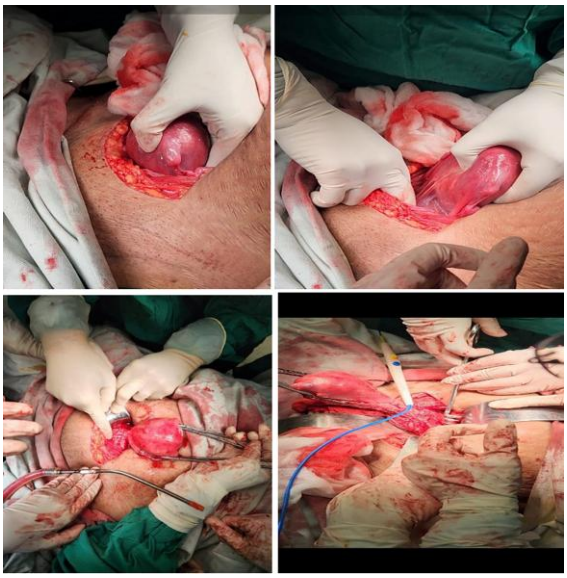

Figure 2: Intra operative findings

Histopathology: The cervix shows evidence of cervicitis. The Fallopian tubes are suggestive of acute salpingitis. The mass was diagnosed as a benign leiomyoma with areas of hyaline changes Occasional clusters of mature adipocytes are seen. The surface shows ulceration, fibrinosuppurative exudate and bacterial colonies. There was no evidence of atypia nor malignancy in the material examined.

Postoperative Course: Post operatively, the patient was kept on intravenous antibiotics and analgesics. Vaginal Betadine douching was done on day four and eight. On day ten, the patient had complaints of soaked abdominal wound dressing. On suture removal, the patient presented with a complete wound dehiscence up to the subcutaneous layer. The swab revealed staphylococcus aureus sensitive to amikacin and linezolid. Daily dressing was done under all aseptic precautions and high protein diet was advised. The patient was then taken for secondary resuturing of the wound under anesthesia on day seven of the wound dehiscence. She was then discharged on day three of post-resuturing the wound. On follow up, suture removal was performed on day 14 after resuturing. The patient appeared healthy and had no new complaints.

Discussion

Prolapsed cervical fibroids can present dramatically with bleeding, infection, and a mass per vaginam. Differentiating them from uterine inversion is difficult when the fundus is not palpable or when imaging is inconclusive. Inversion is typically associated with acute severe haemorrhage and shock, often postpartum, while cervical fibroid prolapse may have a subacute course (3). Imaging, especially MRI, helps to differentiate between the two. However, examination under anesthesia (EUA) and intraoperative findings remain the gold standard in many cases. In the patient presented, despite imaging and clinical confusion, a definitive diagnosis was made surgically. Anatomy of the ureters is expected to be distorted in cases of an impacted cervical fibroid. Hence meticulous dissection of the bladder coupled with careful application of clamps is a pivotal step in the surgery. In the case presented, the enucleation of the cervical myoma through the posterior incision on the uterocervical junction abdominally was the key surgical step in the surgery. This diagnostic confusion could have been prevented by presenting early at the hospital, where the patient could have been diagnosed and taken up for the myomectomy through the abdominal route without the risk of infection or necrosis of the mass. The surgical management of cervical myomas can be challenging and it requires a great experience, skill and expertise of the surgeon. The presence of a cervical leiomyoma has been identified as an independent factor affecting operation time in minimally invasive surgery (4). Identification of a correct cleavage plane for the surgeon becomes difficult in relation to the position of cervical myoma, as it can have close relations with pelvic structures, procedures can be further complicated by more restricted and inaccessible surgical spaces (5). Retrospectively, the assumption can be made that the post-operative wound dehiscence can be a consequence of the suppurative inflammation on the surface of the prolapsed myoma (as mentioned on the histopathology report) but the enucleation of the myoma was not possible vaginally due to the same reason hence the decision of abdominal hysterectomy had to be taken. Certain case reports with large cervical fibroid have been reported intermittently which eventually needed a hysterectomy after ruling out malignancy (6, 7, 8).

Conclusion

Prolapsed giant cervical fibroids are rare and may mimic uterine inversion, leading to diagnostic confusion. Careful examination, imaging, and surgical exploration are crucial. Early recognition and appropriate surgical planning can prevent morbidity and preserve patient's safety. Their surgical management requires a multidisciplinary approach in modern era of surgery.

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The Trocar: Issue 1 Volume 7 / Page 53-59 ISSN: 2736-5530

Laparoscopic Transabdominal Cervical Cerclage: from Evidence to Clinical Practice: A Meeting of Obstetrics and Minimally Invasive Surgery.

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DOI: 10.36205/trocar7.2026008

Received: 2025- 11-01 - Accepted: 2025-11-18

Abstract

Transabdominal cervical cerclage is a therapeutic alternative for patients with cervical incompetence who have failed a previous transvaginal cerclage or who have anatomical limitations that prevent its performance. With the development of minimally invasive surgery, the laparoscopic approach has proven to be a safe and effective option, combining the benefits of obstetric management with the advantages of modern gynecological surgery. The case of a 36-year-old patient with a history of recurrent second-trimester miscarriages is presented. She underwent a laparoscopic transabdominal cerclage. The procedure was completed without complications, with minimal blood loss and rapid recovery, achieving a favorable obstetric outcome by letting the pregnancy continue to 38.5 weeks. The surgical technique is described step by step, highlighting key anatomical landmarks, relevant technical aspects, and recommendations to reduce the risk of complications. The available evidence supporting the effectiveness of this technique in prolonging pregnancy and improving perinatal outcomes in selected cases is also reviewed. It also highlights its advantages over the open approach, such as less postoperative pain, lower morbidity, and faster return to work. In conclusion, laparoscopic transabdominal cervical cerclage is emerging as a safe and effective option in appropriately selected patients. The integration of this case, the literature review, and the detailed technical description reinforce the role of minimally invasive surgery as a meeting point between obstetrics and surgical innovation.

Key words: cervical incompetence, transabdominal cerclage, laparoscopy, minimally invasive surgery, obstetrics

Introduction:

Cervical incompetence is an obstetric condition characterized by the inability of

the cervix to remain closed during pregnancy. It affects approximately 1% of the population. It can cause second-trimester miscarriages and premature births, and its diagnosis is difficult as there is no definitive test (1,2). Premature birth, defined as birth before 37 weeks of gestation, is a leading cause of infant mortality and morbidity. There are a few effective strategies to prevent it, including cervical cerclage, introduced in the 1950's, a common intervention used to prevent second-trimester pregnancy loss or premature birth (3). Transabdominal cerclage is a treatment option for cervical incompetence. It is recommended for patients with a previous transvaginal cerclage and spontaneous preterm birth before 28 weeks. It can be performed

laparoscopically or open, depending on the gestational age and the experience of the surgeon (4). The laparoscopic approach offers the advantage of greater proximity to the internal cervical os and a lower risk of suture migration, lower morbidity, less blood loss, and faster recovery (5). In patients with refractory cervical incompetence, where traditional methods are ineffective, laparoscopic abdominal cerclage is an option. This procedure involves placing a suture around the cervix through a laparoscopic procedure (6). This technique has a live birth rate of 96.4% in patients who also underwent vaginal cerclage placement in a previous pregnancy. Average duration of the procedure is 26 +/- 4.7 minutes, with an average blood loss of 11.9 milliliters, and no reported infections, urinary tract injuries, or conversions to laparotomy (7). Transabdominal cervical cerclage by laparoscopy is as effective as that performed by laparotomy, but with lower surgical morbidity (2% of complications compared to 22% at laparotomy), so the choice of the method depends on surgical experience and discussion with the patient (8).

Case Report:

A 36-year-old female patient, G2 P1 A1, with no significant medical history. Her first pregnancy ended with a cesarean section at 27 weeks due to cervical incompetence, with a newborn weighing 850 g. She subsequently suffered an incomplete miscarriage at 19 weeks, also secondary to cervical incompetence, resolved by instrumental uterine curettage. Given the clear history of cervical incompetence, a laparoscopic transabdominal Benson-Durfee cerclage was performed. The procedure was performed without complications, the procedure lasted 60 minutes, a V Care type uterine mobilizer was used, with an estimated blood loss of 100 ml, and she was discharged the following day. Subsequently, the patient continued with follow-up and ultrasound confirmed the correct placement of the cerclage. (Figure 1).

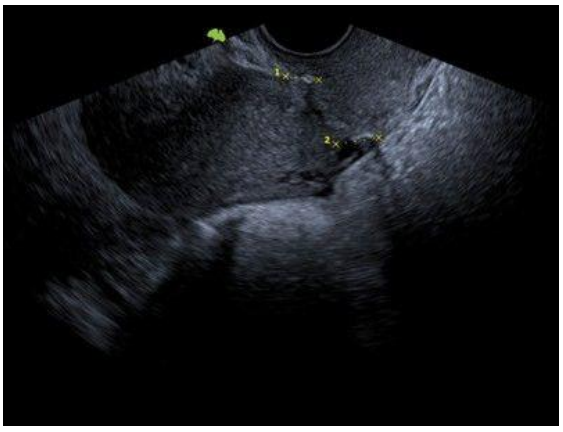

Figure 1: Green arrow: correct placement of the cerclage

The pregnancy progressed satisfactorily until 38.5 weeks, when a Caesarean section (CS) was scheduled. The newborn has a weight of 2930 g with an Apgar score of 8/9, with an estimated blood loss of 300 ml during the CS. The postoperative course was uneventful, and the patient was discharged 48 hours later in a good general condition. The surgical technique will be described step by step from the anatomical point of view.

1: Preparation and access (Figure 2): The patient is placed in a modified dorsal lithotomy position, with a slight Trendelenburg position to facilitate pelvic exposure. Pneumoperitoneum is installed through the Palmer point access, and trocars are placed. The abdominal and pelvic cavities are assessed, identifying the uterus, adnexa, bladder, and rectum.

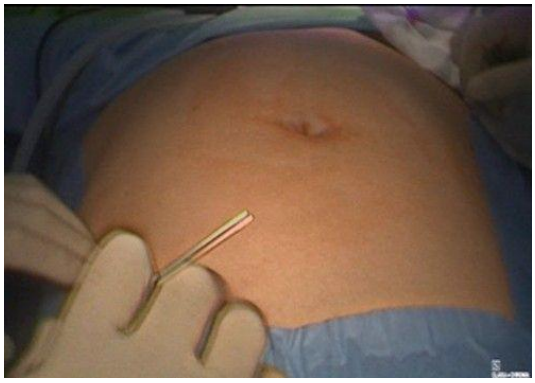

Figure 2: preparation and access at Palmer's point.

2: Exposure of the lower uterine segment (Figure 3-5): the uterus is moved anteriorly or laterally to expose the utero-cervical junction (key anatomy: Anterior aspect of the lower uterine segment and cervix, vesicouterine fold, and peritoneal reflection of the bladder). The vesicouterine peritoneum is carefully incised and dissected, moving the bladder caudally to expose the anterior aspect of the cervix.

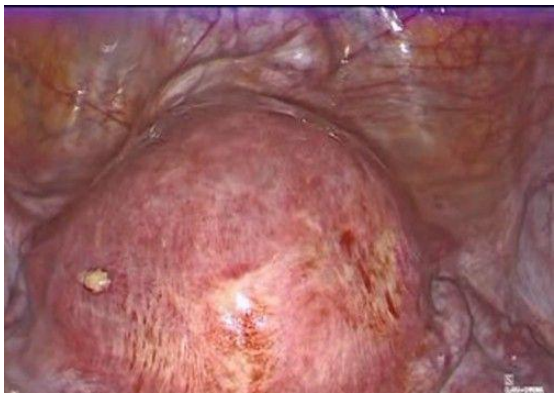

Figure 3: exposure of the lower uterine segment

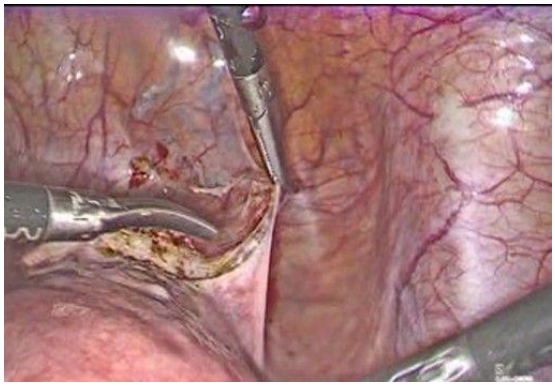

Figure 4: Careful incision of the bladder peritoneum

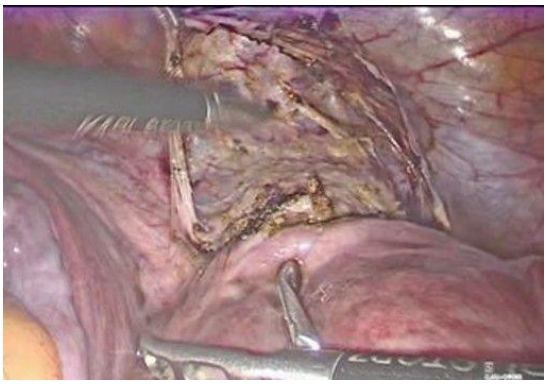

Figure 5: the bladder I moved caudally.

Identification of lateral structures (Figure 6): Uterine arteries: These are located medially toward the uterus. It is essential to recognize them and maintain a meticulous dissection to avoid injury. Ureters: These are located laterally and posterior to the uterine vessels. It is important to always maintain indirect visualization and consider the avascular plane of the broad ligament. Working plane: This plane is defined between the uterine artery and the lateral insertion of the cervix, where the Mersilene tape will be placed.

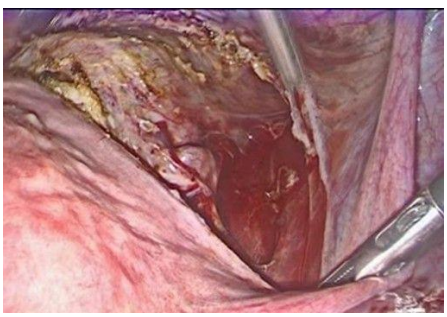

Figure 6: exposure of the uterine arteries.

Mersilene Ribbon Pass (Figure 7-10): A 5 mm Mersilene tape (or similar) is used, mounted on a semicircular needle or introduced using a laparoscopic forceps, the needle is introduced from the anterior aspect of the isthmus-cervix to the posterior aspect, medial to the uterine artery and just superior and medial to the uterine insertion of the uterosacral ligament close to the level of the internal cervical os. Care is taken to avoid injuring uterine vessels or penetrating the cervical cavity. The procedure is repeated symmetrically on the contralateral side, passing the tape from posterior to anterior, always medial to the uterine artery.

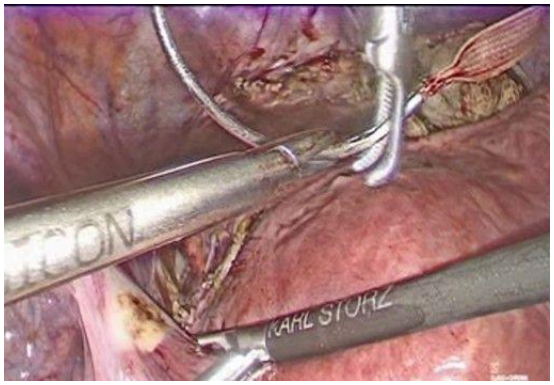

Figure 7: introduction of the 5 mm Mersilene tape

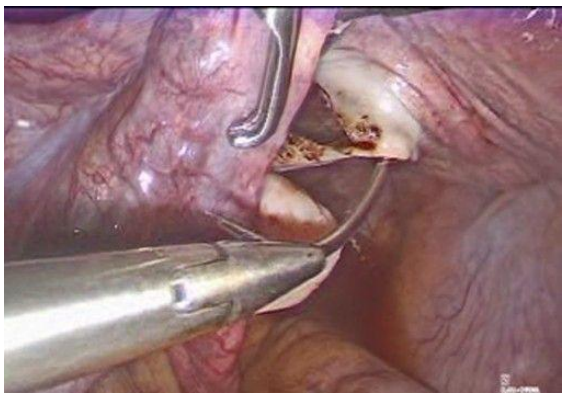

Figure 8: introduction of the needle in the anterior aspect of the cervix.

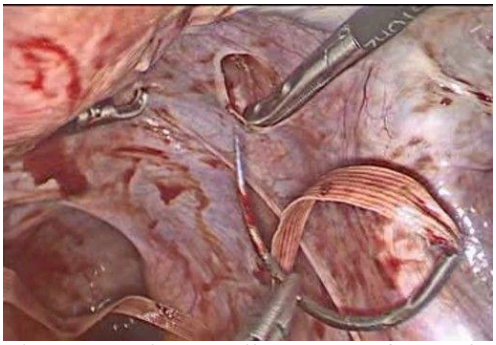

Figure 9: the needle passes from the anterioraspect of the isthmus-cervix to the posterior aspect, medial to the uterine artery and just superior and medial to the uterine insertion of the uterosacral ligament close to the level of the internal cervical os.

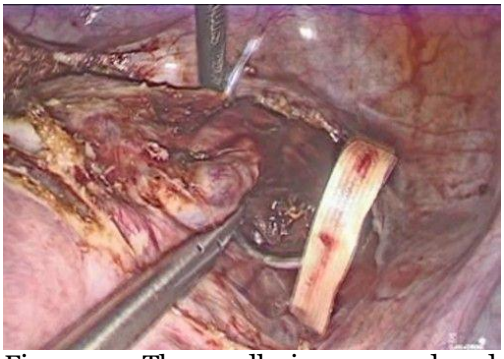

Figure 10: The needle is regrasped and brought back to anterior on the right side.

Securing the tape (Figure 11): The two ends of the tape are externalized on the anterior aspect of the cervix. They are tied firmly over the anterior aspect of the uterine isthmus, securing the cerclage without compromising cervical blood flow. It is recommended to tie two or three firm knots.

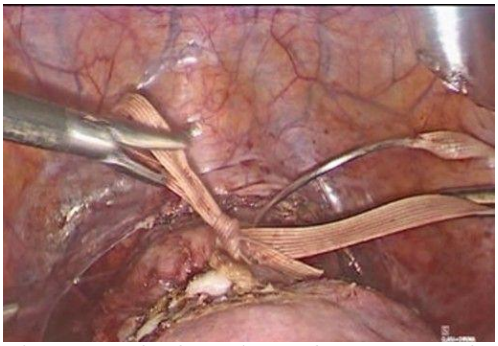

Figure 11: the knot is made to secure the tape.

Final review and closure (Figure 12-13): The absence of bleeding is verified along the dissection path and around uterine vessels, the vesicouterine peritoneum is

repositioned over the dissected area, covering the tape knot, and trocars are removed under direct vision and the cavity is deflated.

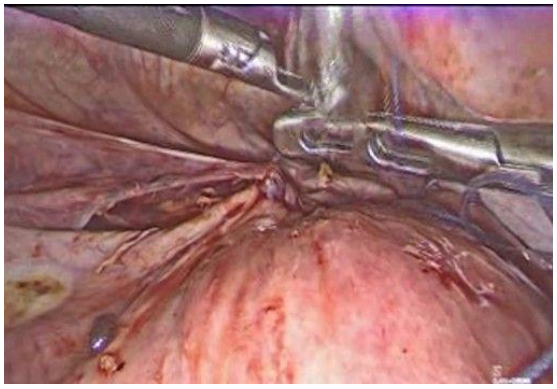

Figure 12: Repositioning of the vesicouterine peritoneum.

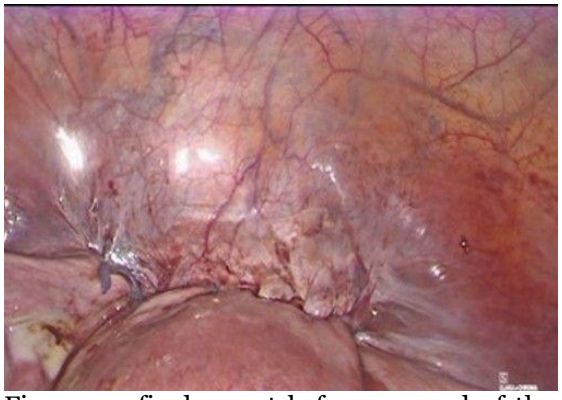

Figure 13: final aspect before removal of the trocars.

Key anatomical points: The safety plane lies medial to the uterine vessels, within the cervical stroma, but lateral to the cervico-isthmic junction. The ureter runs lateral and inferior to the broad ligament, so the tape must always be passed in the correct plane to avoid entrapment. The knot should be on the anterior surface of the uterine isthmus, protected by the vesicouterine fold.

Discussion:

Cervical insufficiency remains a significant obstetric challenge due to its association with recurrent miscarriages and preterm births. In patients with failed transvaginal cerclage or unfavorable anatomical conditions, transabdominal cerclage represents an effective option, especially when performed laparoscopically. In a recent meta-analysis, Marchand et al. (2022) demonstrated that both open and laparoscopic transabdominal cerclage achieve neonatal survival rates approaching 95%, with significant improvements in gestational age and birth weight (9). While open transvaginal cerclage showed a greater reduction in preterm births, the laparoscopic approach offered advantages in postoperative recovery and hospital stay, reinforcing its role as the technique of choice in certain cases. Furthermore, another analysis by the same group showed that laparoscopy is associated with less intraoperative bleeding and a lower risk of major hemorrhage, reinforcing its safety compared to open transvaginal cerclage (10). Correct cerclage placement is a critical success factor. Demirel et al. (2023) reported a case in which the Mersilene tape inadvertently passed through the cervical canal, highlighting the importance of incorporating verification techniques such as hysteroscopy at the end of the procedure (11). In our case, correct placement was confirmed by ultrasound, with a satisfactory outcome until the pregnancy reached term. Regarding transvaginal techniques, McAuliffe et al. (2023) found that the Shirodkar cerclage is associated with a lower risk of preterm birth than the McDonald cerclage, particularly births before 35, 34, and 32 weeks, as well as higher birth weight (12). While the quality of the studies limits the strength of these conclusions, the findings reinforce the principle that suture height and firmness are determining factors for success, a concept that can be extrapolated to the Benson-Durfee transabdominal cerclage. Latin American evidence also supports the efficacy of this method. In a case series in Mexico, five cases of laparoscopic abdominal cerclage were reported, with a neonatal survival rate of 80% and a mean time to delivery of 37.2 weeks. Furthermore, the advantages of minimally invasive surgery over laparotomy were confirmed, such as less bleeding, less postoperative pain, and earlier return to work (13). These results are consistent with the case presented, where the patient progressed without surgical complications and achieved a full-term pregnancy with a good neonatal outcome. Regarding alternative approaches, vaginal progesterone and serial

ultrasound measurements of cervical length remain cornerstones in the prevention of preterm birth in patients at risk of cervical insufficiency, especially those without prior surgical history or in whom invasive procedures are to be avoided. Likewise, the cervical pessary has emerged as a non-surgical intervention that may offer benefits in selected cases, although the evidence remains heterogeneous and its role is still debated. Similarly, several international guidelines suggest individualizing the therapeutic choice, considering factors such: as residual cervical length, patient preference and the availability of surgical expertise, emphasizing that transabdominal cerclage should be reserved for situations in which conservative or transvaginal alternatives are not feasible or have failed. Finally, the potentially catastrophic risks of transabdominal cerclage should not be underestimated. Dandapani et al. (2019) described a case of uterine rupture at term in a patient diagnosed by computed tomography who went into spontaneous labor, with serious maternal and fetal consequences (14). This report underscores the need for rigorous obstetric planning, with elective intervention before the onset of labor. In the case presented, a planned cesarean section at 38.5 weeks prevented this type of complication (1).

Conclusion:

Laparoscopic Benson-Durfee transabdominal cerclage is confirmed as a safe and effective alternative in patients with cervical incompetence and a history of failed vaginal access. The evidence reviewed supports its ability to prolong gestation, improve neonatal survival, and reduce complications, with clear advantages over laparotomy thanks to the benefits of minimally invasive surgery. Our clinical case illustrates how proper patient selection, meticulous execution of the technique, and strict obstetric planning achieve favorable maternal and perinatal outcomes. In this sense, laparoscopic cerclage is positioned as a key tool at the intersection of obstetrics and minimally invasive surgery, always within a multidisciplinary approach and under specialized follow-up.

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Real-Time Surgical Guidance with Robotic-Integrated Intraoperative Ultrasound in Bowel Endometriosis: A Two-Case Experience

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DOI: 10.36205/trocar7.2026009
Received 2025-12-20 Accept:2026-03-19

Abstract

Background:
Deep infiltrating endometriosis (DE) involving the bowel presents a significant surgical challenge due to difficulty in accurately assessing the lesion's depth and determining the appropriate extent of the bowel resection.
Material and Methods:
The use of intraoperative endorectal ultrasound (Endo-USG) integrated with the robotic TilePro interface is described as a real-time guidance tool during robotic surgery for bowel endometriosis.
Clinical Application:
Two patients with bowel DE underwent robotic surgery using the intraoperative Endo-USG guided surgical decision-making tool. In the first case, ultrasound confirmed muscularis involvement, prompting rectal disc excision. In the second case, Endo-USG demonstrated superficial disease despite preoperative MRI suggesting deeper infiltration, allowing conservative rectal shaving and avoidance of unnecessary bowel resection.
Conclusion:
Robotic-integrated intraoperative Endo-USG may enable more appropriated real-time lesion characterization, and by giving more information supports tailored surgical strategies, and enhances precision in bowel endometriosis surgery. This technique may help to prevent overtreatment while ensuring complete disease excision.

Key words : intraoperative ultrasound, Ddep infiltrating endometriosis (DE), image-guided surgery, robotic- assisted surgery, rectal shaving.

Introduction:

Deep infiltrating endometriosis (DE) involving the bowel affects approximately 8–12% of women with endometriosis and most commonly involves the rectosigmoid colon (1). Surgical management aims to achieve complete disease excision while preserving bowel function.

However, intraoperative assessment of bowel wall infiltration remains challenging, as visual inspection and palpation may underestimate lesion depth especially with less experienced surgeons (2). The choice between rectal shaving, disc excision, or segmental bowel resection is often based on preoperative imaging and intraoperative judgment. Inaccurate assessment may lead to incomplete excision or unnecessary radical bowel surgery, both of which can adversely affect patient outcomes (3). Intraoperative endorectal ultrasound (Endo-USG) provides real-time, high-resolution visualization of bowel wall layers, complementing visual assessment and improves accuracy of indepth evaluation (4). Integration of Endo-USG with robotic platforms using TilePro technology allows ultrasound images to be displayed simultaneously with the operative field on the surgeon's console, enhancing precision and surgical confidence.This article describes a novel operative technique utilizing robotic-integrated intraoperative Endo-USG to guide real-time surgical decision-making in bowel endometriosis, illustrated through two clinical cases.

Materials and Methods:

This report describes the application of a novel operative technique in two consecutive patients undergoing robotic surgery for bowel endometriosis at a tertiary referral center.

All procedures were performed using a robotic surgical platform equipped with TilePro visualization capability. Following standard robotic port placement and adhesiolysis, intraoperative endorectal ultrasound was performed using a transrectal ultrasound probe. Saline hydrodissection was used when necessary to enhance delineation of tissue planes.

Ultrasound images were displayed in real time on the robotic console using the TilePro interface, allowing simultaneous visualization of the operative field and ultrasound findings. Based on real-time assessment of lesion depth and bowel wall involvement, the surgical approach was tailored intraoperatively.

Results:

Case 1

A 39-year-old G1P0A1L0 woman presented with severe dysmenorrhea, vaginismus, dysuria, dyschezia, and constipation refractory to medical therapy. Preoperative MRI demonstrated uterine adenomyosis with a superficial rectal plaque. During robotic surgery, dense adhesions in the rectovaginal space raised suspicion of deeper rectal involvement. Intraoperative Endo-USG revealed a hypoechoic lesion extending up to the muscularis layer of the rectum. Based on these findings, a robotic rectal disc excision was performed in collaboration with a colorectal surgeon. TilePro integration allowed confirmation of complete excision and rectal wall integrity. Histopathology confirmed muscularis-involving endometriosis. At one-year follow-up, the patient reported complete resolution of bowel symptoms.

Case 2

A 33-year-old unmarried woman presented with severe dysmenorrhea,

right iliac fossa
pain, and constipation. Preoperative MRI suggested deep infiltrating endometriosis with probable rectal muscularis involvement (Figure 1).

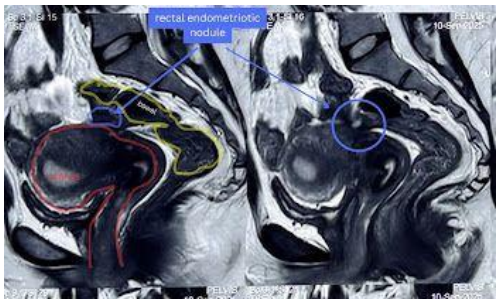

Figure 1: Both sides rectal endometriotic nodule on MRI.

Following saline hydrodissection, intraoperative Endo-USG demonstrated superficial mucosal involvement without muscularis infiltration (Figure 2).

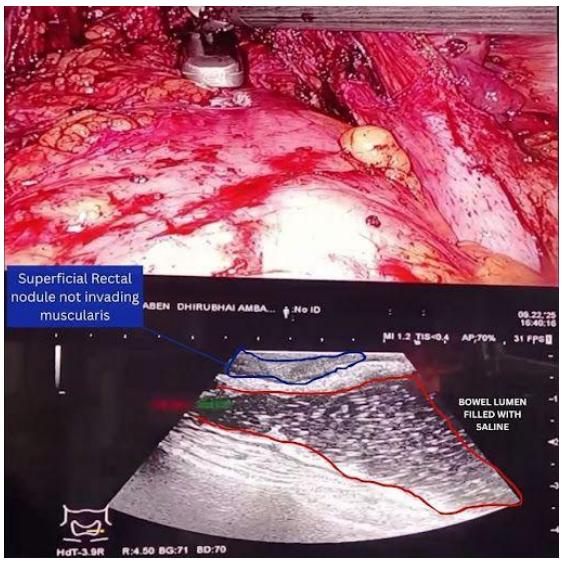

Figure 2: Intraoperative, robotic integrated ultrasound image with simultaneous view during surgery showing a superficial rectal nodule, not invading muscularis

Based on these real-time findings, conservative rectal shaving was performed instead of the initially planned disc excision (Figure 3,4).

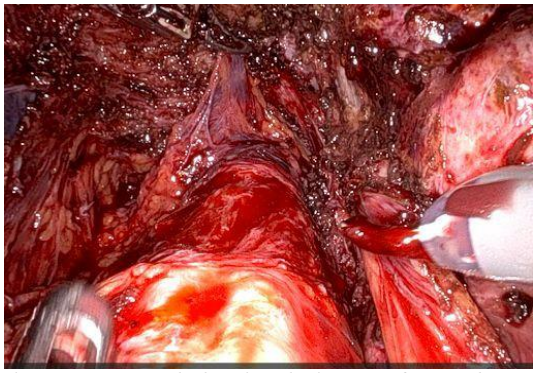

Figure 3: Rectal shaving being performed.

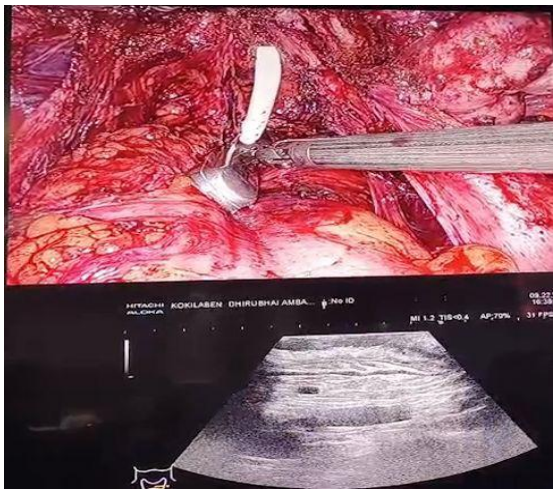

Figure 4: Completeness of the resection confirmed by US.

Histopathology confirmed superficial endometriosis. At six-month follow-up, the patient reported marked improvement in dyschezia and constipation.

Summary of the two cases in table 1 and comparison with the study data with data in literature in table 2.

TABLE 1

Parameter	Case 1	Case 2
Age / Parity	39 years / P0A1L0	33 years / Nulliparous
Symptoms	Dysmenorrhea, vaginismus, dysuria, dyschezia, constipation	Severe dysmenorrhea, right iliac fossa pain, constipation
MRI Findings	Superficial rectal plaque	DIE involving rectal muscularis
Planned Procedure	Robotic hysterectomy + B/L salpingectomy + rectal shaving	Robotic rectal disc excision
Intraoperative Finding (Endo-USG)	Deep nodule extending to muscularis	Lesion confined to mucosa (superficial)
Final Procedure Performed	Robotic rectal disc excision (with colorectal surgeon)	Conservative rectal shaving
Role of TilePro Integration	Simultaneous visualization of ultrasound and surgical field for precision excision	Guided assessment to avoid unnecessary disc excision
Histopathology	Endometriosis involving muscularis	Superficial endometriosis
Outcome / Follow-up	Relief of dyschezia and constipation at 1 year	Resolution of dyschezia and constipation at 6 months
Key Learning Point	IOUS confirmed deep infiltration, enabling complete excision	IOUS prevented overtreatment by confirming superficial disease

Different parameters of the two cases icluding pathology and followup.

TABLE 2

Study	Modality	Key Findings	Comparison with Present Cases
Slama et al., 2020	Laparoscopic IOUS	Improved identification of DIE nodules and depth	Similar IOUS benefit, but without robotic integration
Alec et al., 2024	IOUS after bowel shaving	Confirmed completeness, safe & efficient	Our study adds real-time intraoperative guidance
Hardman et al., 2024	Robotic-integrated IOUS	Guided double discoid excision of rectosigmoid DIE	We demonstrated dual use — both excision and conservative approach
Mikhail et al., 2023	Robotic TilePro with IOUS	Identified single sigmoid DIE lesion	Our report expands on multiple cases and decision tailoring

Comparison between different studies, different modalities of Intraoperative Ultrasound, Keyfindings in the literature and the comparison with the study at hand.

Discussion:

Surgical management of bowel endometriosis must be individualized according to the depth of bowel wall infiltration (3). Rectal shaving is appropriate for superficial disease, whereas disc excision or segmental resection is reserved for deeper infiltration. Accurate intraoperative assessment is therefore critical. In our experience, intraoperative Endo-USG provided real-time anatomical information that directly influenced intraoperative decision-making. In Case 1, ultrasound confirmed muscularis involvement, justifying disc excision. In Case 2, ultrasound findings contradicted preoperative MRI, allowing avoidance of unnecessary bowel resection. Previous studies have demonstrated the utility of intraoperative ultrasound in bowel endometriosis surgery (4). However, most reports describe laparoscopic ultrasound without robotic integration or post-excision assessment. The integration of Endo-USG with robotic TilePro technology could represent a significant advancement, as it enables continuous dual visualization of surgical anatomy and ultrasound findings without interrupting the surgical workflow (5). This approach may enhance surgical precision, reduces intraoperative uncertainty, and supports tailored, organ-preserving surgery. Although limited by the small sample size and short follow- up, this report demonstrates feasibility and possible clinical benefit.

Conclusion:

Robotic-integrated intraoperative endorectal ultrasound may be a valuable adjunct in the surgical management of bowel endometriosis. By enabling real-time assessment of the lesion's depth and bowel wall involvement, this technique may facilitate ta ailored surgical decision-making, prevent unnecessary radical resections, and enhance surgical precision. Wider adoption and structured evaluation of this technique has the potential to contribute to precision-guided minimally invasive endometriosis surgery.

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Early Laparoscopic Excision of a Non-Communicating Rudimentary Horn Pregnancy Conceived via Transcoelomic Migration: A Video Report

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DOI: 10.36205/trocar7.vid2601
Received: 25-11-20 – Accepted: 26-01-02

Abstract

A rudimentary horn pregnancy is a rare and high-risk form of ectopic gestation that frequently evades early detection and carries a significant risk of uterine rupture. An exceptionally early diagnosis of a non-communicating rudimentary horn pregnancy at four weeks and four days, identified during evaluation for pregnancy of unknown location is presented. A 34-year-old woman was diagnosed with irregular β-hCG kinetics and an absent intrauterine gestational sac on initial ultrasonography. Targeted imaging demonstrated a tiny gestational sac within a left non- communicating rudimentary horn. Diagnostic hysteroscopy confirmed a unicornuate uterine cavity, and laparoscopy verified the ectopic implantation. Definitive management consisted of laparoscopic excision of the rudimentary horn with ipsilateral salpingectomy, performed with careful dissection along the horn–uterus junction, identification of ureteric peristalsis, and confirmation of contralateral tubal patency. The postoperative course was uneventful, and the patient subsequently achieved a term intrauterine pregnancy. This video highlights critical steps in early recognition and minimally invasive management of rudimentary horn pregnancy, underscoring the importance of targeted imaging, prompt diagnosis and standardized laparoscopic technique to prevent rupture and optimize reproductive outcomes.

Design:

A video article.

Keywords: Rudimentary Horn Pregnancy, Unicornuate Uterus, Transcoelomic Migration, Laparoscopic Excision, Ectopic Gestation.

Introduction:

Rudimentary horn pregnancy is one of the rarest and most hazardous forms of ectopic gestation, with an estimated incidence of 1 in 76,000 - 150,000 pregnancies (1). It occurs almost exclusively in association with an unicornuate uterus, a Müllerian anomaly representing 2.4–13% of uterine malformations, up to 90% of all rudimentary horns are non-communicating, predisposing to occult

implantation and early rupture (2,3). Conception within a non-communicating horn results from transperitoneal migration of sperm or a fertilized ovum (4). The hypoplastic myometrium limits distensibility, contributing to rupture rates of 50–90%, typically between 10–20 weeks of pregnancy, often before a diagnosis has been established (1,3). Diagnosis is challenging, as two-dimensional ultrasonography detects only 26% - 33% of cases and may mimic tubal or cornual ectopic pregnancy (2,5). Tsafrir's criteria - pseudobicornuate configuration, a surrounding myometrial mantle and absent cervical continuity - aid early recognition but require expertise (5), while 3D ultrasonography and MRI further enhance diagnostic accuracy (6,7). An exceptionally early (four weeks four days) diagnosis of a non-communicating rudimentary horn pregnancy identified during evaluation for a pregnancy of unknown location is reported.

Case report:

A 34-year-old G2P1 presented with 1 1/2 months of amenorrhea without pain or bleeding. Her history included an uncomplicated term vaginal delivery, laparoscopic detorsion of a twisted dermoid cyst (struma ovarii) ten years earlier, and a hysteroscopic metroplasty five years prior. Initial transvaginal ultrasonography did not reveal an intrauterine gestational sac, and she was classified as having a pregnancy of unknown location at four weeks and four days pregnancy. Serial β-hCG values rose from 53 to 2357 mIU/mL over ten days, but with irregular increments ranging from 11% to 76%, prompting concern for an ectopic pregnancy. Repeat transvaginal imaging demonstrated a unicornuate uterus with a separate left rudimentary horn containing a 1.8-mm gestational sac the left ovary showed a corpus luteum and both ovaries had polycystic morphology (Figure 1).

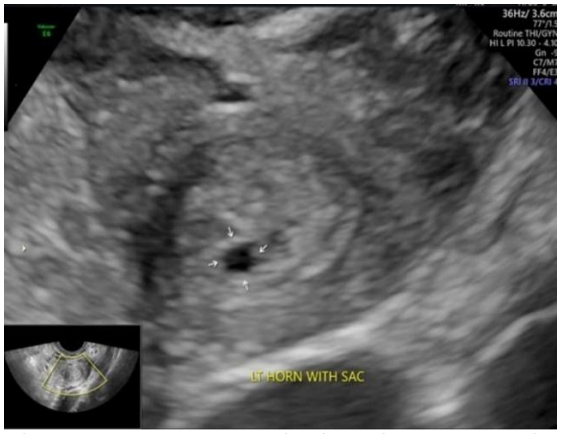

Figure 1. Transvaginal ultrasonography showing a
left non-communicating rudimentary horn containing
an early gestational sac (arrows).

Diagnostic hysteroscopy confirmed a unicornuate right uterine cavity with a single right tubal ostium. Laparoscopy identified a non-communicating left rudimentary horn, which was excised together with the ipsilateral tube, chromopertubation confirmed right tubal patency. Postoperatively, β- hCG declined by 76% within 24 hours. Histopathological examination of the excised specimen confirmed the presence of chorionic villi and trophoblastic tissue within the rudimentary horn, consistent with an ectopic pregnancy (Figure 2).

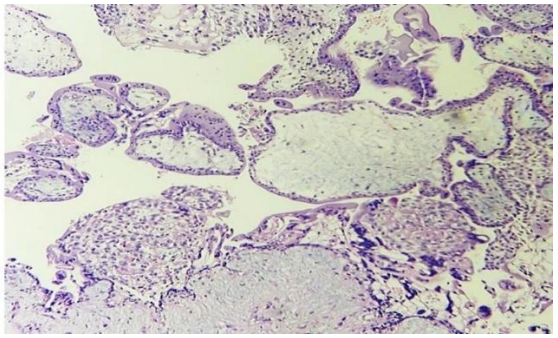

Figure 2. Histopathology of the excised specimen
demonstrating chorionic villi with trophoblastic tissue,
confirming ectopic pregnancy (H&E stain).

The patient received routine postoperative care and follow-up. No contraception was advised, as the excision of a non-communicating rudimentary horn does not contraindicate future pregnancies nor

adversely affect reproductive outcomes in the normally developed unicornuate uterus. She conceived spontaneously six months following surgery and subsequently had an uncomplicated term vaginal delivery.

Discussion:

Surgical excision of a non-communicating rudimentary horn remains the definitive management in view of the substantial risk of rupture and associated maternal morbidity. Operative complexity is due to the distorted pelvic anatomy, the variable vascularity and the inconsistent fibromuscular attachment between the horn and the unicornuate uterus (6,8). The gravid horn is characteristically hypervascular, heightening the risk of intraoperative hemorrhage, and visualization may be further compromised in the presence of rupture or hemoperitoneum (9,10). At very early gestations, transvaginal ultrasound (TVUS) remains the first-line imaging modality for suspected ectopic pregnancy. In the present case, high-resolution TVUS combined with serial β-hCG measurements were sufficient to raise strong suspicion of a rudimentary horn pregnancy despite the early gestational age. Although MRI can aid in delineating Müllerian anomalies, it was deferred as it was unlikely to alter management and could delay definitive treatment. Direct endoscopic evaluation provided real-time anatomical confirmation, rendering additional cross-sectional imaging unnecessary (5). Conventionally, suspected rudimentary horn pregnancies are evaluated using a stepwise approach comprising ultrasonography, adjunctive MRI, and delayed laparoscopy. In contrast, the integrated same-setting hysteroscopy–laparoscopy workflow used in this case enabled immediate correlation between intrauterine and extrauterine anatomy, confirmed the absence of a communicating horn and allowed definitive management in one single procedure, thereby minimizing diagnostic delay and rupture risk (2,5). Once a rudimentary horn pregnancy is suspected, conservative or medical management is generally discouraged because rupture is unpredictable and frequently catastrophic. Medical management with methotrexate has demonstrated variable success and does not mitigate the inherent structural risk posed by a gravid rudimentary horn (1,11). Consequently, surgical excision was favoured even at four weeks and four days gestation to prevent progression to rupture and to achieve definitive treatment under controlled conditions. Although the patient was asymptomatic, rising β-hCG levels and clear anatomical suspicion supported early semi-urgent laparoscopy, allowing minimally invasive excision and avoidance of emergency surgery. Laparoscopic excision is the preferred modality in hemodynamically stable patients, supported by evidence demonstrating its safety, feasibility, and superior visualization (6,9,10). Conversely, laparotomy is indicated in unstable or ruptured presentations to facilitate prompt hemorrhage control. As rupture frequently results from delayed diagnosis, early identification is critical and enables minimally invasive intervention before significant bleeding ensues (12). Early diagnosis of a rudimentary horn pregnancy remains uncommon. Most reported cases are diagnosed after rupture or beyond eight to ten weeks gestation. Even in contemporary series using high-resolution ultrasonography, prerupture diagnosis is typically achieved at or beyond six to seven weeks. Diagnosis during the very early first trimester has been reported only in isolated cases (12-14). Diagnosis at four weeks four days as in the present case therefore represents an exceptionally early identification, permitting definitive laparoscopic management prior to rupture. Optimal surgical practice entails comprehensive preoperative imaging, meticulous intraoperative identification of the ureter and pelvic vasculature, and conservative use of energy devices near the unicornuate uterus to preserve tissue integrity. Postoperative counselling should address reproductive prognoses and emphasize the need for early targeted imaging in subsequent pregnancies. Overall, laparoscopic excision is the most appropriate approach for stable patients, with laparotomy reserved for emergency

presentations, and early diagnosis remains the principal determinant of favourable outcomes.

Conclusion:

Rudimentary horn pregnancy is an uncommon but potentially life-threatening form of ectopic gestation that often evades early diagnosis. In patients presenting with pregnancy of unknown location and atypical β-hCG rise, this condition must be considered. Early identification allows timely minimally invasive surgical intervention, preventing rupture and preserving reproductive potential. This case demonstrates the value of integrated hysteroscopic and laparoscopic evaluation and provides a stepwise operative approach through an accompanying instructional video.

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TheTrocar Issue 1 Volume 7 / Page 71-75 ISSN: 2736-5530

Isthmocele - Bladder Perforation: Management of a complicated case (Video Case report)

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DOI: 10.36205/trocar7.vid2602
Received:10.10.2025 – Accepted: 4.11.2025

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Abstract

Introduction: Isthmocele, a cesarean scar defect, represents an anechoic pouch-like indentation at the lower uterine segment, often associated with abnormal uterine bleeding, pelvic pain, and secondary infertility. Hysteroscopic repair is the preferred approach for symptomatic women with adequate residual myometrial thickness (RMT). However, bladder perforation (2%) is a known but rare complication, particularly in cases with dense vesicouterine adhesions.

Design: A video case report (Video 1).

Case Presentation: A 38-year-old woman with previous two cesarean deliveries and a failed laparoscopic isthmocele repair presented with irregular bleeding. Transvaginal ultrasound revealed a 6 × 7.8 × 6 mm triangular niche with an RMT of 5.9 mm. During hysteroscopic resection of fibrotic tissue, a 2–3 mm posterior bladder wall perforation occurred due to dense adhesions. Immediate laparoscopic conversion was performed, with adhesiolysis, double-layer bladder repair, and omental interposition.

Outcome: The postoperative course was uneventful. Follow-up imaging confirmed complete uterine contour restoration and bladder healing. The patient remained asymptomatic and was scheduled for assisted reproduction.

Conclusion: Bladder injury is a recognized complication of hysteroscopic isthmocele repair, particularly in large or bladder-adherent niches. Careful intraoperative vigilance, prompt recognition, and timely laparoscopic management with omental interposition are critical to

achieving optimal outcomes. A multidisciplinary and individualized approach ensures anatomical restoration, prevents recurrence, and preserves fertility potential.

Key words: : Isthmocele, Cesarean scar defect, Hysteroscopic repair, Bladder perforation, Laparoscopic repair

Introduction:

An isthmocele, also termed a cesarean scar defect or niche, represents an anechoic, pouch-like indentation at the site of a previous cesarean section, typically located in the lower uterine segment. The most widely accepted sonographic definition describes it as a triangular or semicircular defect with a depth of ≥2 mm at the cesarean scar site [1]. The reported prevalence of isthmocele varies widely between 19% and 88%, depending on diagnostic criteria, imaging modality, and the number of prior cesarean deliveries [1–3]. Approximately one-third to half of affected women develop symptoms, most commonly postmenstrual spotting, chronic pelvic pain, dyspareunia, and secondary infertility due to intracavitary fluid accumulation interfering with implantation [2,3].

Several factors contribute to the development of isthmocele, including incomplete myometrial healing, excessive incision width, low uterine incision, and technical aspects of uterine closure [1,4]. Recognition of this entity has increased with routine use of transvaginal ultrasound (TVS) and saline infusion sonohysterography, which improve diagnostic accuracy [1].

Management is determined by symptom severity, reproductive plans, and residual myometrial thickness (RMT). Hysteroscopic repair is generally recommended for symptomatic women with an RMT ≥2.5–3 mm, whereas laparoscopic or vaginal repair is preferred when the myometrial thickness is less than 2.5 mm or in the presence of extensive adhesions [1,4,5]. Surgical correction aims to restore normal uterine anatomy, improve bleeding symptoms, and enhance fertility outcomes Despite its safety, bladder perforation (≈2%) remains a rare but serious complication [2]. We present this case to highlight the importance of prompt recognition and effective management of this complication, which, to the best of our knowledge, is the first of its kind reported in the literature.

Case report:

A 38-year-old woman (P2L2) with previous 2 cesarean section presented with irregular uterine bleeding and discharge per vaginum. She underwent a previous laparoscopic repair of isthmocele (failed) with myomectomy. She was desirous of conception and was unable to conceive on her own. She had a failed IVF in the past and was awaiting next embryo transfer. There was no other relevant medical or surgical history.

Ultrasound Findings:

Transvaginal ultrasound (October 2024) revealed a triangular anechoic niche measuring 6 × 7.8 × 6 mm, located 30 mm above the external os, with a residual myometrial thickness of 5.9 mm (53% of adjacent myometrium). The right ovary was adherent to the uterus; the left ovary

contained a simple follicular cyst. Mild adenomyosis was noted in the fundus.

Operative Details:

Under general anesthesia, diagnostic hysteroscopy confirmed a large anterior niche. During resection of fibrotic tissue, a 2–3 mm perforation occurred into the posterior bladder wall. Cystoscopy was immediately performed, confirming the bladder rent. A ureteric stent was gently passed through the defect and was visualized traversing the isthmocele and exiting through the cervical canal, thereby delineating the tract of perforation. Laparoscopy was subsequently undertaken, using the stent as a guide to precisely localize the site of injury—an effort akin to finding a needle in a haystack. Dense vesicouterine adhesions were carefully lysed, freeing the bladder from the cervix and lower uterine segment. The bladder defect was then repaired in two layers with interrupted sutures, and an omental flap was interposed between the bladder and uterus to prevent recurrence and re-adhesion. Final cystoscopic inspection confirmed watertight closure and bilateral ureteric efflux.

Outcome:

Hemostasis was achieved, and the postoperative course was uneventful. The Foley catheter was retained for 10 days. Follow-up ultrasound demonstrated complete restoration of uterine contour and no residual niche. The residual myometrial thickness at point of LSCS scar was 4.8mm. The patient was asymptomatic on subsequent review and planned for assisted reproduction therapy.

Discussion

Surgical correction of isthmocele has been shown to relieve symptoms, improve endometrial receptivity, and enhance fertility potential [6,7]. The choice of surgical route depends primarily on RMT and the extent of bladder adhesion. Hysteroscopic resection offers excellent results in cases with adequate myometrial thickness (≥3 mm) by removing the fibrotic ridge and restoring normal uterine outflow [8].

However, in cases with thin residual myometrium (<3 mm) or where the bladder is closely adherent, laparoscopic or combined repair is considered safer and more effective [7]. In this case, hysteroscopic resection led to a 2–3 mm bladder perforation due to dense vesicouterine adhesions and close proximity of the niche to the bladder wall—an uncommon but recognized complication.

Bladder injury, though uncommon, remains a notable risk during hysteroscopic isthmocele correction, especially with distorted anatomy from prior cesarean sections [5,10]. A systematic review reported bladder lacerations and perforations during laparoscopic isthmocele repairs in isolated cases, often related to severe adhesions or inadvertent extension during dissection [5]. Early recognition, immediate laparoscopic conversion, and primary repair with double-layer suturing, as performed in this case, are the recommended management steps [9,10]. The use of an omental interposition flap further prevents postoperative adhesion formation and fistula development [9].

Postoperative follow-up with transvaginal ultrasound is essential to confirm anatomical restoration and adequate RMT before resuming fertility treatments. Expert consensus recommends delaying conception for at least 3 months post-repair and advocating for elective cesarean delivery at 37–38 weeks in subsequent pregnancies to prevent scar rupture [1,4,11].

This case underscores the importance of careful preoperative planning, intraoperative vigilance, and a multidisciplinary approach in managing complex isthmocele cases. Awareness of possible complications and readiness for prompt surgical conversion are vital for optimal outcomes.

Conclusion

Bladder perforation is a recognized complication of hysteroscopic isthmocele repair, particularly in cases with dense vesicouterine adhesions or large anterior defects. This case highlights the importance of careful intraoperative vigilance, prompt recognition of injury, and timely surgical management to prevent morbidity and preserve fertility. Meticulous bladder repair and omental interposition ensure optimal healing and anatomical restoration. An individualized, multidisciplinary approach guided by preoperative assessment and surgical expertise remains essential for achieving favorable reproductive and functional outcomes in women undergoing isthmocele repair.

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TheTrocar Issue 1 Volume 7 / Page 76-78 ISSN: 2736-5530

Hope Beyond Adhesions: Stepwise Hysteroscopic Adhesiolysis and Cavity Restoration in Severe Intrauterine Adhesions (Video article)

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DOI: 10.36205/trocar7.vid2603
Received: 2025-09-17 - Accepted: 2025-09-30

Abstract

Objective: To present a stepwise, evidence-based approach for managing severe intrauterine adhesions post-myomectomy, emphasizing the role of staged hysteroscopic adhesiolysis, mechanical barrier placement, hormonal modulation, and relook hysteroscopy to optimize clinical outcomes.

Case report: A 31-year-old nulligravida woman with primary infertility and severe intrauterine adhesions following open myomectomy and multiple failed interventions underwent hysteroscopic adhesiolysis and an inert intrauterine device was inserted as a mechanical barrier. Postoperative hormonal therapy with conjugated estrogen and medroxyprogesterone acetate was administered to promote endometrial regeneration. Second look hysteroscopy was done six weeks later. It demonstrated a restored uterine cavity and a regenerated endometrium. The patient resumed regular menstruation and reported improved clinical symptoms.

Conclusion: Severe intrauterine adhesions can be effectively managed with a stepwise protocol combining hysteroscopic adhesiolysis, mechanical barrier, hormonal therapy and relook hysteroscopy. This approach enhances uterine cavity restoration, reduces adhesion recurrence, and improves menstrual and fertility outcomes.

Key words: Intrauterine adhesions, Hysteroscopic adhesiolysis, Relook hysteroscopy

Introduction:

Intrauterine adhesions (IUAs) result from trauma to the basal endometrium leading to fibrous bands that partially or completely obliterate the uterine cavity, causing menstrual disturbances and infertility. They may occur following dilation and curettage, myomectomy, or uterine infections, with prevalence reported as high as 19.1% depending on the extent of uterine trauma. Severe

adhesions are particularly challenging to treat, as they often recur despite surgical intervention (1). Hysteroscopic adhesiolysis remains the gold standard for diagnosis and management, with outcomes improved by combining mechanical barriers, postoperative estrogen–progestin therapy, and relook hysteroscopy. Our aim in this case-based video article is to demonstrate a stepwise hysteroscopic adhesiolysis protocol, emphasizing cavity restoration with intrauterine splinting, hormonal modulation, and the importance of relook hysteroscopy in preventing recurrence (2,3).

Case report:

A 31-year-old nulligravida woman, working as an advocate, presented with an 8-year history of dysmenorrhea and 3–4 years of hypomenorrhea, described as scanty to moderate bleeding without clots. She had attained menarche at 13 years, with initially regular, painless cycles. Her surgical history began in 2017, when she presented with acute lower abdominal pain. Ultrasound revealed a large submucous fibroid (7.4 × 6.6 × 5.7 cm, left posterolateral wall), for which she underwent an open myomectomy. In July 2018, she developed fever, and ultrasound demonstrated hematometra with cervical stenosis; this was managed with dilation and curettage (D&C). She had been married for six years in a non-consanguineous union, with regular cohabitation but no prior pregnancies or abortions. She expressed a strong desire to conceive. In March 2019, a D&C attempted during infertility evaluation failed, as the uterine cavity could not be entered. In October 2019, she underwent diagnostic and operative hystero-laparoscopy. Findings revealed bilateral hydrosalpinx with fimbrial damage, treated by bilateral salpingectomy. Concomitant hysteroscopy documented as unhealthy endometrium (probably the false passage). Between 2021 and 2023, multiple diagnostic hysteroscopies failed. She underwent two in vitro fertilization (IVF) cycles in 2022 and 2023. Both required transabdominal trans myometrial embryo transfer due to cervical inaccessibility; however, both attempts were unsuccessful. In July 2025, pelvic ultrasound demonstrated a bulky uterus (10.1 × 8.4 × 5.7 cm) with patchy sub endometrial adenomyosis in the fundus and anterior/posterior walls, and an anterior intramural/subserosal fibroid (1.7 × 1.5 cm). A blind-ended tract (9.5 mm) extending from the endometrial cavity into the anterior myometrium, likely iatrogenic from prior trans myometrial transfers, was identified. Endometrial thickness measured 7.6 mm (done in pre-menstrual period). The cervical canal appeared tortuous, deviating leftward and turning almost 90° rightward before entering the cavity. Bilateral polycystic ovaries and a left para-ovarian cyst were also noted.

On examination, she was well nourished and vitally stable, with healed abdominal scars. Bimanual examination revealed a mobile, non-tender uterus of approximately 8-week size. The history of failed hysteroscopies and inability to enter the cavity raised a strong suspicion of intrauterine adhesions. Diagnostic hysteroscopy revealed a severely obliterated uterine cavity with dense fibrous adhesions and synechiae along the lateral walls, aligning with Grade III (Severe) as per the Manchanda's Endoscopic Centre (MEC) classification (4). Based on the "Loddo Score: A New Intrauterine Adhesion Classification System," the condition received a score of 14, categorizing it as moderate—indicating the need for careful management and suggesting a moderate prognosis (5). Hysteroscopic adhesiolysis was performed using cold scissors, followed by lateral wall metroplasty with a monopolar resectoscope to restore cavity anatomy. An inert intrauterine device (IUCD, copper removed) was placed as a mechanical splint. Postoperatively, the patient was given conjugated estrogen (4 mg/day for 21 days) followed by medroxyprogesterone acetate (20 mg/day for 7 days) in accordance with our unit's standard

protocol. At second-look hysteroscopy after six weeks, the uterine cavity appeared near normal, with regenerated endometrium and adequate capacity for conception. The patient resumed regular menstruation.

Conclusions:

Severe intrauterine adhesions represent a complex clinical challenge requiring a structured and evidence-based approach. This case demonstrates that a stepwise hysteroscopic adhesiolysis protocol—combining meticulous surgical removal of adhesions, mechanical splinting with an inert intrauterine device, and postoperative hormonal therapy—can effectively restore uterine cavity anatomy and function. The addition of relook hysteroscopy is critical in confirming successful cavity restoration and minimizing adhesion recurrence. Such comprehensive management not only improves menstrual outcomes but also optimizes the uterine environment for potential fertility restoration, providing hope beyond adhesions for affected women.

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TheTrocar Issue 1 Volume 7 / Page 79-83 ISSN: 2736-5530

Laparoscopic Excision of Cesarean Scar Pregnancy and Repair of the Uterine Defect (Video Article)

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DOI: 10.36205/trocar7.vid2604
Received: 2025-08-19 - Accepted:2025-09-21

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Abstract:

Caesarean scar pregnancy (CSP) is a rare but serious condition that can result in severe maternal and fetal complications and occurs when pregnancy implants on the uterine scar or in the niche after a previous caesarean scar (CS) (1). Due to its increasing incidence and lack of consensus regarding optimal treatment, the need for effective and standardized surgical strategies is growing. In this video article, a clinical case of CSP is presented and illustrated by a step- by-step laparoscopic technique for safe excision and correction of uterine defect.

Keywords: Caesarean Scar Pregnancy, Gynecologic Surgical Procedures, Isthmocele repair, laparoscopy, Ultrasonography

Case Report:

The case of a 42 -yr-old patient is presented, with 2 previous caesarean sections, gravida at 5 weeks and 5 days of gestation, asymptomatic. The early pregnancy ultrasound revealed a gestational sac measuring 15x14x6 mm, without embryonic structures, implanted in the Caesarean scar niche, without embryonic structures, and a residual myometrial thickness (RMT) of 2 mm. After informing the patient on the management options, she decided for a surgical management. A diagnostic laparoscopy was performed, confirming the diagnosis of an ectopic pregnancy in the isthmic region. Proceeding with a combined laparoscopic/hysteroscopic technique, the dissection of the vesicouterine space was performed, the

isthmocele was opened and the pregnancy was removed together with the isthmocele pouch. Subsequently, with the guide of a foley catheter placed in the uterine cavity, the caesarean scar defect was repaired using a double-layer simple interrupted suture including the whole thickness of myometrium and endometrium. The postoperative period was uneventful and the patient was discharged the following day. The patient is currently in the eighth month after surgery, with no reported complications.

Discussion:

Caesarean scar pregnancy (CSP) is defined as a pregnancy with implantation in, or in close contact with, the niche of a previous cesarean section scar (2). The true incidence of CSP remains unknown; however, it is estimated to occur in approximately 1:1.800 to 1:2.500 pregnancies in women with a history of Caesarean delivery (3,4). Its incidence has been rising, largely attributed to the increasing number of Caesarean deliveries and to advances in imaging techniques that allow earlier and more accurate diagnosis (5,6). The exact mechanism of CSP implantation is unclear, though proposed theories include low oxygen tension in the scar tissue and impaired healing of the Caesarean incision, both of which may predispose to abnormal trophoblastic invasion. It is believed that CSP is a precursor to, and shares a common histology with, placenta accreta spectrum (PAS) and that these constitute a continuum of the same disease (7). The clinical presentation of CSP is variable. Approximately one-third of patients are asymptomatic, with the diagnosis made incidentally during routine examinations, such as first- trimester ultrasound. The symptoms of CSP are generally nonspecific, the most frequent clinical finding is vaginal bleeding, pain may be present (1,5). Women with ruptured CSP may also present with massive hemorrhage and hemodynamic collapse (4). Early detection of CSP requires a high index of suspicion. Transvaginal ultrasound with color Doppler, ideally between 6–7 weeks of gestation, is the primary diagnostic tool (5). A low, anterior gestational sac in the scar site, close to the bladder and surrounded by Doppler flow, sometimes bulging outward, should raise concern for CSP (4,8) The following ultrasonographic criteria have been proposed for the diagnosis of CSP:

1.empty uterine cavity and endocervix.

2.sac or placenta embedded in the scar.

3.triangular or rounded sac filling the scar niche.

4.thin or absent myometrium.

5.rich vascularity.

6.embryonic structures with or without cardiac activity (7). Three-dimensional ultrasound and power Doppler may improve accuracy (4).

Differentiation from spontaneous miscarriage and cervical ectopic pregnancy is essential. CSP growth patterns include the endogenic type

(Type I or “on the scar”), progressing toward the uterine cavity, which may rarely result in a viable pregnancy but with high risk of abnormal placentation and hemorrhage and the exogenic type (Type II or “in-the-niche”), invading deeply into the scar with a high risk of rupture and massive bleeding ((5,9,10). Recently, Ban et al. proposed a new five category clinical classification system based on anterior myometrium thickness at the scar and the diameter of the gestational sac with recommended surgical strategy, reaching high treatment success rates (97.5%) with minimal complications (6). Given the substantial risks associated with CSP, expectant management is rarely advised and pregnancy termination is generally recommended upon diagnosis (1,4,8). Treatment strategies include medical or surgical approaches, with the choice depending on severity of symptoms, CSP type, RMT, fertility desire, surgeon’s expertise, and institutional resources (5,6,9). Medical therapy involves the use of injectable medical agents or local pressure with devices such as balloon catheter. Medical management with methotrexate (MTX), either systemic or local, offers a non-invasive and low-cost option for fertility preservation but is associated with high failure and complication rates (1,11). Uterine artery embolization (UAE) and high-intensity focused ultrasound (HIFU) can be used in combination (1). Surgical management compared with medical therapy may be associated with higher success rates and includes hysteroscopy, laparoscopy, laparotomy, and gestational sac suction (8,11). It is indicated in hemodynamically unstable patients or after failed medical therapy, and offers the advantage of simultaneous scar repair, potentially reducing recurrence risk (1). The choice between hysteroscopy or laparoscopy depends on the CSP type. Hysteroscopy is more suitable for the endogenic CSP type while laparoscopy is indicated for exogenic types, although combined approach can be used. Hysteroscopy allows good visualization of the gestational sac and allows to assess the adequacy of any repair. Using a loop electrode without electricity, the products of conception are separated from the uterine wall (5). Laparoscopic excision is performed by first separating the bladder from the low uterine segment, followed by excising the uterine wall (wedge resection) and removing the pregnancy. The incision is then repaired. It is considered the most effective technique, with low complication rates and significant improvement in RMT, especially with multilayer closure (1,9). In either case, simultaneous scar repair can be performed and the choice of modality depends greatly on the RMT. Hysteroscopic resection is minimally invasive but limited with a RMT <2–3 mm, in which case laparoscopy is preferred (9). Laparoscopic repair under hysteroscopic guidance allows precise defect localization and complete resection, with reported postoperative increases in myometrial thickness and symptom relief (9,12,13). Vaginal approach involves excising the scar pregnancy through a transvaginal incision, followed by double-layer closure of the uterine defect. This technique is effective but requires surgical expertise

and careful patient selection (1,13). Overall, early intervention is associated with better outcomes and combination treatments are very effective therapies to preserve fertility while minimizing complications (11,5). Despite multiple treatment modalities, no consensus exists on the optimal management strategy, highlighting the need for individualized care and further comparative studies (5,6). Subsequent pregnancies following CSP can happen with a risk for recurrent scar implantation, abnormal placentation, and uterine rupture (14). Patients who become pregnant after treatment of a CSP should be encouraged to have an early (5-7-week) first-trimester transvaginal scan to determine the location of the gestation (15).

Conclusions:

There is currently no consensus regarding the treatment of caesarean scar pregnancy, with various modalities described in the literature. Laparoscopic resection can be a safe and effective approach for managing these cases. This minimally invasive approach allows for precise resection while preserving uterine integrity and minimizing complications. The video is believed to help enhance comprehension of key anatomical and technical details that are crucial for successful outcomes.

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