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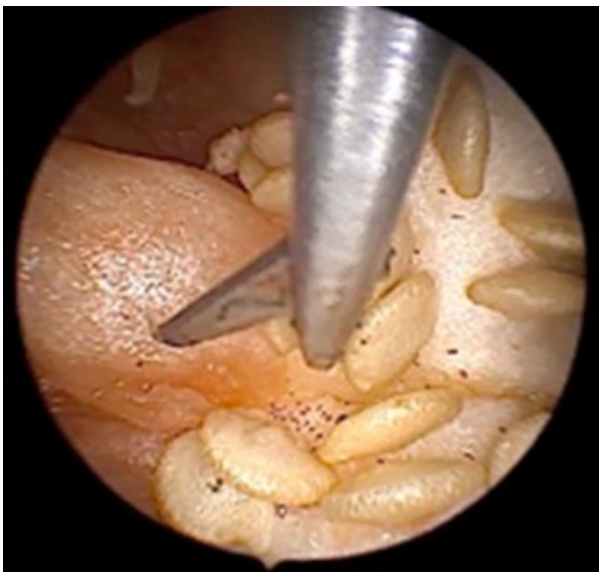

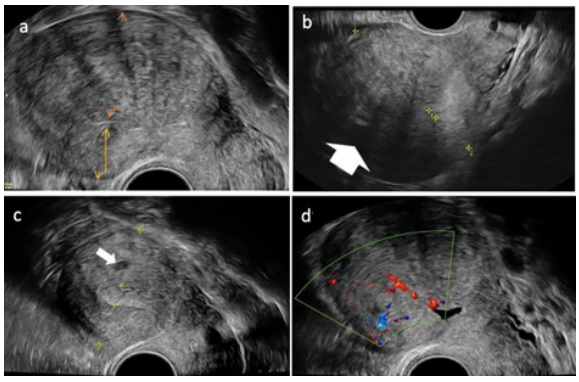

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Editorial – 21st Edition of *TheTrocar*

With this 21st edition of *TheTrocar* we continue to build on a journey that began in 1998, and since 2020 has evolved into an open-access platform under the umbrella of the International Society for Gynecological Endoscopy (ISGE). We are proud to present a rich and diverse issue, which comprises 15 contributions — a balanced mix of original research, reviews, expert recommendations, case reports and video-articles — reflecting the growing demand and engagement from our global community.

In this edition you will find two original papers that advance our scientific understanding, two reviews that appraise current evidence or evolving techniques, and two expert recommendations or opinion pieces that share insights and guidance drawn from clinical experience. Beyond that, four compelling case reports provide detailed reflections of unique clinical scenarios — often the kind of practical knowledge that proves invaluable especially in low-resource or uncommon settings. Finally, five video-articles — a format increasingly appreciated for its didactic value — complement our traditional written content.

This expansion of content underscores not only *TheTrocar*'s growth in numbers, but also its maturation as a truly global exchange platform. From centers with state-of-the-art equipment to colleagues working under resource constraints, from young researchers seeking their first publication to seasoned experts offering their experience *TheTrocar* brings all voices together. This inclusivity lies at the heart of ISGE's mission: to make minimal-invasive gynecologic surgery accessible worldwide, and to share knowledge across continents.

Importantly, the mixed format of this issue - combining original research with reviews, opinions, clinical case reports and videos - mirrors the real-world landscape of gynecological endoscopy: a field where innovation, clinical acumen, shared experience and open dialogue all matter. By embracing this variety, we encourage contributions not only from those who conduct large prospective trials, but also from practitioners whose strength lies in ingenuity, in adapting established techniques to emerging needs, or in reporting rare but instructive cases. The enthusiastic response to our call for submissions, and the increasing volume and diversity of contributions, encourages and motivates us - the publisher, the editorial board, the reviewers - to keep working toward a journal that serves as a platform for the global community. We remain committed to open access, affordable or free publication for ISGE members, and a peer-review process that respects both scientific rigor and inclusiveness.

We invite you, our readers and contributors, to immerse yourselves in this issue. Let the clinical observations, the surgical techniques, the evidence summaries and expert reflections inspire you - and perhaps welcome you to contribute your own experience in future editions. Only through global collaboration and exchange can we continue to advance gynecological endoscopy for the benefit of patients everywhere.

Good health and progress
For the Editorial Board

Guenter Noé

Editor in chief

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The frontpage shows: Pepper Training model for hysteroscopy ans sonographic image of adeno-myosis

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The Integrated Animal Tissue - Bell Pepper Model: A Cost-effective Haptic Training Model for Resectoscopic Surgery.

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Abstract

Introduction: Resectoscopic surgery presents a significant challenge for gynaecologists and has a long learning curve which can be reduced by effective training. We propose and evaluate the Integrated Animal Tissue - Bell Pepper Model (IAT-BPM), a cost-effective and accessible training tool designed to combine the benefits of both plant and animal tissue models and overcome the limitations of currently available training modalities for resectoscopy. performing resectoscopic surgery before and after a three-day training program utilizing the model. The model, created by combining animal tissue with a bell pepper, allowed trainees to practice myomectomy using a bipolar resectoscope. Post-training, participants completed a questionnaire to evaluate increase in confidence and provide feedback on the model's ease of use, anatomical fidelity, haptic feedback and overall performance.

Results: The model led to a statistically significant increase in surgeon confidence after the training andreceived positive feedback for ease of use, anatomical fidelity, haptic feedback and overall performance.

Conclusion: The IAT-BPM is a practical and effective tool for training in resectoscopic surgery. The use of readily available materials makes it an accessible and cost-effective solution for surgical skill acquisition and independent practice.

Keywords:

Hysteroscopy, Training, Operative Hysteroscopy, Simulation, Resectoscopic Surgery

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Introduction:

Operative hysteroscopy is the new standard of care for the management of intrauterine pathology (1). As indications for performing hysteroscopic surgery become wider, it becomes more important for the gynaecological surgeon to add these procedures to their surgical arsenal. Resectoscopic surgery expands the scope of hysteroscopic treatment to large polyps, submucous and even intramural fibroids and endometrial ablation. However, resectoscopic surgery has a longer learning curve and higher risk of complications like perforation, bleeding and electrosurgical injury (2). Surgeon expertise is an important factor in determining the success rate and risk of complications in operative hysteroscopy and resectoscopic surgery. Most complications occur during the learning phase of the surgeon as they master the technique and thus a structured training program for surgeons is important (3). Surgical training involves three consecutive learning stages; cognitive, associative and autonomous. The cognitive stage involves learning basic surgical theory and concepts in the form of lectures, video demonstrations and textbooks. The associative stage involves the surgeon practicing their surgical skills. It is important to observe and practice both the external hand movements and internal movements of the instrument, develop hand-eye coordination and develop the unique motor skills required in operative hysteroscopy. The autonomous stage involves the surgeon practicing their skills independently. This stage is essential for complete development, thus presenting a need for instructional tools that are reproducible outside the dedicated training environment (4). Currently available training methods include a surgical apprenticeship in the operating room which has a long learning curve and limited opportunity for hands on training. Simulation training is a newer modality of training which has been show to improve surgical skills, knowledge and confidence. Current hysteroscopy simulation training utilizes various models, each with distinct advantages and limitations. Virtual reality (VR) simulators offer accurate reproduction of anatomy and the opportunity to practice specific procedures and clinical

scenarios while providing objective real-time feedback on surgical metrics. However, they are prohibitively expensive and may sometimes lack haptic feedback. Non-biological material models made from substances like silicone and plastic can simulate anatomy with good fidelity but lack haptic feedback and do not conduct electricity like biological tissue and thus cannot be used for training electrosurgical operative procedures. Animal tissue models, such as the pig bladder model or the cow uterus model offer moderate fidelity but their primary advantage is the simulation of the tactile sensation of human tissue, allowing the trainee to modify their actions with haptic feedback. It also simulates the issues of impaired vision due to tissue bits and bubbles generated during electrosurgery as seen in real surgery. However, there are practical difficulties in both sourcing and using these models and they require dedicated operating rooms and training centers. Plant tissue models can be prepared from common, widely available inexpensive materials like bell peppers, butternut pumpkins and potatoes and can be used to simulate procedures like polypectomy and septum resection. While practical and easy to use, they suffer from low fidelity and poor haptic feedback (5).

An Integrated Animal Tissue - Bell Pepper Model, specifically designed for resectoscopic surgery is described, using animal tissue integrated into the bell pepper (Capsicum annuum).

This combines the practicality and ease of use of plant tissue with the fidelity and haptic feedback of animal tissue, providing a widely accessible and cost-effective method to train resectoscopic surgery. Its performance as a training tool for resectoscopic surgery is evaluated in a three-day training program for hysteroscopic surgery conducted for 40 gynaecologists in Mumbai, India.

Material and Methods:

Experimental Design:

A prospective study was conducted for 40 trainee gynaecologists attending a three-day training

program in operative hysteroscopy. All participants served as their own controls. Participants were administered a subjective questionnaire prior to commencement of their training assessing surgeon confidence in diagnostic and operative procedures. Participants were then provided didactic lectures and proctored hands-on

sessions with a standard bell pepper model for basic surgery and the IAT-BPM for resectoscopic surgery. A questionnaire was administered post training to collect feedback on the model.

Instruments and Technique

Each training set up had a 2.9mm 30° hysteroscope with a 5mm operative sheath, connected to

a camera control unit and monitor, with an LED light source as the primary operating instrument. Hysteroscopic scissors and graspers were the instruments available for use. Bipolar loop resectoscopes connected to underwater diathermy electrosurgical generators were also provided. Distension media used was 0.9% normal saline irrigated with a Hysteromat ® (Karl Storz SE & Co KG Tuttlingen Germany) providing the facility to control inflow, outflow and fluid deficit estimation like real surgery. The trainees were guided on correct assembly and handling of the hysteroscope and then underwent hands on training on the standard bell pepper model with a set of prescribed exercises under the guidance of proctors. The participants were asked to perform diagnostic hysteroscopy first to build hand-eye coordination and understand the movement of the hysteroscope. The trainees next used scissors and graspers on the capsicum seeds to simulate polypectomy, scissors to simulate septum resection and metroplasty and used the natural crevices of the pepper to practice tubal cannulation (Figure 1 – 6).

Figure 1: Diagnostic Hysteroscopy

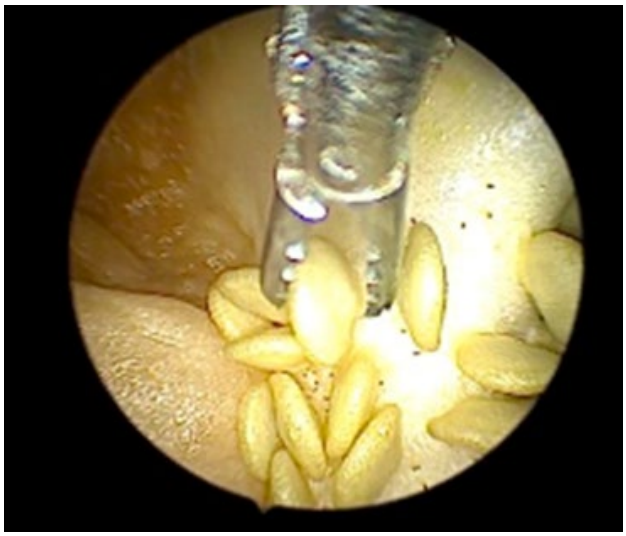

Figure 2: Polypectomy with grasper

Figure 3: Polypectomy with scissor

Figure 4: Septum Resection

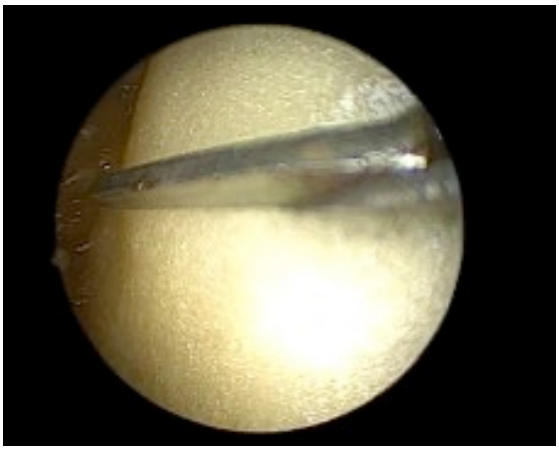

Figure 5: Lateral Metroplasty

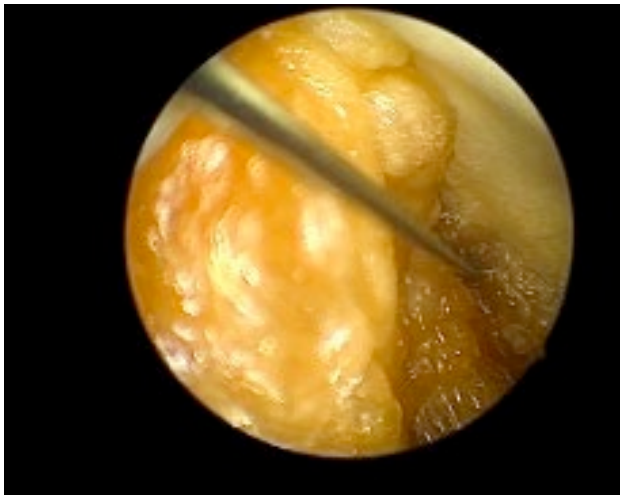

Figure 6: Tubal annulation

The IAT-BPM was prepared by taking a selection of bell peppers (C. annuum) and cutting a circle around the stem to detach it and clear it out (Figure 7-8).

Figure 7: Cutting the stem

Figure 8: Clearing out the cavity

A bit of animal tissue was then secured to the underside of the cut stem using

sutures, simulating a pedunculated submucous myoma and secured (Figure 9-10).

Figure 9: Animal tissue sutured

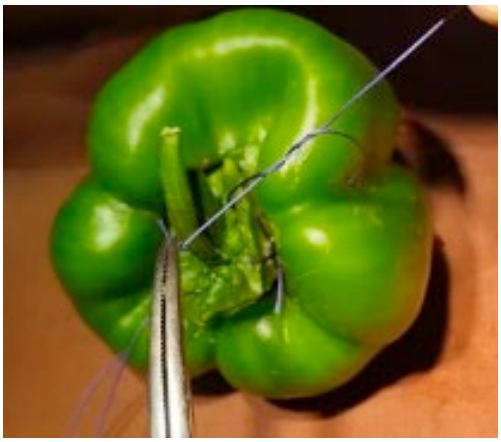

Figure 10: Stem secured in position

The stem along with the animal tissue was then placed back on top of the bell pepper and secured with sutures (Figure 11).

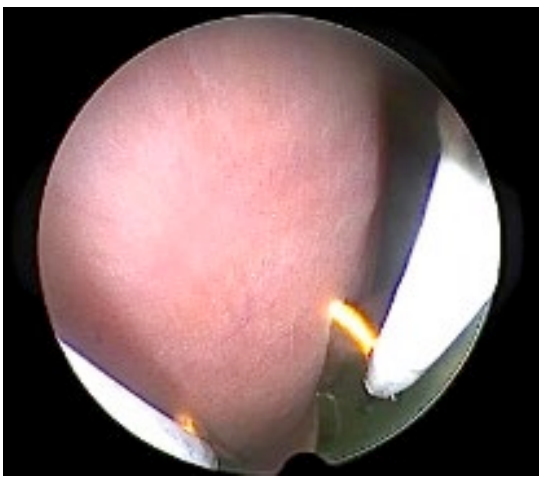

Figure 11: Resectoscopic Surgery

A 5mm trocar was used to create an opening, approximately in the midsection on any one of the sides of the pepper as an entry point for the resectoscope. The model was then placed on a suitable stand, placed in a reservoir tray to collect the fluid spill. This was then placed at a convenient height with the monitor placed at a location mimicking the ergonomics of actual surgery. This model was provided at each station. The participants were provided resectoscopes with a bipolar loop electrode, connected to the electrosurgical generator set to the same parameters as actual surgery and given instructions and guidance on its assembly. The trainers emphasized the importance of correct surgical techniques like placing the loop behind the myoma and activating the energy only as the loop moved towards the operating surgeon, never away from him/her. resectoscope with a bipolar loop electrode was then used to practice myomectomy on the animal tissue and shave off bits with the correct technique, while dealing with the problems of vision caused due to bits of tissue and bubbling (Figure 12). At the end of the

session, the pepper was cut in half for the trainees to inspect the result of their practice.

Figure 12: Tissue bits and bubbling

Outcome:

The primary outcome of this study was to compare surgeon confidence in performing resectoscopic surgery before and after the three-day workshop. Confidence levels were measured using the 5-point Likert scale questionnaire administered before and after the workshop. The secondary objectives included collecting feedback regarding the ease of use, anatomical fidelity, haptic feedback and overall satisfaction with the model.

Statistical Analysis:

The data collected was tabulated and analyzed with JASP Team (2024). JASP (Version 0.19.3) [Computer software]. The Wilcoxon Signed Rank text was used to compare pre- and post- intervention parameters. P - values less than 0.05 were considered significant.

Results:

A total number of 40 delegates attended the hysteroscopy training program from whom feedback was collected and analyzed. The delegates all had varying degrees of experience in operative hysteroscopy with 11 (27.5%) having only observed hysteroscopy cases, 16 (40%) having performed only diagnostic procedures, 11 (27.5%) performing minor operative procedures and 2 (5%) performing advanced operative procedures. The delegates had a statistically significant increase in confidence in performing resectoscopic surgery at the end of the training program (2.3 ± 0.9 versus 3.8 ± 0.7, $P < 0.01$); 0 = strongly disagree; 5 = strongly agree. 67.5% of participants were satisfied or better with how easy the model was to use. 52.5% of participants were satisfied or better with the anatomical fidelity provided by the model. 80% of participants were satisfied or better with the haptic feedback provided by the model. 85% of

participants were satisfied or better with the overall performance of the model in training.

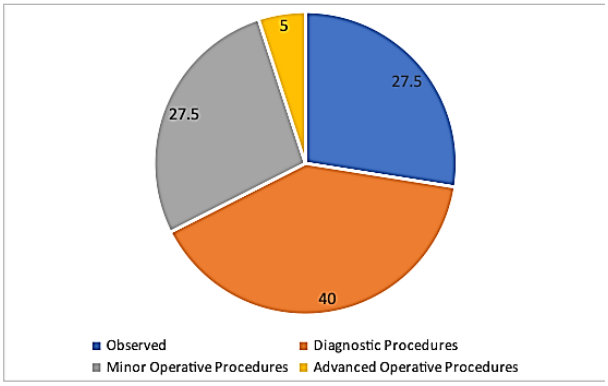

Table 1: Distribution of surgeon experience

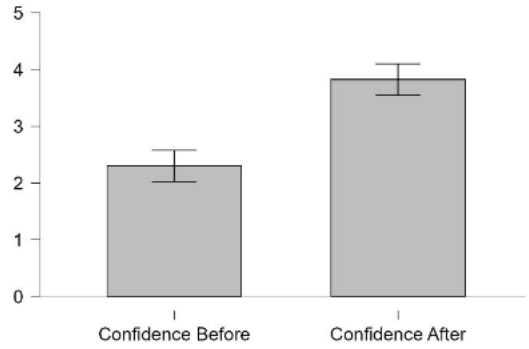

Figure 13: Confidence in Resectoscopic Surgery

Discussion:

Resectoscopic surgery allows the gynaecological surgeon to treat a wider variety of disorders with the hysteroscopic approach. However, it presents its own separate challenge of requiring a greater degree of hand - eye coordination and surgical precision than other hysteroscopic surgery. Thus, it presents the need for a method of training and simulation of the procedure. This study aimed to evaluate the IAT-BPM as training tool for resectoscopic surgery. The primary finding, a statistically significant increase in surgeon confidence in performing resectoscopic surgery after the three-day workshop, suggests that the model successfully allows surgeons to practice and internalize the unique motor skills required for resectoscopic surgery in a safe and reproducible environment. This model aims to overcome several key limitations of currently available training modalities (5). Plant models struggle to simulate the feel of human tissue and the challenges of electrosurgical procedures, issues which are addressed by the integration of animal tissue. This makes the model compatible with the more commonly available bipolar resectoscopes, avoiding the need for a return electrode and the risk of electrocution that is seen with monopolar cautery. The realistic haptic feedback allows the surgeon to modify their actions based on both visual and tactile stimuli as is required in real surgery. This advantage was strongly supported by our findings, with 80% of participants expressing satisfaction or

better with the haptic feedback provided. Furthermore, the challenge of impaired vision due to tissue bits floating in media and bubbles generated during surgery is also simulated. The model also avoids the practical difficulties and resource-intensive nature of using larger animal tissue models, making it a widely accessible and cost-effective platform for trainees to practice independently which is also supported by our survey data. All the components required for assembly of this model are readily available domestically and are easy to store and dispose. Further research would be required to compare the IAT-BPM to other training modalities, incorporating objective measures of skill acquisition, such as metrics from video analysis or surgical skill assessment tools, to further validate the model's efficacy.

Conclusions:

The Integrated Animal Tissue - Bell Pepper Model is an effective and accessible training tool for resectoscopic surgery. The model provides realistic haptic feedback and uses readily available, cost-effective components to make it a practical solution for independent practice.

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Improving Hysteroscopic Visualization - The GloveSeal Technique to Prevent Operative Vision Compromise in Hysteroscopy.

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Abstract :

Introduction : Hysteroscopy is often hindered by impaired vision due to distension media leakage between the hysteroscope's eyepiece and the camera head, causing fogging and blurring that necessitates frequent disassembly and cleaning. This prolongs surgical time and can increase surgeon frustration. This study evaluated the "GloveSeal" technique, a simple, cost-effective modification using a modified sterile surgical glove to create a watertight barrier, preventing this issue.

Methods: A prospective comparative study was performed on 40 patients undergoing complex hysteroscopic procedures. Patients were split into the standard assembly group (n=20) and the GloveSeal group (n=20). The primary outcome was visual quality during hysteroscopy.

Results: The GloveSeal group demonstrated a statistically significant improvement in mean visual quality score compared to the standard assembly group (1.45 vs. 0.75, $P < 0.01$). "Good quality" vision was maintained more often and vision deterioration requiring cleaning occurred significantly fewer times in the GloveSeal group ($P < 0.05$).

Conclusion:
The GloveSeal technique provides a more consistent visual field during hysteroscopy and reduces the frequency of surgical interruptions, potentially leading to more efficient and effective procedures.

Key words: Hysteroscopy, Operative vision, Fogging, Hysteroscopic Equipment, Scope Cleaning

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Introduction:

Hysteroscopy is a technique to visualize the uterine cavity using a hysteroscope inserted through the cervical canal. The ability to identify and treat intrauterine pathology is dependent on clear and consistent visualization throughout the procedure provided by uterine distension by distension media. The hysteroscope is inserted and secured into a metallic sheath which may be diagnostic or operative and of different sizes. Modern diagnostic and operative sheaths feature isolated, dual ports that provide continuous laminar flow of the distending media, ensuring optimal irrigation and imaging of the uterine cavity. The sheath and scope together are assembled with the camera head (1). While impairment of vision in laparoscopic and robotic surgery occurs at the objective lens in the tip of the scope, due to temperature and humidity differences or contact with bodily fluids, the impairment of vision in hysteroscopic surgery occurs at the eyepiece (2). Fluid spilled from the cervix around the hysteroscopy sheath runs down the exterior of the sheath, down to the camera head. Here, the fluid insinuates between the parts of the assembly to collect between the head and the scope. As a result, there is fogging of the image on the monitor, blurring and “halo-like” distortion of light. The view is clear initially (Figure 1) but starts deteriorating as the surgery proceeds due to the moisture between the camera head and the telescope eyepiece, eventually causing complete fogging of vision (Figure 2).

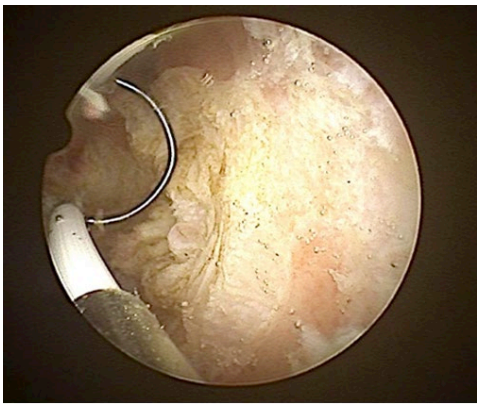


Figure 1: No blurring

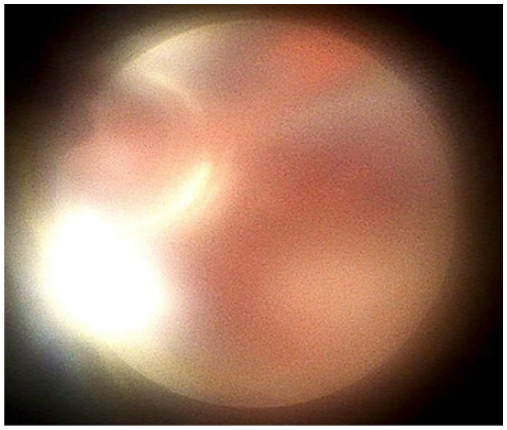


Figure 2: Severe blurring

Unlike the lens fogging during laparoscopic surgery, cleaning this fluid requires complete disassembly of the hysteroscope from the camera. This issue can recur leading to frequent interruptions in surgery to restore optimal vision, increasing overall procedure time and contributing to surgeon frustration. The problem is further complicated when a sterile plastic camera cover is used as fluid gets accumulated within it. It also occurs when the same camera unit is used for laparoscopy in the same sitting, as in diagnostic hystero -laparoscopy for infertility. We suggest the GloveSeal technique, a cost effective and technically simple modification of the standard hysteroscope assembly using a modified sterile surgical glove to "seal off" the camera head, forming a watertight barrier between the camera head and the hysteroscope. This reduces the problem of lens fogging leading to clearer vision and all but eliminating the need for disassembly and cleaning of the camera head. The efficacy of this technique was evaluated in a comparative study measuring the quality of vision with and without using the technique.

Material and Methods:

Experimental Design

A prospective comparative study was performed on 40 patients undergoing hysteroscopy. The study included patients undergoing complex operative hysteroscopic procedures of ISGE Level IIa and above as well as patients undergoing diagnostic laparoscopy in the same session. Patients undergoing diagnostic hysteroscopy and simple operative procedures were excluded. from the study. The procedures were performed by a single surgeon. The standard hysteroscope assembly was used in 20 patients (Group 1, n = 20*)* and the GloveSeal assembly in 20 patients (Group 2, n = 20*)*.

Instruments and Technique

A 2.9 mm 30° hysteroscope was the principal optical element connected to a three-chip HD camera control unit and monitor with an LED light source. A 5 mm Bettocchi-type operative sheath and 18 to 22 French resectoscopes were used as required. The standard assembly involved the scope assembled with its sheath and the entire assembly connected to the camera head with a sterile plastic cover around it. The GloveSeal technique involved the use of a sterile surgical glove as a seal between the scope and the camera head in addition to the sterile plastic cover.

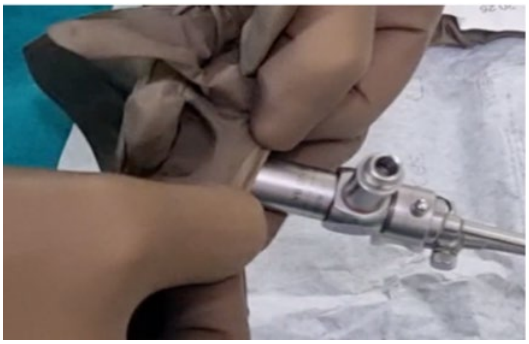
The GloveSeal was assembled as follows:

1. The hysteroscope was assembled with its sheath.

2. A sterile surgical glove of size number 6 was taken (Figure 3).

3. The middle finger was cut at its tip (Figure 4).

4. The cut tip of the middle finger was stretched over the hysteroscope eye piece (Figure 5, 6).



5.The index and ring fingers were wrapped tightly around the scope and tied to form a knot or left loose at the surgeon's discretion (Figure 7)

6.The camera head was connected to the hysteroscope and the glove was dragged over the camera head (Figure 8, 9).

7. The camera head was draped with a sterile plastic cover, over the glove.

8. The glove with the plastic cover around it was secured with a wire tie, completing the GloveSeal (Figure 10, 11).

The inflow and outflow channels were connected as usual. The distension media used was 0.9% Normal Saline, infused with a Hysteromat® (Karl Storz Se & Co KG Tuttlingen Germany). A Sims' speculum was introduced into the vagina. The hysteroscope assembly was placed at the external os and advanced under visual guidance. The use of dilators and vulsellum for entry were permissible at the discretion of the surgeon.

Instruments and electrosurgery were used as required.

Outcome Measures:

The primary outcome measure was the quality of hysteroscopic vision and was scored by the surgeon at the end of the procedure. Impact of fogging and blurring on the vision of the uterine cavity were measured by an arbitrary scoring system (0 = significant impairment of vision, requiring cleaning of the instrument, 1 = some impairment of vision and fogging, 2 = good quality vision). The details were recorded on a proforma.

Statistical Analysis:

The data collected was tabulated and analyzed with JASP Team (2024). JASP (Version 0.19.3 computer software). Mann - Whitney test was used for comparison of ordinate variables. Two-tailed *P*-values <0.05 were considered significant. Fisher's exact test was used for comparison of frequencies. Data represented as mean ± standard deviation unless mentioned otherwise.

Results:

All patients included in the study, divided in the standard assembly group (group 1: n = 20) and the GloveSeal group (group 2: n = 20) were analyzed. The procedures performed across both groups were 22 hysteroscopic myomectomies (55%), six hysteroscopic septum resections (15%), five hysteroscopic metroplasties (12.5%) and seven diagnostic hystero laparoscopy procedures (17.5%). They were divided similarly in both groups, being myomectomy in 12 (60%) and ten (50%) cases, septum resection in three (15%) and three (15%) cases, metroplasty in two (10%) and three (15%) cases and hystero laparoscopy procedure in three (15%) and four (20%) cases respectively.

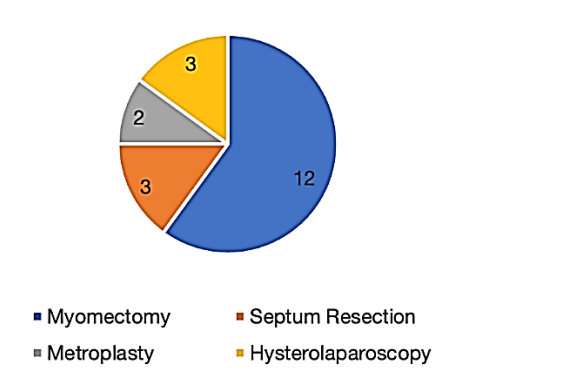


Figure 12: Distribution of cases Group 1

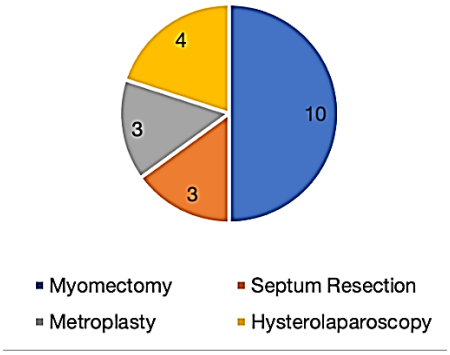


Figure 13: Distribution of cases Group 2

A statistically significant increase in mean visual quality score was noted for the GloveSeal group compared to the standard assembly group (1.45±0.686 versus 0.75±0.786, $P < 0.01$). 'Good quality' vision (visual quality score = 2) was maintained throughout the procedure significantly more often in the GloveSeal group ($P < 0.05$). Deterioration of vision to the point where cleaning was required (visual quality score = 0) occurred significantly fewer times in the GloveSeal group ($P < 0.05$). There were no complications in any case.

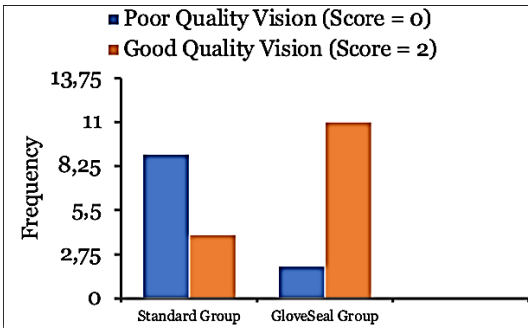


Figure 14: Comparison of visual quality

Discussion:

While many studies describe the impact of fogging and operative vision disruption during laparoscopic and robotic surgery, to our knowledge no previous studies have explored this impact in hysteroscopic surgery. Frequent interruptions in the surgical procedure due to operative vision disruption contribute to prolonged operative time, surgeon workload, cognitive burden and impaired patient safety (2-6). This study aimed to evaluate the efficacy of the GloveSeal technique to prevent operative vision compromise. The GloveSeal technique was developed in an effort to reduce the burden of repetitive cleaning of the hysteroscope while performing surgery, while being simple to implement and only using readily available materials. The latex surgical glove size number 6 was selected as it is the smallest glove size available in most operation theatres that also fits securely around the hysteroscope eye piece and because of its trivial cost. The authors used a size 6 glove (Encore® Latex Micro, Ansell, India) because of its powder free nature and good elasticity but any sterile, powder free latex surgical glove of size 6 or 6.5 from any

manufacturer may be used. Stretching the cut end of the glove finger over the eyepiece is easier than negotiating the entire scope through the wrist cuff. The final GloveSeal assembly provides a watertight barrier around the eyepiece for additional security against leakage. Clear visualization of the uterine cavity is important for the safe and effective execution of hysteroscopic procedures. The GloveSeal technique maintains a more consistent and superior visual field. Poor visualization necessitates frequent withdrawal of the hysteroscope for cleaning. In addition to the time lost in disassembling and cleaning the hysteroscope, further time is required to reestablish optimal vision inside the uterine cavity which is frequently stained with blood clots in the interim. This prolongs operative time, potentially increasing patient discomfort and risk of complications. The advantage of the GloveSeal technique lies in its ability to prevent vision deterioration to the critical point where cleaning is required more often, leading to a smoother procedure. As all procedures in this study were performed by a single surgeon, further research with a larger cohort of multiple operators would be beneficial to validate the findings and assess the technique's generalizability across different operating scenarios.

Conclusions :

This study demonstrates the impact of distension media leakage on visual quality and presents a cost-effective solution that provides a statistically significant improvement in visual quality and reduction in frequency of surgical interruption. Its simplicity and wide applicability can potentially lead to more efficient and effective procedures.

Procedure	Group 1 (Standard Assembly)	Group 2 (GloveSeal)
Myomectomy	12 (60%)	10 (50%)
Septum Resection	3 (15%)	3 (15%)
Metroplasty	2 (10%)	3 (15%)
Hysterolaparoscopy	3 (15%)	4 (20%)
TOTAL	20	20

Table 1 Distribution of cases

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Effective Management of Pregnant Women with Adenomyosis: A Comprehensive Approach to Minimize Adverse Pregnancy Outcomes: a Review

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Abstract

Introduction: Adenomyosis increases the risk of adverse pregnancy outcomes. Recent clinical observations at 3rd Park Hospital Obstetrics and Gynaecology clinic have highlighted a significant number of cases involving women experiencing miscarriages and were found to have adenomyosis. The impact of adenomyosis on pregnancy outcomes is examined and management approaches that can minimize adverse outcomes are explored.

Materials and Methods: A review of relevant literature (2010-2024) from electronic databases using the PRISMA guidelines in selecting the relevant studies for review.

Results: Intravenous immunoglobulin (IVIg) therapy can regulate maternal immunity. A low-dose aspirin can improve endometrial receptivity. Corticosteroids like prednisolone can correct immunological imbalances. Progesterone supplementation with dienogest can create an optimal uterine environment. Antioxidants like CoQ10 can reduce oxidative stress. GnRH-a administered for three months prior to conception can reduce adenomyotic lesions and improve implantation rates.

Conclusion**:** While no single treatment is universally effective, a comprehensive approach addressing the underlying pathways can minimize complications in pregnancies complicated by adenomyosis. Pregnancy in women with adenomyosis must be managed in a high-risk obstetric unit given its multifaceted role in pregnancy.

Recommendation: Administering GnRH-a for 3 months prior to pregnancy to improve placentation and reduce the risk of miscarriages is recommended.

Key words: Adenomyosis, Pregnancy, Obstetrics, Complications, Adverse-Outcomes.

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Introduction:

Adenomyosis, a condition characterized by the abnormal growth of endometrial tissue within the uterine myometrium, has become pertinent in reproductive medicine due to its potential impact on pregnancy outcomes. Recent clinical observations at the 3rd Park Gynaecology and Obstetrics clinic highlight significant cases of miscarriages and other poor pregnancy outcomes. All these have been associated with adenomyotic changes in the uterus, as revealed by in-house ultrasound examinations on the patients. These outcomes include miscarriages, foetal growth restriction, preterm labor, preeclampsia, atonic bleeding, uterine rupture, abnormal placentation, preterm premature rupture of membrane, and small for gestational age (SGA) infants (1–18). Managing pregnant women with adenomyosis is indeed a complex and multifaceted challenge, given the condition's poorly understood pathophysiology, risk factors, and potential interventions. Currently, there is minimal research and literature on the appropriate approaches for managing adenomyosis in pregnancy. This review provides some insight into various approaches that can be explored to prevent adverse outcomes for pregnant women with adenomyosis.

Materials and Methods:

This review included literature (2010-2024) from electronic databases including PubMed, Cochrane Library, Google Scholar, and MEDLINE. The search utilized the PRISMA guidelines to select the relevant studies for review. The search yielded 7920 results, and 47 studies were finally selected for further evaluation and review. Studies that were outside the scope of adenomyosis in pregnancy, published in languages other than English, those with no access to full texts, those with unsuitable study methodologies and design, and those with insufficient data have been excluded (Figure1).

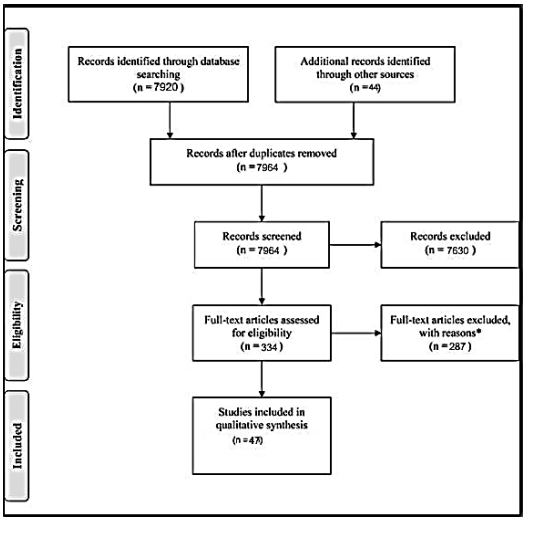

Figure 1: The PRISMA protocol for selecting the relevant studies utilized

in the review

Pregnancy Complications with Adenomyosis:

Adenomyosis adversely affects the uterine muscle layer and can manifest itself as focal and/or diffuse adenomyosis, and in rare cases, cystic adenomyoma (11,19). Khan et al. note that diffuse dispersion of numerous foci of endometrial glands and stroma within the myometrium is considered as diffuse adenomyosis (20). Circumscribed nodular aggregates on either anterior or posterior wall of the uterus are considered as focal adenomyosis (19). Harada et al. pointed out that diffuse adenomyosis involves alterations in the entire uterine muscle layer, particularly sub-endometrial constituents. This alteration is responsible for adverse obstetric complications (2). Cystic adenomyoma involves focal adenomyosis with further compensatory hypertrophy of the immediate myometrium (21). Diffuse adenomyosis alters the entire uterine muscle layer, particularly sub-endometrial constituents and increases the risks of pregnancy complications, compared to focal adenomyosis (2,11). Harada et al. and Tamura et al. established that women with diffuse adenomyosis will more likely experience preeclampsia and uterine infection (including severe conditions such as septic abortion and postpartum abscess formation) than those with focal adenomyosis (2,10). Tamura et al. established that the women with diffuse adenomyosis had an increased risk of second-trimester miscarriage, cervical incompetency, increased risk of preeclampsia, and uterine infection (10). Adenomyotic lesions may cause myometrial stiffness, chronic inflammation, altering endometrial function and receptivity. These alterations impair foetal development and placental function, potentially increasing the risk of early pregnancy loss or spontaneous miscarriage (2–4,10,15,22). A 2017 case-control study conducted by Hashimoto et al. found that all 49 pregnant women diagnosed with adenomyosis had an increased risk of second- trimester miscarriage due to adenomyotic alterations of the endometrial function and receptivity (8). Tamura et al. linked miscarriages to increased myometrial stiffness and intrauterine pressure in patients with adenomyosis (10). When a significant portion of the placenta is in contact with adenomyotic lesions, there is an increased risk of reduced blood circulation within the intervillous

space leading to foetal growth restrictions (23). Adenomyotic lesions may adversely affect placentation and spiral artery transformation, which can contribute to the pathogenesis of foetal growth restrictions (3–5,8,9). Preeclampsia, which involves arterial hypertension and proteinuria, is also associated with abnormal placentation and vascular function (2,14,16). Tsikouras et al. found that in preeclamptic women, a significant proportion of the spiral arteries are abnormal (due to the effect of adenomyosis), causing pathological placentation, with increased vascular resistance, activation of the coagulation mechanisms, and endothelial dysfunction (24). Adenomyosis may cause increased local inflammation and elevated prostaglandin levels (2,15,16). An ensuing inflammatory response and increased prostaglandin levels create an abnormal uterine environment, predisposing one to preterm labor and premature rupture of membranes (PPROM) before 37 weeks of gestation (16). Preterm labor involves regular uterine contractions that lead to cervical changes before 37 weeks of pregnancy. PPROM involves the rupture of the amniotic sac before labor begins, and before 37 weeks of pregnancy (1,2,15,16). In a case-control study involving a cohort of 2138 pregnant women, Juang et al. established that women with adenomyosis had increased instances of preterm delivery and preterm pre-labor rupture of membranes (25). These obstetric complications could be attributed to increased local inflammatory response and higher levels of prostaglandins in these women (25). The abnormal uterine environment in adenomyosis raises the risk of abnormal placental implantation (like placenta previa or placental abruption) which are associated with increased risks of preterm birth, haemorrhaging, and other adverse pregnancy outcomes (1,2,16,26). Orozco et al. analysed obstetric outcomes in 7,608 pregnant patients with adenomyosis and found that placental abruption occurred in 3.9% of the patients, implying that the risk of presenting abruption placentae increased by 19% in these patients compared to those without adenomyosis (3). Adenomyotic lesions disrupt normal uterine contractility, increasing risks of uterine atony and postpartum haemorrhage (10). The risk of post-partum complications is significantly high among women with adenomyosis. In a multicenter retrospective survey involving 272 pregnant women with adenomyosis

from 65 facilities, four women reported to have experienced atonic bleeding, and one patient experienced a uterine rupture (10). Most studies have generally established that women with adenomyosis have an increased likelihood of experiencing spontaneous miscarriages, preterm labor and preterm delivery, PPROM, SGA, preeclampsia, atonic bleeding, and uterine rupture compared to those without adenomyosis. The risk of rupture seems to be related to myometrial stiffness, poor stretchability, and contractility (1–6,8– 13,15,16,18,20,22,25–28).

The Sonological Phenotypes of Adenomyosis:

Adenomyosis disrupts the normal structure and function of the uterus. Specific phenotypes of adenomyosis include a bulky, globular uterus, asymmetrical myometrial thickening, myometrial cysts, irregular/interrupted junctional zone, hyperechoic islands, trans lesional vascularity and echogenic sub-endometrial lines and buds (21,29,30). The asymmetric or irregular thickening of the myometrium involves one wall (anterior, posterior, or lateral) appearing significantly thicker than the others. This asymmetrical thickening depicts areas with adenomyotic foci/infiltration. Myometrial cysts are circumscribed anechoic cystic areas seen within the myometrium, often corresponding to dilated adenomyotic glands (20,29). The junctional zone is a thin hypoechoic line that separates the endometrium from the outer myometrium (21). It appears thickened, interrupted, or ill-defined due to infiltration by adenomyotic lesions. Hyperechoic islands are regions of increased echogenicity in a linear or nodular pattern scattered within the myometrium (21). On Doppler imaging, trans lesional vascularity is seen as increased vascularity with prominent penetrating vessels running through the adenomyotic areas within the myometrium. Echogenic sub-endometrial lines and buds are fine echogenic linear bud-like projections and striations extending from the endometrium into the myometrial substance, highlighting infiltration by endometrial tissue into the myometrium (29) (Figure 2).

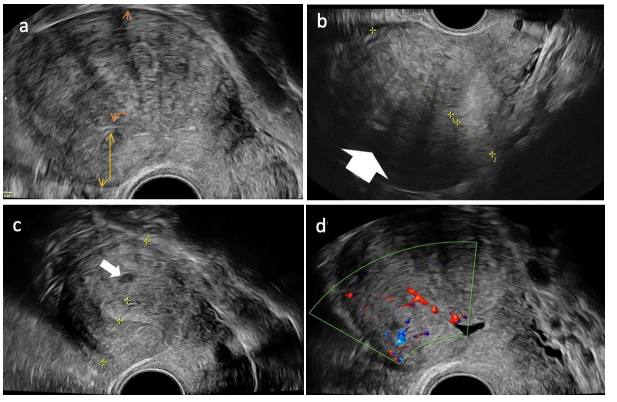

Figure 2: 2-D sonographic imaging of a non-gravid uterus in a longitudinal section highlighting typical phenotypes of adenomyosis. (a) See the globular shape with an asymmetrical myometrial wall-thickening (posterior thicker than anterior – orange arrows), the heterogeneous myometrium with hyperechoic regions, and hypoechoic striations. (b) asymmetrical myometrial wall-thickening (anterior thicker than posterior), the heterogeneous myometrium with fan-shaped shadowing (white arrow). Note the ill- indistinct endometrial-myometrial border (c) A solitary myometrial cyst on the posterior wall (white arrow). (d) Few diffuse vessels (increased vascularity) can be seen on colour Doppler

Adenomyosis Presentation in Pregnancy:

Pregnancy brings significant changes in hormones. Hormonal changes, particularly those due to progesterone, stimulate decidualization in endometrial tissues and may also affect or involve ectopic tissues resulting from adenomyosis (31). Hormonal effects can cause changes in the imaging appearances of adenomyosis and may pose a diagnostic issue if adenomyosis mimics other types of uterine or placental abnormalities, including placenta accreta or gestational trophoblastic disease (31). An example of this is the thickening of adenomyosis with a cystic feature, which could be misinterpreted as trophoblastic tissue. This is most likely with cystic adenomyosis that may be surrounded by decidualized tissue and simulate an early gestational sac or intramural ectopic pregnancy (30). Focal adenomyosis may display irregular, poorly demarcated lesions within the myometrium, which may extend into or distort the placental region (31). These features can pose a challenge in separating the latter from placental anomalies. Diffuse adenomyosis may show thickened and heterogeneous myometrium that can change the shape and/or position of the gestational sac (31). Ultrasound and magnetic resonance imaging (MRI) will remain essential, particularly lower frequency transducers or non-

contrast MRI that can more easily differentiate between placental and myometrial boundaries (31).

Mechanisms through which Adenomyosis causes Adverse Pregnancy Outcomes:

Abnormal Placentation**:**

Adenomyosis may affect placental development, potentially yielding adverse pregnancy outcomes. Junctional zone alterations in women with adenomyosis can affect the vascular resistance of junctional zone spiral arteries to decidualization, increasing the likelihood of insufficiently deep placentation (4). The restriction of physiological transformation of the spiral artery may cause miscarriage, and a lower level of hypoxia may cause foetal fatalities. During embryogenesis, trophoblastic cells invade the endometrium and the myometrial junctional zone to allow decidualization and vascular changes (10). Foetal growth issues occur when blood vessels do not undergo physiological change due to inadequate deep placentation (10). Poor formation of myometrial spiral artery might cause placental abruption by elevating the blood flow rate from the uterine artery (4). A dysfunctional junctional zone (usually > 7mm) is associated with implantation failure (1). Understanding of junctional zone abnormalities in adenomyosis may guide in ensuring targeted intervention to improve placentation.

Immunological changes:

Adenomyosis may alter immune profiles in the endometrium which can cause placental abnormalities (2,32). The eutopic endometrium in adenomyosis has abnormal immune cell types and inflammatory indicators, which contribute to implantation failure (32). Both innate and adaptive immune cells increase in the endometrium. These additional immune cells produce pro-inflammatory signals, resulting in an inflammatory environment within the uterus (2,32). Concurrently, adenomyosis patients have fewer uterine natural killer (uNK) cells in their endometrium, which play an important role in implantation and placentation (32,33). This uNK cell deficit is characterized by an increased expression of the inhibitory receptor CD94 on these cells, which inhibits their function. The immunological alterations, together with steroid hormone abnormalities such as progesterone resistance, reduce endometrial receptivity, which is necessary for optimal implantation and placental development (32). In essence, increased inflammatory cells

and mediators, along with impaired uNK cell activity, create an unfriendly endometrial environment, preventing embryo implantation and placentation (32). This immunological dysregulation, defined by excessive inflammation but repressed uNK activity, interacts with progesterone resistance to raise the likelihood of unfavourable outcomes such as implantation failure, miscarriage, and placental abnormalities. in women with adenomyosis (32,33). Can these immune alterations in adenomyosis be modified through specific interventions to enhance endometrial receptivity?

Hyperinflammatory microenvironment:

Adenomyosis creates a hyperinflammatory microenvironment in the uterus (34), potentially causing immune responses within the uterus, which can impair normal placentation. Women with adenomyosis have increased levels of pro-inflammatory cytokines and markers such as interleukin-1 (IL-1), IL-6, and tumor necrosis factor-alpha (TNF-α) in the endometrium and myometrium (10,34). The inflammatory state in adenomyosis elevates the production of free radicals. This process causes oxidative stress and damages embryonic cells thus inhibiting normal embryo development and implantation process (4). Some studies have shown increased expression of prostaglandins, inflammatory mediators in the eutopic and ectopic endometrium of women with adenomyosis (10). Prostaglandins can induce uterine contractions and impede implantation (10). Adenomyosis lesions overexpress the enzyme cyclooxygenase-2 (COX-2), causing elevated prostaglandin production and propagating the inflammatory cycle (10). This persistent hyperinflammatory microenvironment hinders embryo implantation and normal placental development (10). Therefore, anti-inflammatory prophylaxis be explored to minimize oxidative stress and enhance normal placentation?

Myometrial wall Contractility:

Myometrial contractility is crucial in pregnancy. Adenomyotic lesions significantly alter myometrial contractility. Adenomyosis leads to increased uterine wall thickness, elevated intrauterine pressure, and abnormal uterine contractility (30). The increased wall thickness and distortion of the myometrium can cause stiffness and elevated

intrauterine cavity pressures during pregnancy (10). This can contribute to pregnancy complications such as pre-term labor and birth. Adenomyosis also disrupts the normal make-up and function of the myometrial smooth muscle. This disruption causes dysregulated uterine contractility patterns. Abnormal and excessive uterine contractions can occur in late pregnancy (10).

Abnormal progesterone receptors:

Hormonal environment in the uterus is critical in maintaining pregnancy. Adenomyosis disrupts this hormonal environment. Adenomyosis characterizes an abnormal response to the hormone progesterone due to the reduced expression of progesterone receptors (PR) in the myometrium (26). Women with adenomyosis have lower levels of PR, hence a diminished response to circulating progesterone levels (35). This progesterone resistance leads to unopposed estrogenic effects, as the downregulation of PR causes a corresponding upregulation of estrogen receptors (ER) (35). The increased ER expression alters the expression profiles of cellular adhesion molecules like integrins and cadherins, which are crucial for embryo- endometrial interactions during implantation (35). Notably, the levels of integrin B-3 are low in adenomyosis, impairing embryo attachment and implantation (35). The progesterone resistance perpetuates the proliferative and inflammatory state in adenomyosis (35). Progesterone insensitivity, alongside excess estrogenic actions and inflammatory mediators can cause implantation failure, miscarriages, and placental abnormalities observed in pregnancies complicated by adenomyosis (35). Therefore, enhancing progesterone receptor sensitivity in women with adenomyosis may reduce implantation failure and improve pregnancy outcomes.

Chronic Impaired Inflammatory State of the Endometrium (CIISE)

CIISE is an inflammatory endometrial disorder. Adenomyosis increases the risk of CIISE (19). Khan et al., asserts that CIISE is mostly asymptomatic and sometimes shows subtle symptoms such as pelvic discomfort, spotting, and leukorrhea (19). Some studies have linked CIISE to reproductive failures, including recurrent implantation failures post IVF-ET, repeated miscarriages, and mysterious infertility (19,36,37). The inflammatory state caused by CIISE delays the proper differentiation of

the endometrium during the mid-secretory phase, which is vital for embryo implantation (19). CIISE downregulates the expression of genes associated with embryo receptivity and decidualization, creating a hostile environment that impairs embryo implantation (36,37). The plasma cells that accumulate in the endometria of women with CIISE produce excessive levels of mucosal antibodies, predominantly IgG2, which can directly interfere with the implantation processes (19). Therefore, targeting the inflammatory and immunological pathways in CIISE could enhance endometrial receptivity and reduce pregnancy complications due to adenomyosis.

Results and Findings:

Different Treatment Approaches to Ensure Positive Pregnancy Outcomes:

Since there is still no consensus on any specific approach to manage adenomyosis in pregnant women, can an appropriate treatment approach involve an attempt to address the mechanisms through which adenomyosis causes adverse pregnancy outcomes?

Table 1 summarizes several treatment approaches that can be used to ensure successful pregnancy outcomes. These studies look at different kinds of interventions aimed at minimizing complications during pregnancy. Interventions covered include intravenous immunoglobulin (IVIg) therapy, low-dose aspirin supplementation, corticosteroid administration, hormonal treatments such as progesterone and GnRH agonists, and combination therapies.

Discussion:

Managing adenomyosis in pregnant women is a complex issue. It requires a holistic management that can address key issues on how the mechanisms in adenomyosis affects the uterus. Such mechanisms include abnormal placentation, immunological changes, hyperinflammatory microenvironment, contractility of the myometrial wall, abnormal receptors for progesterone, and chronic impaired inflammatory state of the endometrium). Proper management may include intravenous immunoglobulin (IVIg), low-dose aspirin, corticosteroids, hormonal therapy such as progesterone and GnRH agonists, or combination therapies. IVIg may modulate the maternal immune response by supplying natural antibodies, regulating cytokines, and

inducing foetal-maternal tolerance once the pregnancy is established. After pregnancy confirmation, a regimen of 500 mg/kg over 5 days per month would provide treatment until 34 weeks' gestation (39). High-dose IVIg is also feasible, which would be 20 grams administered daily for 5 consecutive days during the early stages of gestation (40). Low- dose aspirin therapy can improve endometrial receptivity and reduce pregnancy complications (16,41,42). A dosage of 50 to 75 mg daily, administered from 12 to 36 weeks of gestation, is recommended. Aspirin has anti-inflammatory effects and prevention of platelet aggregation (16,41,42). This improves uterine blood flow, enhances endometrial growth, and reduce the risk of preeclampsia and other placental-mediated complications. The combination of aspirin with other therapies, such as transdermal estrogen gel, may improve endometrial receptivity and pregnancy outcomes (16,41,42). Progesterone supplementation (like dienogest) may enhance implantation and foetal protection (9,43). Nevertheless, the optimal timing, dosage, and duration of progesterone therapy in adenomyosis-complicated pregnancies require further research. Gonadotropin- releasing hormone agonists (GnRH-a) can be potential preconception treatment for adenomyosis. GnRH-a therapy reduces the size of adenomyotic lesions and creates a more favourable uterine environment for implantation. The regimen may involve administering GnRH-a for 3 months prior to attempting conception to improves implantation rates (35,44). GnRH-a therapy must be discontinued before conception due to its potential teratogenic effects. The use of corticosteroids (such as prednisolone) is still undergoing research. Low-dose prednisolone (5-10 mg daily) started before conception or in early pregnancy may help correct immunological imbalances associated with recurrent miscarriage (45). However, corticosteroids may increase the likelihood of gestational diabetes and preterm birth (46). Therefore, the optimal timing and duration of corticosteroid therapy in adenomyosis require further investigation. Adenomyosis can impair mitochondrial activity in uterus cells (47). Antioxidants such as CoQ10 reduce oxidative stress (48) and may also be administered to improve mitochondrial function. CoQ10 has been shown to have anti-

inflammatory properties that could potentially reduce inflammation associated with adenomyosis (48). Further research into the dosage, timing, and combination of these interventions in adenomyosis-complicated pregnancies is crucial. The exploration could pave way for personalized treatment strategies to enhance pregnancy outcomes.

Conclusion:

Adenomyosis significantly increase the risk of adverse pregnancy outcomes, which include miscarriage, preterm birth, various hypertensive disorders, placental abnormalities, and postpartum complications. Such outcomes arise due to the complex adenomyosis- associated mechanisms, such as immune dysregulation, hyperinflammatory milieu, impaired placentation, myometrial dysfunction, progesterone resistance, and chronic impaired inflammatory state of the Endometrium (CIISE) (49). Managing pregnancy with adenomyosis in women necessitates an integrative approach that considers these mechanisms. IVIg has good potential for improving pregnancy outcomes through modulation of the maternal immune system and enhanced foetal-maternal tolerance. Low-dose aspirin therapy may foster endometrial receptivity and vascularization and perhaps lower the incidence of a multitude of such problems. Proper utilization of corticosteroids before conception or in early pregnancy may help correct immunological imbalances linked with recurrent miscarriage, but the risks and uncertainty around adenomyosis require further research. Dienogest-progesterone supplementation prior to pregnancy may offer a suitable uterine environment for implantation and foetal development by acting as an anti-inflammatory and immunomodulator. Furthermore, antioxidants such as CoQ10 may reduce oxidative stress and inflammation associated with adenomyosis, hence improving pregnancy outcomes. While no single treatment is 100% effective, a multimodal strategy customized to the individual patient's clinical presentation and risk variables may provide the highest chance of a favourable pregnancy result. Thorough investigation is imperative to develop and optimize current care techniques, ensuring that women with adenomyosis can have safe pregnancies with reduced the risk of adverse outcomes.

Recommendation:

Administering GnRH-a for three months prior to pregnancy (either natural or IVF attempts) to improve implantation and reduce the risk of miscarriages is recommended. This will suppress estrogen production, and allow a temporary reduction in the size and activity of adenomyotic lesions. By creating a more favourable uterine environment, GnRH-a therapy may improve implantation rates and reduce the risk of early miscarriage. The improved uterine environment results from decreased inflammation, reduced myometrial hyperactivity and enhanced endometrial receptivity.

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Additional Material:

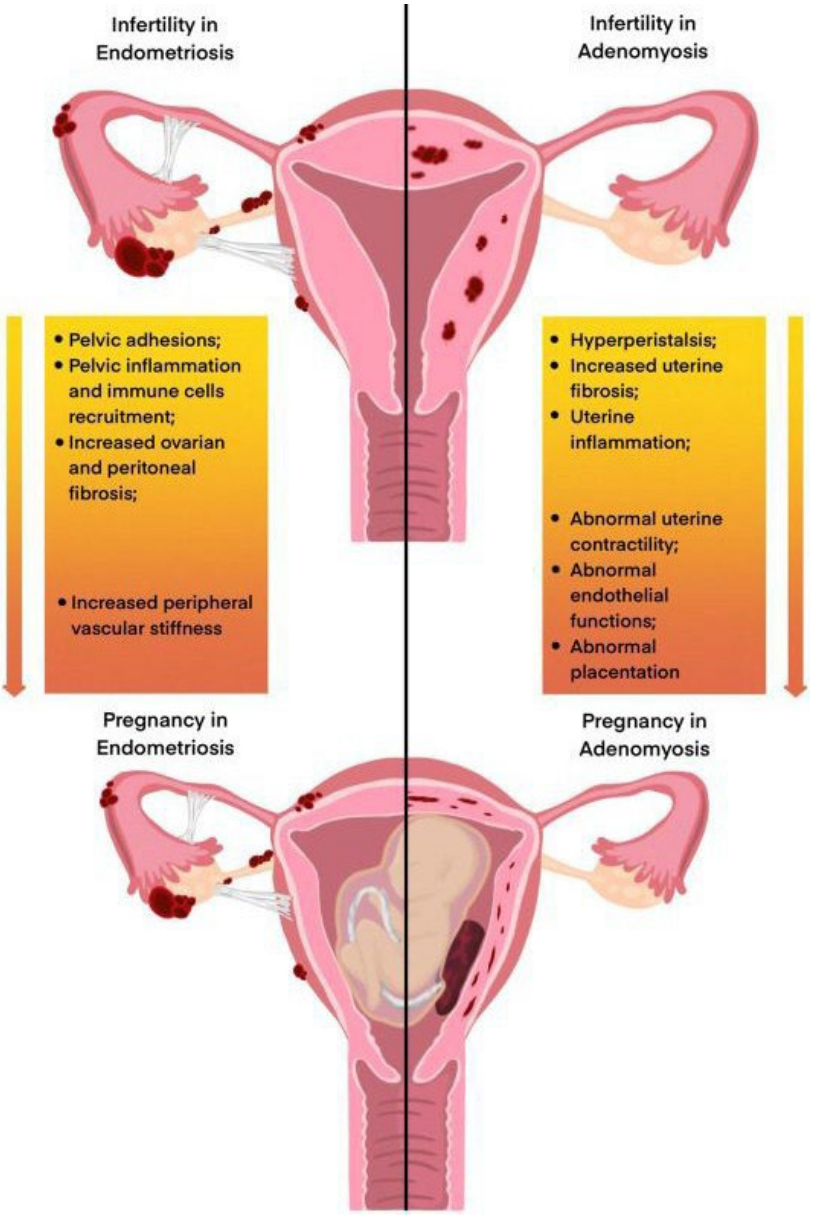

Figure 3: Mechanisms of adverse reproductive and pregnancy outcomes in women with pelvic endometriosis and adenomyosis. Used with permission from "Association of endometriosis and adenomyosis with pregnancy and infertility." (38) DOI: https://doi.org/10.1016/j.fertnstert.2023.03.018 License: https://creativecommons.org/licenses/by/4.0/

Authors and Year of Publication	Aim/Objective of the Study	Methodology Used	Intervention	Outcome	Conclusion
Shi *et al.*, 2022	To evaluate the efficacy of IVIg in treating RSA in pregnant women with immune abnormalities.	Systematic review and meta-analysis of 15 randomized controlled trials involving 902 patients.	Administration of IVIg therapy to the experimental group, with a control group receiving a placebo.	IVIg significantly increased the live birth rate in women with recurrent spontaneous abortion.	IVIg shows promise for treating RSA caused by immune abnormalities.
Mahjabeen *et al.*, 2013	To evaluate the effects of high dose IVIg in primary and secondary unexplained miscarriages in patients with RPL.	Retrospective study of 168 couples with primary or secondary RPL, divided into IVIg and control groups.	IVIg group received 50 gm of IVIg monthly, starting within 2 weeks of attempted conception and continued up to term. Control group received normal saline drip at the same intervals.	Higher percentage of live births (81% vs. 31%) and full-term live births (76.2% vs. 23.8%) in the IVIg group compared to the control group.	High dose IVIg has a beneficial role in primary and secondary recurrent miscarriages, significantly improving live birth rates.
Zhang *et al.*, 2021	To evaluate differences in Doppler parameters and pregnancy outcomes in URPL patients and the effects of low-dose aspirin (LDA) on endometrial receptivity.	Observational study at Ren Ji Hospital, Shanghai, China, involving 190 URPL patients and 35 control patients.	Daily low-dose aspirin supplementation for 2 months in URPL patients.	URPL patients had significantly thinner endometrium and higher PI, RI, and S/D values. LDA reduced resistance in endometrial and uterine artery blood flow, improving endometrial receptivity.	URPL patients had impaired uterine perfusion. LDA improves endometrial receptivity.
Chi *et al.*, 2018	To evaluate the efficacy of transdermal estrogen gel and oral aspirin combination therapy in improving endometrial receptivity and fertility prognosis in patients with moderate to severe Intrauterine adhesion (IUA) following transcervical resection of adhesion (TCRA).	Clinical study comparing transdermal estrogen gel only therapy with combination therapy of transdermal estrogen gel and oral aspirin.	Combination therapy: Transdermal estrogen gel and oral aspirin administered post-TCRA. Control group received transdermal estrogen gel only.	Combination therapy significantly increased expression of endometrial receptivity markers (αvβ3 and laminin), reduced PI and RI of the uterine artery, promoted angiogenesis, prevented fibrosis, and improved pregnancy rates.	Postoperative combination therapy with transdermal estrogen gel and oral aspirin may enhance endometrial receptivity and improve fertility prognosis more effectively than estrogen-only therapy.
Li *et al.*, 2022	To evaluate whether glucocorticoid administration can improve pregnancy outcomes in women with unexplained positive autoantibodies.	Systematic review and meta-analysis of seven prospective and retrospective cohort studies.	Glucocorticoid administration to women with unexplained positive autoantibodies, starting before or during pregnancy.	Glucocorticoid treatment improved clinical pregnancy rate (RR 2.19, 95% CI 1.64–2.92) and live birth rate (RR 1.92, 95% CI 1.17–3.16), particularly when started before pregnancy. No effect on miscarriage rate (RR 0.75, 95% CI 0.55–1.02).	Glucocorticoid therapy may improve clinical pregnancy and live birth rates in women with unexplained positive autoantibodies.
Kemp *et al.*, 2016	To provide an update on the benefits, risks, and uncertainties regarding antenatal corticosteroid use in pregnancy.	Narrative review of scientific literature	Antenatal corticosteroid therapy for recurrent miscarriage, congenital adrenal hyperplasia, and preterm birth.	Improved neonatal outcomes, particularly in pulmonary function, but potential risks, including adverse outcomes and lasting epigenetic changes.	Antenatal steroids may prevent pregnancy loss and morbidity in many more.
Gabidullina *et al.*, 2020	To investigate how adenomyosis impacts woman's reproductive function.	Systematic literature review	Medical treatment with dienogest, along with modern imaging methods for early diagnosis and organ-preserving surgery.	Dienogest treatment improves endometrial conditions, increases IVF cycle effectiveness, and may have immunomodulating effects useful for implantation and fetal protection.	Progestin's immunomodulating effect may be useful for implantation and fetal protection of post-treatment pregnancies. Dienogest treatment enhances the effectiveness of IVF cycles for adenomyosis.
Donnez *et al.*, 2021	Evaluating the efficacy and safety of GnRH antagonists in managing adenomyosis, including during pregnancy.	Review and analysis of existing literature and clinical studies.	Administration of GnRH antagonists (e.g., linzagolix) in high doses for 12 weeks.	Significant reduction in uterine volume, decreased uterine bleeding, alleviated pain symptoms, improved quality of life. Specific results include a 55% decrease in uterine volume and substantial symptom relief.	GnRH antagonists may be effective in treating adenomyosis.
Lin *et al.*, 1999	To study the role of gonadotropin releasing hormone agonists (GnRH-alpha) in treating adenomyosis with infertility.	Diagnosis of adenomyosis via laparoscopy in 4 infertile cases, followed by surgical treatment of coexisting conditions and GnRH-alpha therapy.	GnRH-alpha therapy for six months before laparoscopic surgery in 1 case and after surgery in 3 cases.	All cases became amenorrheic during therapy, uterine size decreased to normal or near normal, and menstruation returned after treatment. Three cases conceived within four menstrual periods, resulting in one healthy birth, one premature cesarean due to threatened rupture, and an ongoing normal pregnancy.	GnRH-alpha can reduce adenomyotic uterine size and facilitates fertility.
Tesarik, J., 2021	A review of different antioxidants on female reproductive function	A systematic review	Various antioxidants, including vitamins (C, E, A, B1, B6, B12, D3), resveratrol, growth hormone, and mitochondrial-targeted antioxidants.	Mixed results: some studies showed improvement in fertility outcomes with antioxidant use, while others did not find significant effects.	Personalized antioxidant treatment strategies can ensure safety and efficacy in improving female reproductive function.

IVIg- Intravenous immunoglobulin, RSA- recurrent spontaneous abortion, RPL- recurrent pregnancy loss, URPL - unexplained recurrent pregnancy loss, PI = Pulsatility Index, RI = Resistive Index, S/D = Systolic-to-Diastolic Ratio

Table 1: Treatment Options/Consideration

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Uterine Transplantation versus Surrogacy for Absolute Uterine Factor Infertility: Challenges, Complications and Mini Literature Review

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Abstract

Although uterus transplantation (UT) is a promising solution for women with absolute uterine factor infertility (AUFI), it remains in the experimental phase with mixed outcomes across different studies, while alternative pathways to motherhood, such as surrogacy is accessible. To date, more than 90 UT procedures have been performed worldwide. However, various complications have been reported concerning the outcomes for donors, recipients, and neonates. These challenges highlight significant hurdles in the broader application of UT in clinical settings. At present, nearly all women with AUFI face a choice between involuntary childlessness and acquiring parenthood through surrogacy. This mini review aims to examine the clinical outcomes, complications, and ethical considerations surrounding UT and compare it with surrogacy.

Key words: Uterine Transplantation (UT), Absolute Uterine Factor Infertility (AUFI), Pregnancy Outcomes, Ethical Consideration, Complications

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Introduction:

Absolute uterine factor infertility (AUFI) refers to infertility caused by the absence or abnormality of the uterus, which prevents embryo implantation or the maintenance of pregnancy (1,2). Uterus transplantation (UT) has emerged as a potential treatment for AUFI that has been successfully conducted in over 10 countries. However, alternatives like surrogacy are available for AUFI. The UT procedure involves transplanting a uterus from either a living donor (LD) or a deceased donor (DD) into a woman with AUFI. According to the Third International Congress of the International Society of Uterus Transplantation, a total of 91 UT procedures has been performed globally, with 71 from living donors and 25 from deceased donors, resulting in 49 live births, 40 from LD UT and 9 from DD UT (3-7). Technically, UT is a complex and multi-step surgical procedure. It requires lengthy surgeries, significant psychological and emotional challenges for both donors and recipients, ongoing immunosuppression and potential in utero effects on offspring with substantial costs. Women undergoing UT must be carefully screened, be in a supportive relationship, and fully understand the risks and benefits of the procedure. As such, concerns regarding the physical and psychological complications for donors, recipients, and neonates have been raised (8). This manuscript aims to provide an overview of uterine transplantation and comparisons with alternative methods like surrogacy, emphasizing gaps in the literature regarding recipient challenges and ethical considerations that are often overlooked in previous studies.

Surrogacy versus UT

UT has been the topic of intense ethical discussions which are related to the non-life saving experimental nature of UT, the existence of successful alternatives (such as surrogacy), and the risks for the donor. It has been argued that UT improves on other options, such as surrogacy, only by satisfying personal desire to experience gestation as well as childbirth and that these are insufficient to justify the high financial cost associated with UT. These criticisms have also been specifically deployed against public

funding for UT in countries with socialized medical care and insurance-based or mixed systems (9,10). Caplan et al. pointed out the different risk-benefit ratio involved in a transplant procedure not meant to be lifesaving but instead meant to be quality-of-life improving and warned about the risk of "therapeutic misconception" for a procedure that is experimental (11). In addition, Arora and Blake, who justified UT for its non-life saving nature and believed that alternatives are available, nonetheless, also invoked patients' autonomy in choosing between alternatives, stressing the importance of informed consent and the fact that UT is experimental (12). Dickens et al. discussed the ethics of uterus donation and the familial or social pressure that a related donor may feel or the motivation of an unrelated donor (13). Accordingly, it is better to state that UT is associated with considerable risk and currently necessitates conception via in vitro fertilization (IVF), a highly medicalized pregnancy and delivery by Caesarean section. Additionally, there is limited availability for this procedure as it is offered at few specialized centres globally. When comparing the risks of surrogacy with those of the woman undergoing UT, the former could be opted because the latter one needs to tolerate at least three surgical procedures and take immunosuppressive medication to be able to have a child. This imbalance has no solution when only the clinical aspects of the comparison are considered. The ethics for UT are complex. The question remains whether it is ethical to put two people at risk when performing a UT when other options are available (14,15). In contrast, according to the National Assisted Reproductive Technology Surveillance System data from 2020, gestational surrogacy is currently offered by 90% of the Centres for Disease Control and Prevention-reporting IVF centres in the United States (16). It is beneficial for patients with serious medical diseases, such as heart or kidney patients, prohibited from becoming pregnant, and repeated implantation failure in assisted fertilization (17). Some women cannot bear the burden of pregnancy, childbirth and breastfeeding, as well as disability due to old age and the fear of passing on debilitating genes (18). There is a

genetic link to the child when the embryo(s) originate from the gametes of the intended parents. In addition, it has a lower medical risk than the UT procedure. Besides, more control over prenatal care and embryo selection by IVF would be achieved. Legislation on surrogacy varies between countries and it is legally accepted in several countries (United States, United Kingdom, Canada, Australia, Russia, Israel, Iran, Afghanistan, Bangladesh, Tajikistan, Kyrgyzstan, Ukraine, Georgia, Greece, Brazil, South Africa and India) (19,20). Some studies cited that UT transplantation presents unique advantages in specific contexts. The most important benefit of UT is that it allows women with AUFI to personally experience pregnancy, gestation, and childbirth, which can have profound psychological, emotional, and social value (9–12). Furthermore, in countries where surrogacy is legally restricted, culturally unacceptable, or ethically controversial, UT may represent the only available pathway to achieve biological parenthood (19–21). In these cases, UT not only preserves the genetic link between parents and offspring but also respects the autonomy of women who wish to undergo the process of gestation themselves. Nevertheless, it must be emphasized that surrogacy remains the safer option overall, given the high surgical risks, complications, and need for lifelong immunosuppression associated with UT (22).

UT Challenges related to recipients

The ethical implications of UT as an alternative to surrogacy remain contested, particularly regarding the role of genetic continuity. Surrogacy preserves a genetic link between intended parents and offspring, framing UT as an ethically superior option based solely on genetic considerations would be premature, given the procedure's experimental nature, the transient use of the transplanted organ, and unresolved questions about long-term risks. The debate must also account for cultural and legal disparities in how societies weigh genetic parenthood against gestational experience. Until further evidence clarifies these trade-offs, ethical evaluations of UT should remain provisional and context-dependent challenges related to

recipients (23-26). Also, for the woman who undergoes a living donor uterine transplantation (LDUT), the risks of the operations, the LDUT itself, the Caesarean section to deliver the baby and the hysterectomy after the delivery are problematic. As UT is considered as a vascular composite allograft (VCA), these ethical concerns have been discussed among members and societies of the transplant community. In addition, Perier et al. reported several complications in UT recipients, including vaginal stenosis (71.4%), infections (44.4%), cytopenia (57.1%), and renal toxicity (14.3%) (27). Reduced glomerular filtration rate (GFR) is a common concern in UT recipients, particularly when tacrolimus is used as part of the immunosuppressive regimen (28). There was a significant reduction in GFR from pre-transplant levels (106.4 mL/min per 1.73 m^2) to post-transplant follow-up values (92.1 mL/min per 1.73 m^2, $p = 0.001$). The graft failure rate is 26%, with 72.7% of failures attributed to anastomotic issues and thrombosis, and the remainder due to haemorrhagic shock, infection, or chronic rejection (29- 31). Kisu et al. reported an overall graft failure rate of 19.8%, with a higher rate in DD UT (28%) compared to LD UT (16.9%) (6). The chronic exposure to immunosuppression in UT recipients is associated with a decline in renal function, which can persist even into the postpartum period (32). Veroux et al. noted that 18.6% of LDUT grafts were lost, with the most common causes being vascular thrombosis, recurrent infections, venous outflow obstruction, and poor reperfusion after vascular declamping (33). Given that most uterine living donors are postmenopausal, studies indicate that the size of the uterus decreases with age and that atherosclerosis may reduce uterine vasculature, increasing the risk of graft failure due to poor reperfusion or thrombosis (34). Furthermore, UT recipients may face increased infection risks during pregnancy due to the physiological immunomodulation associated with immunosuppressive therapy. In some cases, graft removal has been necessitated by infections, including uterine abscess, herpes simplex virus (HSV), and candida as well as septic abortion caused by escherichia coli

((29,35,36,37). Recipients must be fully informed about the possibility of graft removal before or during pregnancy due to medical or surgical complications, which could lead to ethical and emotional dilemmas regarding the termination of a pregnancy (38). Ayoubi et al. found that 32.3% of UT recipients experienced complications classified as ≥ Grade III according to the Clavien-Dindo classification, with 23.5% of these complications resulting in graft removal (39). Vaginal stenosis, a frequent complication, often requires re-intervention or stenting (35,37). While some studies have suggested that pre-transplant vaginal characteristics do not influence the incidence of vaginal stenosis, the condition itself does not appear to hinder conception of pregnancy (37). There is currently no early biological or radiological marker to assess uterine function post-transplant. Evaluation typically involves Doppler ultrasound monitoring of uterine arteries, uterine size, and endometrial growth, along with regular monitoring of menstrual cycles. Transplant success rates have been reported to be 74% overall, with 75.0% success in LD UT and 57.1% in DD UT. Pereira et al. cited that pregnancy rates in recipients with viable grafts were 70.3% overall, with 84.6% of pregnancies resulting from LD UT and 15.4% from DD UT. The live birth rate per pregnancy was 60.7%, with 73.0% from LD UT and 27.0% from DD UT. However, 34.6% of recipients experienced at least one pregnancy loss (27). Obstetric complications, including gestational hypertension, preeclampsia, preterm labor, intrahepatic cholestasis of pregnancy, and placentation abnormalities, have been reported (30,37,40). Preeclampsia, gestational diabetes, and hypertension remain common complications in UT recipients (15.4% each), and the correlation between these complications and transplant status is still under investigation. Screening for gestational diabetes is particularly important due to the immunosuppressive therapies involved. Organ transplant remains an invasive procedure with significant risks related to the surgery itself, to rejection and immunosuppression, therefore each expansion of

transplantation medicine (beyond life-saving transplants) challenges the ethical balance (41).

UT Challenges Related to Donors

Hysterectomies performed on living donors generally take around 10 hours due to the complexity of the venous system surrounding the uterus, whereas surgeries involving deceased donors typically last up to 3 hours (29). Once the uterus is confirmed to be healthy, implantation surgeries are usually conducted via open surgery, lasting between 4 and 6 hours (42). Brannstrom et al. reported that the duration of open procedures was between 2–6 hours in 73% of cases (29).

UT Challenges Related to Neonates

Approximately 60.7% of neonates born from UT recipients were preterm, while 39.3% were full-term (30,37,40). Neonatal complications, such as respiratory distress syndrome (RDS), neutrophilia, and hypoglycaemia, have been observed. Furthermore, foetuses may be exposed to immunosuppressive treatments administered to their mothers, potentially affecting fetal development (43). Prematurity and low birth weight are common, likely due to the transplanted uterus's reduced ability to grow and function compared to a native uterus. Additionally, UT recipients often do not feel fetal movements or contractions, further complicating monitoring of the pregnancy. As a result, many UT neonates require extended stays in neonatal intensive care units (NICU), primarily due to RDS (2).

Ethical Considerations

Uterus transplantation is classified as a non-vital organ transplant, raising ethical concerns regarding its necessity and risks (44). Gestational surrogacy could be a low-risk procedure in comparison with UT requiring complicated surgeries followed by high-risk pregnancies (22). The latter must undergo at least three surgical procedures and take immunosuppressive to be able to have a baby. Ethical principles such as beneficence, non-maleficence, and autonomy are frequently discussed in

the context of UT (45). Given the necessity of ongoing immunosuppressive treatment, which can have long-term health implications, most centers limit recipients to a maximum of two pregnancies (46). Informed consent is essential, ensuring that the women and their partners are fully aware of the risks involved in UT. The choice of living versus deceased donors also generates an ethical debate. Although success rates are comparable, living donors face significant health risks, which raises concerns about the ethical implications of their involvement (47,48). Age restrictions, which limit eligibility to women under 30, are common in many centres offering UT. This policy, while justified by medical and scientific considerations, may exclude women over 30, despite the increasing trend of postponing childbearing. This restriction could be seen as unfair, especially in light of the availability of alternative assisted reproductive technologies for older women (49).

Conclusion:

UT is in its infancy more experience is necessary to draw definite conclusions. Although the technique does offer new possibilities for women with AUFI, yet UT remains a complex and high-risk procedure. Therefore, an alternative option such as surrogacy is available. Although both UT and surrogacy are solutions to AUFI that allow the transfer of genetic material from intended parents to a child, it is essential to consider whether the advantages of the UT outweigh the disadvantages as compared to surrogacy.

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Standardized 10-Step Laparoscopic Protocol for Rectosigmoid Deep Endometriosis: Intracorporeal Anastomosis and Transvaginal NOSE Approach (Video Article)

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Abstract

Introduction: Deep infiltrating endometriosis (DE) involving the rectosigmoid colon affects up to 12% of women with endometriosis and is often associated with severe pelvic pain, dyschezia, constipation, and cyclical hematochezia (1). When medical treatment fails or when bowel function is compromised due to transmural infiltration, segmental bowel resection becomes necessary to achieve symptom relief and prevent recurrence. However, this type of surgery carries inherent complexity, particularly due to the proximity of autonomic pelvic nerves and the need to maintain bowel and bladder function postoperatively (2, 3). Traditionally, laparoscopic segmental resections have required mini-laparotomy for specimen retrieval and anastomosis construction. These steps, while effective, are associated with added morbidity, including increased postoperative pain, longer recovery, and wound complications (4). Recent advances in minimally invasive surgery have allowed the development of techniques that avoid these limitations by combining Totally Intracorporeal Colorectal Anastomosis (TICA) with NOSE - most often via the vagina in gynecologic cases (5, 6). Although these innovations represent a shift toward truly scarless surgery, their application remains inconsistent, and their technical complexity can be a barrier to adoption. The absence of standardized, step-by-step protocols further contributes to variability in outcomes and surgical learning curves. Therefore, there is a pressing need to define reproducible techniques that can guide surgical teams and facilitate broader implementation in specialized centers treating bowel endometriosis.

Learning Objective: To present a standardized and reproducible 10-step laparoscopic technique for segmental bowel resection and totally intracorporeal colorectal anastomosis in the treatment of rectosigmoid Deep infiltrating Endometriosis (DE),

incorporating Natural Orifice Specimen Extraction (NOSE) to reduce surgical morbidity.
This article aims to present a standardized 10-step laparoscopic protocol for rectosigmoid DE excision, incorporating total intracorporeal anastomosis and transvaginal NOSE, as performed in a high-volume multidisciplinary center.

Key words: Rectosigmoid endometriosis, Laparoscopic bowel resection, Segmentary resection, Intracorporeal anastomosis, Natural orifice specimen extraction (NOSE), Deep infiltrating endometriosis (DE).

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Case Presentation:

A 41-year-old woman presented with chronic pelvic pain, dyspareunia, dyschezia, and chronic constipation. Preoperative pelvic MRI confirmed multifocal DE with an endometriotic nodule infiltrating the inner layer of the muscularis propria at the level of the rectosigmoid junction, approximatively 10 cm from the anal verge (#ENZIAN classification: P0, O 0/0, T1/1, A1, B1/1, C3 (rectal-sigmoid), FA). Therefore, a laparoscopic segmental bowel resection was scheduled with inferior mesenteric artery preservation that allows maintaining the innervation of the rectum and preserving the fibers running with the inferior mesenteric artery. At three months post-operative follow-up, there was a complete improvement in gastrointestinal symptoms and no data on complications associated with the surgical procedure were recorded.

Surgical Technique:

Under general anesthesia, the patient was placed in the dorsal decubitus position. Pneumoperitoneum was established via a trans umbilical incision, and three trocars were inserted using the French technique with additional 5 mm trocar in Palmer's point. The 5 mm trocar in the right iliac fossa was changed with a 12 mm trocar in order to allow the subsequent insertion of the laparoscopic linear stapler. A panoramic inspection of the abdominal cavity and pelvis was performed. All visible endometriotic lesions involving the peritoneum, ovaries, and posterior compartment

were excised. For the intestinal treatment a step-by-step technique was performed:

1. **Systematic survey:** MRI correlation with laparoscopic findings.
2. **Dissection of the posterior compartment:** dissection of avascular spaces and landmarks identifications (Ureterolysis and nerve-sparing dissection of hypogastric plexus). Dissection of the posterior pelvic compartment is performed via a medial-to-lateral approach, preserving adjacent structures.
3. **Dissection of the rectovaginal space:** Opening of rectovaginal space while maintaining the integrity of the rectal and vaginal walls
4. **Colpotomy and uterine separation:** In this case, a hysterectomy was performed, and the colpotomy was used for specimen extraction and to introduce the anvil for the intracorporeal anastomosis.
5. **Delimitation of the affected segment:** Segmental bowel resection is indicated due to transmural infiltration and luminal compromise
6. **Resection planning:** Division of mesocolon close to bowel wall to preserve vascularization and autonomic nerves.
7. **Preparation if the distal margin:** The distal margin is transected with a linear stapler
8. **Dissection of the proximal margin:** the proximal bowel is resected using ultrasonic energy, and the specimen is extracted via the vaginal route.
9. **Anvil vaginal insertion and fixation to the proximal stump:** The anvil is introduced transvaginally, and then secured to the proximal stump with tobacco-pouch technique and barbed suture.
10. **Colorectal anastomosis:** The circular stapler is inserted transanal, ensuring proper alignment, and the anastomosis is completed under direct visualization. Anastomotic integrity is confirmed with pneumatic testing and serosal reinforcement. Colpotomy closure with absorbable sutures.

Discussion:

Outcomes and Challenges of Segmental Resection:

Laparoscopic segmental resection of the rectosigmoid for DE can achieve excellent symptomatic relief and long-

term disease control in appropriately selected patients. Mabrouk et al. reported high rates of pain improvement and low recurrence following complete excision of rectosigmoid endometriotic nodules over a 13-year follow-up (2). Nevertheless, this approach is technically demanding and traditionally requires a small laparotomy for specimen retrieval and anastomosis. The added steps of exteriorizing the bowel and performing a hand-sewn anastomosis prolong operative time and contribute to increased postoperative morbidity. Even a mini-Pfannenstiel incision can lead to significant incisional pain, higher wound complication rates (infection or dehiscence), hernia formation, and bleeding at the extraction site. Thus, despite its therapeutic efficacy, conventional segmental resection carries non-negligible risks linked to the abdominal incision and extended operation time.

Advantages of Total Intracorporeal Anastomosis (TICA):

TICA with NOSE has emerged as a promising alternative to minimize the morbidity associated with traditional techniques. Early exploratory studies demonstrated the feasibility of avoiding any laparotomy during DE bowel resection by retrieving specimens trans-anal or trans-vaginally. Akladios et al. were among the first to show that a NOSE approach in endometriosis could be achieved without increasing complication rates, underlining its safety as compared to the conventional mini-laparotomy method (5). More recent series have reinforced that a fully laparoscopic resection with intracorporeal anastomosis is at least as effective as the standard approach while conferring distinct benefits. Notably, preliminary reports suggest that avoiding a mini-laparotomy leads to less postoperative pain and fewer wound-related problems, along with faster recovery of bowel function and shorter hospitalization. In the first direct comparison of TICA versus conventional anastomosis after extraction, Ianieri et al. found that both techniques yielded significant improvements in gastrointestinal symptoms and quality-of-life scores, with no increase in surgical complications in the TICA group (4). By maintaining a purely laparoscopic

field, TICA also facilitates a nerve-sparing surgical strategy to preserve pelvic autonomic neurovascular structures. This nerve-sparing approach is crucial for reducing long-term sequelae such as bladder atony or bowel dysfunction, thereby potentially improving postoperative genitourinary and gastrointestinal quality of life for patients with DE. Overall, TICA enables the surgeon to complete the resection and anastomosis entirely within the abdominal cavity, avoiding the morbidity of an abdominal incision while ensuring adequate disease removal.

Purse-String Intracorporeal Anastomosis Technique:

A key technical refinement to optimize the safety of intracorporeal anastomosis is the use of a laparoscopic purse-string suture to secure the anvil in the proximal colon. This technique, as described by Seracchioli et al., helps stabilize the anvil head and ensures a uniform tissue cuff for the circular anastomosis (7). By pursing the colonic lumen tightly around the anvil shaft, one can eliminate “dog ear” deformities – small corners of tissue that might otherwise be trapped outside the stapler doughnuts – thereby improving the seal integrity of the anastomosis. This method reduces the risk of anastomotic leakage by achieving a symmetric, well-perfused anastomotic ring. In our experience, the purse-string suture also streamlines the intracorporeal anastomotic step by maintaining the anvil in correct position while the circular stapler is aligned transanally. These technical nuances underscore that advanced suturing skills and standardized steps can enhance anastomotic security even when performed totally laparoscopically.

Role of NOSE and Future Directions:

NOSE techniques – including transvaginal and transanal routes – have gained popularity in colorectal endometriosis surgery as a means to avoid abdominal incisions. Accumulating evidence indicates that NOSE can be adopted without compromising surgical outcomes. A recent systematic review and meta-analysis by Kar et al. compared NOSE to mini-laparotomy for specimen retrieval in endometriosis bowel resections and found no differences in major complication rates (approximately 3–5% in both groups)

(6). Importantly, NOSE was associated with a modest but significant reduction in hospital stay, reflecting enhanced recovery, and a trend toward reduced intraoperative blood loss when the entire procedure was completed laparoscopically. These findings suggest that avoiding even a small laparotomy can positively impact patient recovery. However, the review also highlighted the heterogeneity in patient selection and operative techniques across studies and noted that only one randomized controlled trial was available among the data. Thus, while NOSE appears to be a safe and potentially beneficial alternative to traditional specimen retrieval, its definitive advantages remain to be validated. Further standardization of the NOSE procedure and high-quality randomized trials are needed to confirm the long-term benefits and to establish clear guidelines on patient eligibility. As the adoption of TICA with NOSE grows, ongoing evaluation of functional outcomes (bowel function, continence, sexual function) will be critical to ensure that we are truly improving quality of life and not just operative metrics.

Standardized 10-Step Protocol for TICA with NOSE in DE:

Given the complexity of combining advanced laparoscopic resection and NOSE, a structured approach is essential to reproducibly achieve optimal results. This video article introduces a step-by-step, standardized 10-step protocol for laparoscopic segmental bowel resection in DE with totally intracorporeal anastomosis and transvaginal specimen extraction. By delineating the procedure into ten defined steps – from patient and trocars positioning, through nerve-sparing rectal dissection, to intracorporeal anastomotic creation and specimen removal – we aim to streamline the learning curve for this technique. Standardization will facilitate training, improve consistency between surgeons, and ultimately enhance patient outcomes. In summary, adopting TICA with NOSE for rectosigmoid endometriosis can maintain the proven efficacy of segmental resection while minimizing invasiveness. Emphasis on technical details such as the identification of landmarks, nerve-sparing, purse-string for the anastomosis and adherence to a standardized protocol can ensure that

the approach is executed safely. This advancement underscores the continuing evolution of minimally invasive gynecologic surgery, striving to improve the balance between radicality of endometriosis excision and the quality of postoperative recovery.

Conclusion:

The surgical management of rectosigmoid DE presents a significant technical challenge, particularly when segmental bowel resection is required. Although laparoscopic segmental resection with intracorporeal anastomosis and NOSE has emerged as a promising minimally invasive strategy, its widespread adoption is limited by the steep learning curve and the variability in surgical technique across centers. By proposing a standardized 10-step protocol for TICA with NOSE, this study aims to provide a reproducible surgical roadmap that prioritizes safety, anatomical preservation, and functional outcomes. Structured protocols not only improve consistency and surgical performance but also facilitate teaching, training, and knowledge transfer within advanced endometriosis centers. As surgical techniques continue to evolve, standardization becomes essential to democratize access to high-quality care and to ensure that the benefits of minimally invasive radical excision are available to a broader patient population.

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The Multidisciplinary Team Approach to Deep Infiltrating Endometriosis: Exemplary Performance (Opinion Paper)

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Abstract

Deep Infiltrating Endometriosis (DE) is a multifaceted gynaecological disorder that requires the integration of different disciplines. This review focuses on the Multidisciplinary Team (MDT) approach in the care and management of DE, highlights the key considerations, and explores future implications. An MDT, generally involving gynaecologists, colorectal surgeons, urologists, and pain specialists directed towards more accurate diagnosis, improved surgical outcomes and greater patient-centred symptom management. The potential barriers to MDT include financial and logistical restraints, issues related to seamless coordination between multiple disciplines, and unintentional treatment delays. Strategies to overcome these barriers must include standardizing care processes, capitalizing on developments in tele-conferencing, aligning patient pathways to avoid duplication of service and putting services in place that would be responsive to patient needs by engaging patients in patient-centred research. Although clear barriers exist, the MDT approach should provide benefits in the management of DE. The MDT approach engages closely with recommendations from leading organizations and should apply principles that are fundamental to optimal service delivery of health care. It is necessary to address these barriers to attain holistic care and management of DE.

Keywords: Multidisciplinary Team, Endometriosis, Comprehensive Care, Collaborative Management, Patient-Centred, Excision Surgery

Abbreviations: MDT- Multidisciplinary team, VATS - Video-Assisted Thoracoscopic Surgery, DE - Deep Infiltrating Endometriosis,

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Introduction:

Endometriosis is an increasingly common gynecological disease that affects a significant proportion of reproductive-age women throughout the world. Endometriosis involves the presence of endometrial glands and stroma outside of the uterus with a number of different presentations, including peritoneal endometriosis, ovarian endometriosis, and DE (1–3). DE is an aggressive form of endometriosis that invades greater than 5 mm below the peritoneal surface. The presence of DE can affect multiple organ systems including the bowel, urinary tract, as well as distant invasions to the thoracic cavity (the lungs and diaphragm). Bowel endometriosis has a significant prevalence in the population of women with pelvic endometriosis (5-40%) and up to 10% of these women have urinary tract endometriosis (3). The complexity of DE involves numerous systems, therein making definitive treatment challenging: thus, a comprehensive and multidimensional global approach in management is important. In fact, there has been a better appreciation recently for the MDT approach to manage the difficulties of DE. The MDT approach to management certainly indicates a shift in the direction of optimal healthcare (4). For example, the 1995 the Calman-Hine report suggested MDT approach to chronic disease management was the best model (5). Additionally, the European Society for Human Reproduction and Embryology (ESHRE) Guidelines on the Diagnosis and Management of Endometriosis highlighted that the MDT approach should be the "gold standard" for the management of complex clinically significant cases of DE (6). The guidelines emphasize the importance of referring patients to tertiary centres with the necessary expertise providing the treatments are offered in a multidisciplinary context (6). The British Society for Gynaecological Endoscopy, (BSGE) recently put forward criteria for organizations undertaking complex endometriosis surgical procedures, which acknowledge the importance of a multidisciplinary team including colorectal surgeons and nurse specialists (3,7,8). The MDT approach provides integrated care that accounts for the multidimensional aspects of DE. These aspects ensure accurate diagnosis, surgical planning and holistic care with psychological input (9-18). However, we must consider and address potential obstacles

and limitations to implementing this approach. This opinion paper investigates the role of the MDT in the management of DE, including its potential benefits and obstacles that need to be addressed to optimize outcomes for women with DE.

Materials and Methods:

This is an opinion paper informed by more than 15 years of clinical experience with an evidence-based support. A literature search was undertaken in the scientific databases managed by PubMed, Springer Nature, and Elsevier for literature research in English from 2010 to 2024. Varying combinations of the relevant terms were used: "multidisciplinary-team," "multidisciplinary-approach," "multidisciplinary-care," "multidisciplinary-treatment," "deep-infiltrating endometriosis." All relevant articles were examined including references, and thirty-three relevant papers have been included in this paper. A retrospective review of the case of a 41-year-old nulliparous female with clinically severe DE, who was managed by an MDT approach, was also included. The case highlights the potential benefit of an interdisciplinary approach with respect to surgical planning, intraoperative management and postoperative care.

A Multidisciplinary Team (MDT) Approach- WHAT does this mean?

A multidisciplinary team approach is a collaborative model of healthcare that integrates professionals from diverse disciplines to provide comprehensive coordinated care for patients with complex medical conditions (3,4,7). The MDT approach has significantly gained recognition and has been implemented across various medical fields, especially in managing chronic and multifaceted diseases. The MDT approach has increasingly become significant in managing endometriosis due to the disease's complexity and its broad impacts on the lives of patients (11). The MDT usually comprises gynaecologists, colorectal surgeons, urologists, radiologists, cardiothoracic surgeons, pain management specialists/anaesthesiologists, fertility experts, physiotherapists, specialized nurses, nutritionists, and psychologists (3,19). The core of the MDT approach involves regular team meetings focused on discussing patient cases and formulating treatment plans. The forums ensure shared decision-making

where each individual contributes their expertise to develop a comprehensive approach to managing the patient's condition. This ensures that all aspects of the patient's care are considered from the onset, diagnostic procedures to surgical planning and long-term care in management including psychological support (3).

Rationale for MDT Approach in DE – The "WHY"

Perspective underscores the importance of an MDT approach in managing DE: Authors' Illustration of the rationale for MDT in DIE (Fig 1). Implementing the MDT approach to managing DE offers potential benefits including:

Improved diagnostic accuracy:

The MDT approach combines the expertise of various specialists, allowing for a more comprehensive and quicker evaluation of the patient's condition (3,18).

Better surgical outcomes:

The MDT approach provides a collaborative platform yielding better surgical outcomes such as fertility preservation and reduced pain. It reduces complication rates and ensures more complete excision of endometriotic lesions whilst ensuring conservation of function (17,18).

The MDT approach provides effective pain management strategies.:

Pain specialists and physiotherapists within the MDT integrate pharmacological and non-pharmacological modalities to address the chronic pain associated with DE (15,17). The MDT approach ensures a more efficient use of healthcare resources, averting fragmented care and redundant interventions. It provides a collaborative environment that facilitates opportunities for research and innovation in treating DE, advancing clinical practice as well as the scientific understanding of the disease (20,21).

Enhanced fertility management:

An MDT involving fertility specialists can optimize the timing and type of treatments including pre-operative harvesting and freezing of ova to avert risks of loss of ovarian reserve that occurs with surgery.

Psychological support:

Given the emotional toll of chronic illness, access to psychological support within the MDT can improve a patient's mental health and overall quality of life, reducing risks and burden of anxiety or depression, typical with endometriosis.

Cost-effectiveness:

Currently, most endometriosis patients must undergo repeated visits, evaluations, treatments, or surgeries. In an MDT approach, there is optimal care right from early diagnosis to better surgical and medical outcomes with treatment planning that minimizes patient risk.

Continuity of care:

Coordinated care allows smoother transitions between different treatments and follow-up appointments, improving overall DIE management and ensures patient satisfaction.

Elements of an MDT for Endometriosis:

What makes up an MDT is illustrated in Figure 2. The gynaecologist, with special interest in endometriosis, is typically the main team member responsible for managing the gynecological aspects of care for the patient. This would include an initial assessment of the patient, the surgical management of the gynaecological aspects of endometriosis, and the overall management of the treatment plan for the patient. As a specialized clinician, the gynaecologist plans and completes complex laparoscopic surgeries for endometriosis excision (3,22,23). He/she collaborates with the radiologist/sonographer in the patient assessment process to obtain the diagnostic imaging assessment of the extent and location of DE. Accurate imaging is essential for optimal operative planning as well as postoperative assessments and evaluation (24). The colorectal surgeon has a vital role when there is bowel involvement requiring surgery. Depending on the size, extent, and location of the nodule, the colorectal surgeon will advise on the type of surgery to be performed and conduct the procedure alongside the gynecologist (3,16,20,25). Urologists play a critical role when endometriosis involves the urinary tract (mostly the bladder and ureters). They may be part of the patient's preoperative evaluation to determine the extent of disease involvement (26). During surgery, they may collaborate with the gynecologist to excise bladder and ureteral endometriosis using the best surgical approach (26). A cardiothoracic surgeon is crucial in cases involving thoracic endometriosis (27,28). Surgical intervention may include the excision of thoracic or diaphragmatic endometriotic lesions (27). Pain management is a critical aspect of endometriosis care. Pain

specialists/anaesthesiologists provide better approaches and strategies (both pharmacological and non-pharmacological) for chronic pain management (12,21,29,30). Infertility is often one of the primary symptoms of endometriosis in women of reproductive age. Fertility specialists are commonly a part of the MDT as they can provide input on fertility preservation and on the timing of fertility treatment with other management goals for endometriosis (6,31,32). Women with endometriosis frequently describe having gastrointestinal symptoms, including bloating, dyschezia and constipation. Treating endometriosis improves these symptoms. Occasionally, the patient may require a referral to a gastroenterologist for consultation. The gastroenterologist will identify the cause of the gastrointestinal symptoms (e.g., gastrointestinal bleeding), providing an accurate diagnosis and management of gastrointestinal complications related to endometriosis (20). Often, the specialized endometriosis nurse will be resourceful to patients given that they are the care coordinator. They create continuity of care and connection with the patient and team (22). The physiotherapist addresses the musculoskeletal challenges frequently associated with endometriosis and pelvic floor dysfunction. Physiotherapists assist with treatment to alleviate associated pain, pelvic floor function, and general feeling of physical wellness (2,15). Endometriosis has significant psychological impacts. Patients can experience depression and anxiety, relationships, and self-esteem issues. Psychologists are crucial in the MDT. They walk with patients in their journey toward their optimal mental health (10,11,14). The Gynaecologist is at the core of coordinating the various specialties in providing care at various stages in endometriosis management (Figure 2).

A Typical Care Journey of an Endometriosis patient:

In a typical care journey, a patient may first present to a physician with the typical symptoms and other cyclical pain experiences such as chest pain and low back pain. In these situations, symptoms can be misattributed to other issues, physicians refer to different specialists inconsistently, leading to a delayed diagnosis and disrupted care. The initial consultation occurs before diagnosis. A patient is typically diagnosed after a consultation when imaging (ultrasound or MRI) has been requested and carried out, and after sending a referral for a diagnostic

laparoscopy. Once a treatment plan is established and surgery is booked, it is common for a patient to be referred to one specialist, usually a gynecologist, who will make all decisions regarding their care, without collaboration or collegiality from other specialists that may have been involved, such as colorectal surgeons, urologists, etc. In seeking postsurgical care, often, the patient experience is singularly concerned with the resolution of their symptoms, usually without holistic recovery, as there was minimal support for the emotional, psychological, and fertility issues that patients have. Patients talk about receiving good care from their specialists, highlighting concerns regarding the issues surrounding re-emergence of symptoms. For true longitudinal care of this chronic condition, there is insufficient collaboration or collegiality amongst specialists. However, an MDT approach is a completely different experience, as we have intentionally designed and integrated collaborative models of input from different specialists (Figure 3).

Navigating the Potential Challenges/Barriers

While there are significant benefits to MDT, there are also some critical challenges and barriers that must be addressed. The MDT model engages various specialties in patient care. Its coordination, if not seamless, can severely impact the success of the MDT model of care. Developing written or well-orchestrated communication systems and decision pathways is necessary to address such challenges (4,33). The MDT model requires significant resources. Involving MDTs for DE management will be a challenge in some care settings such as in rural/remote healthcare. There will be fewer or no specialists, as the access to higher specialty care is more limited in their areas. This disparity creates many challenges to providing the best possible DE care in the most complex cases. It will be necessary to discuss and examine alternative and cost-effective models of care for implementing MDT principles across the health care continuum (4).

Consultation delay:

Could occur because an MDT assessment implies consulting multiple specialties. A thorough assessment is the clear priority consideration, but must be managed adequately against time. As such, all specialists must jointly facilitate referral consultations and to ensure that there are correct treatment pathways for the patients to follow to

mitigate treatment delay (4). Differences in MDT composition and practices across health care settings may lead to variability in DE care. It is important to develop standardized protocols for the MDT approach regardless of health care setting. New approaches such as virtual MDT meetings may be important for addressing challenges related to geographical distance and service access for specialized services for patients in remote areas, which is to be appreciated. This will assist the MDT in effectively optimizing care for patients with DE and improving patient outcomes (4).

Endometriosis Case Study Demonstrating the MDT Approach

The case involves a 41-year-old nulliparous woman, with a history of right groin pain, menorrhagia and dysmenorrhea. A detailed transvaginal ultrasound scan for DE was performed by the radiologist. The findings revealed a uterus with extensive diffuse adenomyosis, multiple small intramural myomas, with a negative sliding sign both anteriorly and posteriorly. Extensive endometriosis was noted: Bilateral uterosacral ligaments nodules, the right measuring 2.7 cm x 0.9 cm and the left measuring 1.6 cm x 0.83 cm, Torus nodules (3.0 cm x 0.6 cm and 3.8 cm x 1.0 cm), Bowel nodule with significant deep infiltration, tubo-ovarian pelvic adhesions, and inguinal avascular nodule (3.2 cm x 2.0 cm) about 2 mm away from femoral artery. A pseudo-cyst involving the bladder was also noted. The #Enzian classification for the ultrasound findings was: T2/2, A3, B2/2, C3, FA, FB, F(inguinal) + Myoma.

The following observations were made during surgery:

- The uterus was adherent to the anterior abdominal wall and bladder.
- Bilateral fallopian tubes were adherent to the uterus, ovaries, lateral pelvic wall, and bowel.
- Thickening of the pelvic peritoneum was noted near the left external iliac vein.
- Bilateral uterosacral ligaments displayed thickening with endometriotic and torus nodules.
- A right hydro-ureter was observed due to compression by an endometriotic nodule.

The Intra-operative findings had the following #Enzian classification: P3, T3/3, A3, B3/3, FA, FB, F(inguinal) + Myoma. Laparoscopic surgery for endometriosis (lasting 7 hours and 16 minutes) involved the following key

areas – demonstrating the MDT approach the anaesthetist did administer regional blocks and analgesics. The gynaecologist performed the following:

-Bilateral ureterolysis
-Endometriotic nodules resection from the bilateral uterosacral ligaments and torus.
-Freeing of the bowel from adhesions to the uterus, right ovary, and lateral pelvic wall.
-Resection of an endometriotic nodule from the right lateral pelvic wall near the external iliac vein (peritonectomy).
-Detaching the uterus from the anterior abdominal wall and bladder.
-A right salpingectomy.
The colorectal surgeon performed the following:
-Rectal mobilization and nodule shaving
-Ileocecal resection and appendicectomy using a linear stapler.
-Rectal nodule resection.
A vascular and general surgeon:
-collaborated on the right iliac fossa nodule resection (laparotomy) and subsequent mesh repair, as the nodule extended towards the thigh.

<u>Post-Op Follow-up:</u>
Outcome and progress pain management: the patient reports reduced pain and indicates improved quality of life. Nutritional support: specialized nutritional advice was provided on anti-inflammatory foods and gut health after major bowel surgery. A structured meal plan was introduced to complement wound repair and reduce post-operative inflammation. It was recommended that small, frequent meals be attempted during the early recovery period, with transition to a regular diet as soon as bowel function returns to normal. Physiotherapy: the patient was seen by the physiotherapist for mobilization of the pelvic floor muscles. Psychological support: the patient was linked to a clinical psychologist with specialized knowledge in chronic pain and fertility concerns. Regular counselling was done regarding the surgery, pain control, and fertility issues. The psychological support helped develop coping strategies for possible anxiety and depression that could arise out of the long recovery process. The patient is currently on suppression therapy awaiting fertility treatment.

Conclusion:

The MDT model is regarded as a key evolution in managing DE and an advancement toward the more holistic

and patient-centred care. The MDT brings together clinicians from various specialties, including obstetricians and gynaecologists, colorectal surgeons, urologists, radiologists, chronic pain experts, fertility experts, and psychologists to ensure each perspective relating to a patient's presentation has been modelled into the individualized care. The MDT is a collaborative effort for which clinicians contribute their specialties over time, with prospectives for future innovation for managing DE effectively. The key challenges associated with an MDT approach include limited resource base, scheduling and coordinating the various specialists, unequal access to these specialists and resources, resulting in potential delays in DE management. These issues suggest variations in quality of care. There is a need for standardized practices whilst accommodating local needs and resources. Knowledge education is necessary to enhance standard of care. Therefore, an MDT approach has great potential to manage DE, but potential barriers must be addressed to create an opportunity to work towards true patient-centred, holistic and effective care for this complex condition.

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Figures:

Figure 1: Rational of MDT in DIE

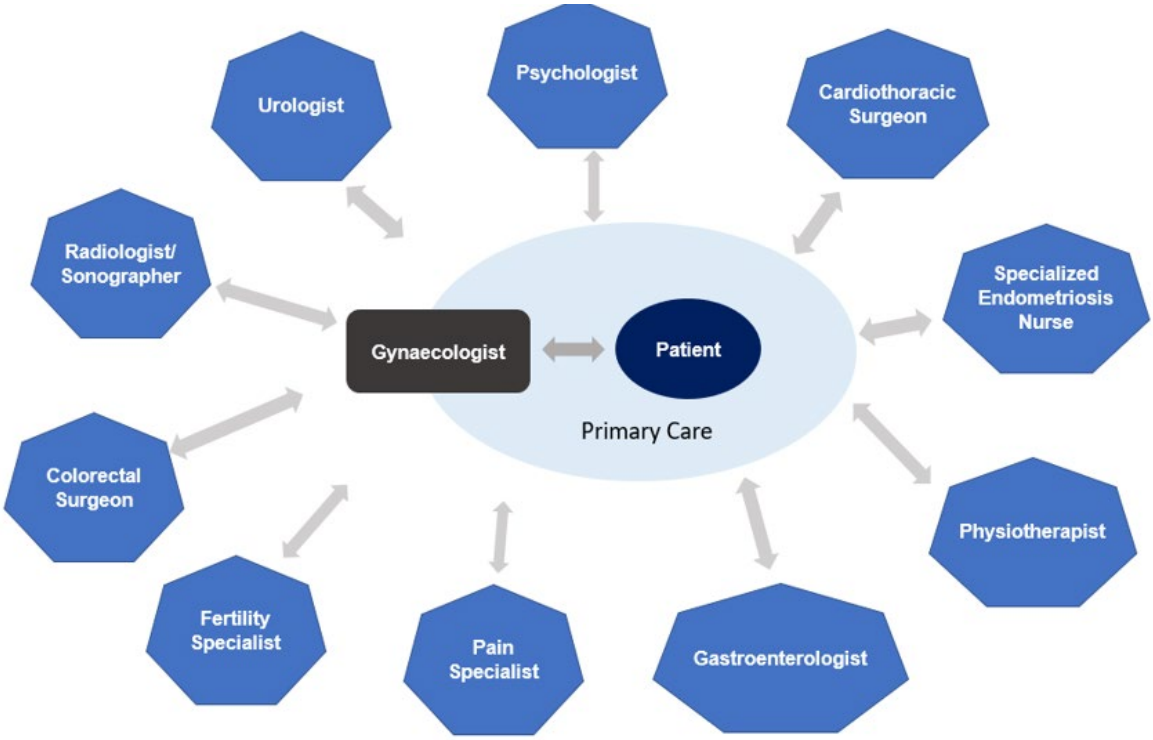

Figure 2: Authors illustration what makes up an MDT

Patient Journey in MDT for DIE:

Initial Consultation (Gynecologist, Radiologist/Sonographer)

- **Gynecologist**: A patient comes with endometriosis related symptoms (pain, infertility, etc.) and the initial consultation and physical examination is done. .
- **Radiologist/Sonographer**: Imaging modalities such as MRI and ultrasound assess this extent of endometriosis. The diagnostic information is given to the MDT to achieve a diagnosis and make decisions regarding cases moving forward.

Preoperative Planning (Gynecologist, Colorectal Surgeon, Urologist, Cardiothoracic Surgeon, Gastroenterologist)

- **Gynecologist**: Will lead the preoperative planning process coordinating the care of each of the specialists based on the lesions' locations.
- **Colorectal Surgeon**: If bowel endometriosis was diagnosed the colorectal surgeon may be involved in the surgical plan.
- **Urologist**: If urinary tract involvement is suspected, a urologist may advise on potentially surgical approaches to bladder endometriosis or ureteral endometriosis.
- **Cardiothoracic Surgeon**: If thoracic endometriosis (e.g., identifying some diaphragmatic endometriosis) was made, will be involved in planning for excision for lesions in the thoracic cavity.
- **Fertility Specialist**: May be involved with the patient and the gynecologist on fertility goals for endometriosis patient with low AMH levels to consider specific aspects such as pre-operative oocyte freezing.
- **Gastroenterologist**: Is involved in managing gastrointestinal symptoms and in cases of bowel endometriosis.

Surgical Intervention (Anesthesiologist, Gynecologist, Colorectal Surgeon, Urologist, Cardiothoracic Surgeon)

- **Anesthesiologist-** involved in pain management.
- **Gynecologist**: Leads the surgical procedure and ensures the excision of endometriotic lesions in the reproductive system.
- **Colorectal Surgeon**: Involved in bowel resection, where necessary.
- **Urologist**: May perform excision or ureterolysis during surgery, when there is involvement of the urinary tract.
- **Cardiothoracic Surgeon**: Conducts excision of the thoracic lesions.

Postoperative Care and Recovery (Pain Specialist, Psychologist, Physiotherapist, Fertility Specialist)

- **Anesthesiologist**: Manages postoperative pain using both pharmacological and non-pharmacological approaches.
- **Psychologist**: Provides mental health support to help the patient cope with post-op emotional and psychological challenges.
- **Physiotherapist**: Assists with physical recovery, offering therapies for pain relief, mobility, and pelvic floor dysfunction.
- **Fertility Specialist**: Collaborates with the patient and the gynecologist on fertility preservation and future fertility treatments, if applicable.

Long-term Management (Gynecologist, Specialized Endometriosis Nurse, Pain Specialist, Fertility Specialist, Gastroenterologist)

- **Gynecologist**: Oversees long-term management, ensuring proper follow-ups and monitoring for recurrence.
- **Specialized Endometriosis Nurse**: Provides ongoing support and ensures continuity of care.
- **Anesthesiologist**: Addresses chronic pain in cases where it arises.
- **Fertility Specialist**: Monitors fertility treatments and offers advice on conception plans.
- **Gastroenterologist**: Monitors gastrointestinal symptoms for effective management of post-surgical digestive complications.

Figure 3: Patient journey **in**

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A Triplet Heterotopic Pregnancy with Favourable Outcome after Laparoscopic Salpingectomy and Loss of One Intrauterine Twin

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Abstract

Heterotopic pregnancy is defined as the simultaneous presence of an intrauterine pregnancy and an ectopic pregnancy in the same patient, independent of the location of the ectopic pregnancy. This is a rare and often unrecognized pathology that poses a diagnostic problem and can be life-threatening if not diagnosed in time. The case reported is of a heterotopic pregnancy, seldom described in the literature; an eight-week evolving triplet pregnancy including a ruptured tubal pregnancy and a twin intrauterine pregnancy. Management consisted of laparoscopic surgery, with salpingectomy to eliminate the ruptured tubal pregnancy while preserving the intrauterine twin pregnancy. The post-operative course was marked one week later by the death of one of the intrauterine twins. The pregnancy was closely monitored and an elective caesarean section performed at thirty-eight weeks enabled the birth of a healthy new-born who weighed 2500g.

Key words:

pregnancy, heterotopic, triplet, laparoscopy, outcome.

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Introduction:

Heterotopic pregnancy (HP), also known as ditopic pregnancy or combined pregnancy, is defined by the simultaneous presence of an intrauterine gestational sac and an ectopic one. It is a combination of an intrauterine pregnancy (IUP) and an ectopic pregnancy (EP) in the same patient,

independent of the location of the EP (1–3). This is a rare and often unrecognized pathology that poses diagnostic problems and can be life-threatening if not diagnosed in time (4–6). The case of a patient admitted to the University Hospital of Kinshasa, carrying an eight-week evolving triplet heterotopic pregnancy, including a ruptured tubal pregnancy and a twin intrauterine pregnancy, a sequence rarely described in the literature is reported.

Case:

A 39-year-old female patient, married for two years, gravida two, nulliparous, consulted the Assossa Medical Polyclinic in December 2023 for fertility care. Her history included a miscarriage shortly after her wedding. The physical examination was unremarkable, and ultrasound showed fibroids: one antero fundal, type 3-5, measuring 41x30 mm, and two antero corporeal, type 4 and 3, measuring 25x19 mm and 18x12 mm respectively. Hysterosalpingography showed bilateral tubal permeability. She was also treated at the same clinic for an upper genital infection. In June 2024, she underwent ovulation induction with Clomiphene Citrate 50 mg daily from day two to six of the menstrual cycle, followed by progesterone twice a day 200 mg from day 17 to day 27 of the menstrual cycle. More than a month later, she went back to the hospital for a delay in her periods, and the pregnancy test was positive. A first ultrasound scan showed two intrauterine gestational sacs with no embryonic echoes. A second ultrasound two weeks later showed a heterotopic pregnancy with two intrauterine sacs and a sac in the right tube (Figure 1). The patient was transferred to the University Hospital of Kinshasa.

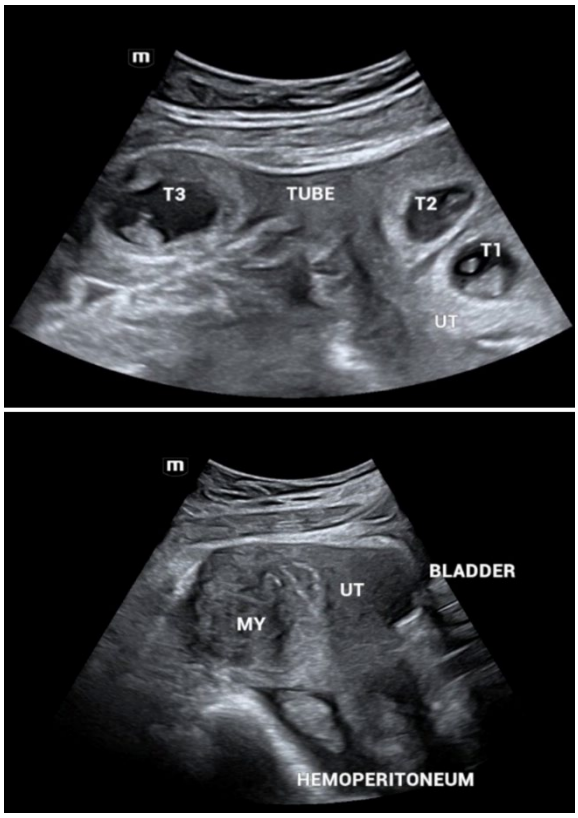

Figure 1: Ultrasound findings: A shows three gestational sacs, two of which are intrauterine (UT) twins (T1, T2) and one in the right tube (T3). B shows a sagittal section of the pelvis. A posterofundal fibroid (MY) and an effusion in the Douglas suggesting hemoperitoneum

were noted.

On admission, she was lucid, blood pressure was 125/80 mmHg, slightly tachycardic at 104 beats per minute, palpebral conjunctivae moderately coloured, abdomen not bloated, soft and depressible with tenderness to the right iliac fossa. On speculum examination, the cervix appeared healthy, the Douglas was not bulging, and on vaginal examination, the uterus was enlarged, with palpation of a 2 cm right adnexal mass, tender and soft. Ultrasound showed an evolving intrauterine twin pregnancy (with cardiac activity) of eight weeks, an evolving right ampullary pregnancy (with cardiac activity) with marginal trophoblastic detachment, moderate intra-abdominal bleeding ion and a large 53x49 mm type 5 postero fundal fibroid.

Management:

Prior to surgery, the patient was placed on an intramuscular progesterone injection combined with an antispasmodic infusion (phloroglucinol in glucose serum). The aim of treatment was to perform a salpingectomy while preserving the intrauterine twin pregnancy. Laparoscopic surgery was opted for, which revealed the following findings: a moderate hemoperitoneum with multiple blood clots, an enlarged gravid uterus, a ruptured right ampullary pregnancy no longer actively bleeding and normal left adnexa (Figure 2).

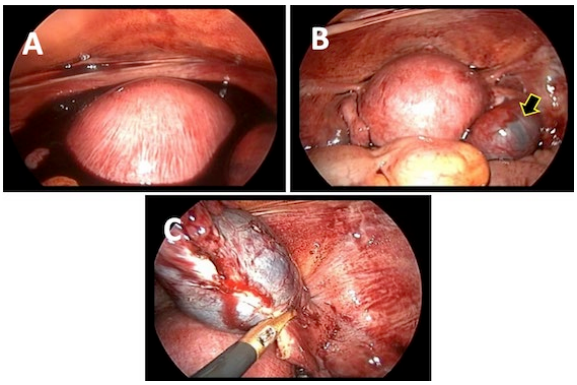

*Figure 2: **A** shows the hemato-peritoneum; **B** shows the pregnant uterus and the ruptured tubal pregnancy; **C** shows the salpingectomy*

300 ml of hemoperitoneum were aspirated first and thereafter a total right salpingectomy was performed using bipolar shears with coagulation and cutting mode. An ultrasound performed immediately post- operatively showed an evolving intrauterine twin pregnancy, and the patient continued with her treatment consisting of progesterone twice a day 200 mg intravaginally and phloroglucinol three times 80 mg intrarectally. Another ultrasound scan performed a week after the operation showed the death of an intrauterine twin at nine weeks. Closer prenatal visits than the usual schedule were performed. At 38 weeks, the patient underwent an elective caesarean section which resulted in the extraction of a female healthy new-

born weighing 2500 g with an APGAR of 9/9/10, a length of 48 cm, a head circumference of 33 cm and a chest circumference of 32 cm (Figure 3). Examination of the placenta revealed a single placenta with a para-central umbilical cord insertion without anomaly, suggesting the disappearance of the dead twin at nine weeks.

Figure 3: Caesarean section images

Discussion:

Heterotopic pregnancy (HP) is a fairly rare pathology. The first case was discovered and described in 1761 by Joseph-Guichard Duverney (7) during the autopsy of a woman in the third month of pregnancy. In the literature, the reported frequency of heterotopic pregnancies in spontaneous cycles is 1/30.000 pregnancies. This frequency is multiplied by 60, even up to 300, when assisted reproduction techniques (ART) are used, i.e. 1/100 to 1/500 pregnancies (2,8,9). Today, its frequency is tending to increase with the development of ART (10). The resurgence of upper genital infections is also a major risk factor after ART (1,2,11). In terms of etiopathogenesis, several theories have been put forward. Ectopic implantation of one of the eggs may be due either to successive fertilizations of two oocytes by two spermatozoa, delayed in time, or to a difference in the migration speed of two simultaneously fertilized eggs. The inhibitory effect of progesterone secreted by the intrauterine implanted egg on tubal peristalsis may be the reason why the second egg stops progressing (1,12). The diagnosis of a heterotopic pregnancy should be made early (before rupture) to enable early management (13,14). However, the visualization of an intrauterine gestational sac very often does not motivate the sonographer to look for another location (4). A systematic review of the literature published in the UK showed that during the period 2005 to 2010, 33% of patients with heterotopic pregnancies had already had a previous ultrasound scan that had concluded to an intrauterine pregnancy (14). This was also the case for the patient presented in this study, whose heterotopic pregnancy was diagnosed at the second ultrasound scan. The most common ectopic location is tubal (15). Management of HP consists in eliminating the ectopic pregnancy and

allowing the intrauterine pregnancy to progress (8). This may involve laparoscopic or laparotomic salpingectomy, ultrasound-guided transvaginal injection of potassium chloride, methotrexate or hyperosmolar glucose, even ultrasound-guided aspiration of the ectopic pregnancy (5,8,15-19). However, laparoscopy is currently the most recommended treatment, as it limits the risk of miscarriage, the prevalence of which after surgery remains around 6.2% (15). The disappearance of an intrauterine twin after salpingectomy, also known as Vanishing Twin Syndrome (VTS), is a complex and multifactorial condition. Although salpingectomy is intended to preserve the mother's life by treating the ectopic pregnancy, in rare cases it can be followed by arrested development of the intrauterine twin. Potential mechanisms are: first intrinsic chromosomal or development anomalies of the intrauterine twin. This is the most frequently cited and most important mechanism in VTS, whether or not surgery is performed. The phenomenon of spontaneous reduction after vanishing of a twin is common in multiple pregnancies (20). The fading twin often carries chromosomal or genetic abnormalities that are incompatible with life. The resorption of this twin is a natural selection process. Salpingectomy, in this case, would not be the direct cause of the disappearance, but a concomitant event or stress factor that accelerates the detection of this underlying non-viability (21–23). The second mechanism is physiological stress. Ectopic pregnancy, particularly if it is symptomatic (pain, bleeding) or in the event of rupture, represents considerable physiological stress for the maternal body. Laparoscopic surgery, although minimally invasive, also adds to this stress. The presence of ectopic tissue, particularly in the event of tubal bleeding or rupture, triggers an inflammatory cascade. Pro-inflammatory cytokines (such as IL-1, TNF-alpha) and other mediators may be released (24,25). Although inflammation is crucial for implantation and maintenance of pregnancy, excessive or aberrant inflammation can be deleterious to early embryonic development and the uterine environment, increasing the risk of miscarriage (26). Surgical stress can also exacerbate this response especially if the uterus is manipulated during the operation (27,28). Finally, there is the stress of general anesthesia (29). The third mechanism is ischemia associated with local or systemic hypoxia: a ruptured ectopic pregnancy can lead to significant internal haemorrhage, which can cause systemic hypoperfusion in the

mother. Although the uterus is a well-vascularized organ, even mild transient hypoxia or ischemia could compromise the viability of an already fragile intrauterine embryo (30,31). The last mechanism is the alteration in hormonal balance after salpingectomy. Although the intrauterine pregnancy is the main source of Human Chorionic Gonadotropin (hCG) after a certain stage, ectopic pregnancy also contributes to the production of pregnancy hormones. Removal of this ectopic trophoblastic tissue can lead to hormonal readjustments. Salpingectomy removes a site of hCG production. Although the fall in hormone levels is generally minimal and the intrauterine twin is supposed to compensate, an already vulnerable intrauterine embryo could be sensitive to these fluctuations, however slight. A temporary reduction in hormonal stimulation could affect the endometrial environment and incipient placental function.

Conclusion

This case highlights the exceptional rarity and diagnostic challenges posed by heterotopic pregnancies. It provides valuable insights into the complexities of this rare condition. It reinforces the importance of considering heterotopic pregnancy in differential diagnoses, especially in patients with pain and pregnancy, and demonstrates that prompt surgical intervention can be life-saving while aiming for the best possible outcome for the intrauterine pregnancy. The subsequent close monitoring and successful delivery, despite the unfortunate early loss of one twin, highlight the resilience and adaptability required in managing such high-risk pregnancies.

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Female Vulvar Leiomyoma Mistaken for Bartholin's Cyst

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Abstract

Leiomyoma of the vulva are very uncommon entities and account for only 0.03% of all gynecological tumours and 0.07% of vulvar tumours in women (1). These mainly occur in women of childbearing age. The patient presented here is 36-year-old women who had found a painless vulvar mass measuring 3x4x3cm at the level of the posterior vaginal opening that was misdiagnosed as a Bartholin's cyst when she was admitted to the hospital, but it turned out to a vulvar leiomyoma during surgery, which was also confirmed by pathology.

Keywords: Vulva, Leiomyoma, Bartholin's cyst, Leiomyosarcoma, Ultrasound

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Introduction:

A leiomyoma of the vulva was first reported by Denys de Leyden in 1733, and its etiology is still unclear. It is generally believed that estrogen and progesterone may contribute to tumor proliferation, as seen with fibroids, which rarely occurs before menarche and usually shrinks or resolve after menopause. A vulvar leiomyoma is very rare benign tumour originating from the smooth muscle cells of the vulvar tissue. It usually grows in the vicinity of the Bartholin 's gland, and can also be seen in the labia majora, labia minora, and clitoris. It presents mostly as a unilateral oval mass, with good mobility, moderate texture, no tenderness, with an independent capsule, and clear boundary with the surrounding tissues. Patients often present with a mass in the

vulva, generally without discomfort, a very small number of patients experience pain, erythema, and itching over the lesion site. The maximum diameter of a leiomyoma in the vulva can reach up to 10 cm, accompanied by symptoms such as heaviness in the vulva, discomfort during sexual intercourse, difficult walking, and it can also present as a pedunculated mass on the vulvar epithelium (2).

Case Presentation:

The patient is a 36-year-old female who had discovered a mass in the vulva for four years that gradually enlarged over the last year. She had one natural delivery and an episiotomy to the left, without any other history of vulvar surgery. At first the size of the mass was about the size of a peanut kernel, and she did not pay much attention to it, the vulvar mass gradually increased in size over the past year and was slightly tender on light pressure. The patient visited our gynecological clinic last year, and the physical examination showed a mass of about 3x4x3 cm in size located in the posterior region of the vaginal opening, with moderate consistency, clear boundaries, and good mobility, without obvious tenderness. The patient was admitted to the hospital with a diagnosis of right Bartholin ‘s cyst. Excision of vulvar lesion was performed after preoperative examinations. The mass was located beneath the fat layer and had clear boundaries with the surrounding tissues. Pathology result confirms the mass to be a leiomyoma of the vulva. (Figure 1, 2). The patient was followed up for one year after the operation. There was no recurrence nor any complaints.

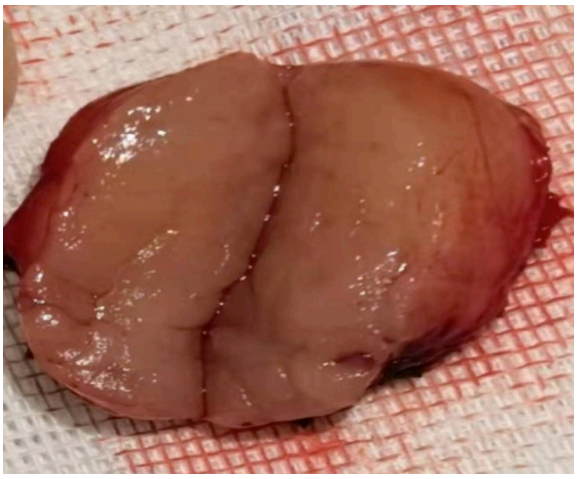

Figure 1: The gross appearance of a vulvar leiomyoma

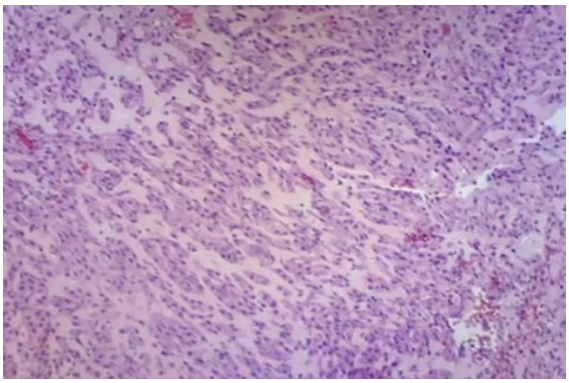

Figure 2: Pathology picture: leiomyoma of the vulva

Discussion:

Clinically is very easy to misdiagnose a leiomyoma of the vulva as a Bartholin's cyst (abscess). The latter is an enlarged mass that can be seen in the lateral part of the vestibule of the vagina on the affected side at pelvic examination, and presents as a cystic mass with fluctuation that can be palpated in the posterior inferior part of the vulva. A vulvar leiomyoma can grow in any part of the vulva, with moderate consistency but is of a solid consistence without fluctuation. In addition, it is still necessary to differentiate from diseases such as sebaceous cyst of vulva, lipoma, fibroma, schwannoma, angiomyofibroblastoma (3). The preoperative diagnosis of vulvar masses can be clinical but can also include imaging. Magnetic resonance imaging (MRI) may have a beneficial role in diagnosing vulvar leiomyoma because of the low signal intensity suggesting smooth muscle on T2-weighted images. It would be advisable to perform a trans labial ultrasound with a transvaginal probe or even better with a high-frequency linear probe before performing an MRI, the latter being expensive and time-consuming. Trans labial ultrasound provides a more precise differential diagnosis: Bartholin's gland, a dense, densely packed fluid or fluid mass with exclusively peripheral vascularization, vulvar fibroma, a solid mass with likely both central and peripheral vascularization. The final diagnosis depends on the postoperative pathologic report and immunohistochemistry microscopically, the pathological patterns are similar to those of a uterine leiomyoma, with spindle cells arranged in bundles or whorls. For tumors with a diameter of > 5 cm, unclear boundaries, > 5 mitoses /10 HP, and significant atypical hyperplasia of cells, the possibility of vulvar leiomyosarcoma should be considered (4). Immunohistochemical markers such as SMA, desmin, and vimentin can assist in diagnosis, and some may show ER (+), PR (+).

The vulvar leiomyoma should be treated actively once diagnosed, and surgical resection with pathological diagnosis should be performed to exclude the possibility of a malignant tumor of vulva, tumor tissue should be completely resected because of the possible recurrence, and a long-term follow-up should be performed after the operation. It has been reported that the time of postoperative recurrences can be as long as more than ten years (5). There are reports of vulvar leiomyoma in pregnancy with rapid growth of the mass

during gestation, considered to be related to elevated estrogen and progesterone levels (6). For pregnant patients presenting with a vulvar leiomyoma, the nature and size of the tumor, gestational weeks, whether the birth canal is obstructed, the risk of surgical bleeding and infection, and the risk of abortion and premature delivery should be considered comprehensively, and then a reasonable treatment plan should be formulated (7).

Conclusions:

In conclusion, due to the rarity of the vulvar leiomyoma and its tendency to be misdiagnosed, it is necessary to perform imaging examination preoperatively such as ultrasound scan or MRI, trans labial ultrasound should be given priority as it is convenient and inexpensive, regardless of the clinical experience of the surgeon.

Acknowledgment:

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Laparoscopic Hypogastric Artery Ligation for Severe Spontaneous Hemorrhage from a Cervical Mass in Pregnancy (Case Report)

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Abstract

Obstetric haemorrhage remains a leading cause of maternal morbidity and mortality worldwide. Selective ligation of the hypogastric (internal iliac) artery is an established surgical option for pelvic haemorrhage control, with the potential to preserve the uterus and ongoing pregnancy. Laparoscopic approaches offer additional benefits in terms of reduced invasiveness and faster recovery. The case of a 40-year- old woman, gravida 4 para 3, at 17.2 weeks of gestation, admitted with profuse vaginal bleeding and signs of hypovolemic shock secondary to spontaneous bleeding from a cervical mass under investigation is reported. Emergency laparoscopic surgery was performed with selective ligation of the right hypogastric artery. The anterior division was identified and ligated with 4-0 chromic suture, achieving haemostasis without complications. Literature supports the use of hypogastric artery ligation for severe obstetric bleeding, whether postpartum or during pregnancy, showing efficacy in reducing blood loss and avoiding more radical procedures. Laparoscopic selective hypogastric artery ligation is a safe and effective option for managing complex obstetric haemorrhage during pregnancy. In experienced hands, it allows rapid haemostatic control, preservation of pregnancy, and minimizes surgical morbidity, representing a valuable tool in conservative obstetric surgery.

Keywords:
hypogastric artery, ligation, laparoscopy, pregnancy complications, haemorrhage.

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Introduction:

Internal iliac (hypogastric) artery ligation is a vital surgical procedure for the control of severe obstetric and gynecological haemorrhage. Although less invasive alternatives, such as selective arterial embolization or temporary balloon occlusion, are currently available, these options present limitations related to resource availability, the need for specialized personnel, and the time required for implementation, which restricts their usefulness in scenarios of massive and unexpected haemorrhage. In this context, several studies have indicated that the prophylactic application of hypogastric ligation during high-risk procedures, such as hysterectomy for placenta accreta, can significantly reduce blood loss and the need for transfusions without increasing complications. A retrospective study conducted in Turkey evaluated the effect of prophylactic ligation of the hypogastric arteries in patients with placenta accreta undergoing hysterectomy. The results showed that this technique significantly reduced intraoperative bleeding, postoperative drainage, and transfusion requirements, without increasing the complication rate or mortality (1). A randomized clinical trial evaluated the efficacy of prophylactic hypogastric (internal iliac artery) ligation before Cesarean hysterectomy in 64 women with abnormal bleeding per partum. Patients who underwent hypogastric ligation had less intraoperative blood loss, less visceral trauma, and reduced surgical and hospital stay times (2). Kostov et al. (2024) review in detail the surgical anatomy of the internal iliac artery, its pelvic anastomoses, and the step-by-step ligation technique, highlighting its therapeutic and prophylactic role in situations such as placenta accreta, uterine rupture, cervical lesions, or bleeding due to advanced gynecological cancer (3). Prajapati et al. (2022) present a retrospective review of 58 cases treated at a tertiary hospital in India over a 20-year period. 53 of these cases were for obstetric reasons and 5 for gynecological reasons. The procedure did control bleeding in 90% of cases of atonic per partum haemorrhages, avoiding hysterectomy in most cases and allowing subsequent pregnancies in 27.3% of women. Complications were rare, including febrile morbidity (6.9%) and superficial vascular lesions (1.7%) (4). Chou et al. (2002) reported the first

documented case of laparoscopic uterine artery ligation using bipolar coagulation to treat delayed postpartum haemorrhage secondary to placental remnants. The procedure effectively controlled bleeding, reduced hospital stays, avoided hysterectomy, and preserved reproductive function, supporting the potential of laparoscopic techniques as safe, minimally invasive alternatives in selected cases (5). A case report of a 29-year-old woman describes how, three days after an uncomplicated vaginal delivery, she presented with massive hemoperitoneum of no apparent cause. Laparoscopic examination identified bleeding from the left uterine artery, which was controlled by laparoscopic ligation of the internal iliac artery. This case highlights the importance of timely diagnosis and treatment and suggests that laparoscopy is a feasible and minimally invasive option for managing this condition, promoting a faster recovery (6). Although open hypogastric artery ligation has been widely used for severe obstetric haemorrhage - including placenta accreta, uterine rupture, and traumatic cervical injuries - and there are isolated reports of laparoscopic approaches to uterine artery ligation for bleeding control, no documented cases of laparoscopic hypogastric artery ligation to treat spontaneous haemorrhage secondary to a cervical mass in a pregnant patient have been identified in the literature. This fact gives this case report unique value, as it provides evidence of the feasibility and efficacy of a minimally invasive approach in an exceptional clinical situation, where bleeding was controlled, uterine integrity was preserved, and major complications were avoided. To date, no reports have been found in the literature on laparoscopic ligation of the hypogastric artery during pregnancy, which emphasizes the novelty and relevance of the present case.

Case Report:

The case of a 40-year-old woman, Gravida 4, Para 3, with a 17.2-week pregnancy, under follow-up for a cervical tumor is reported. No significant pathological, surgical, nor obstetric personal history. She presented to the emergency department due to abundant transvaginal bleeding, accompanied by clinical signs of hypovolemia. On physical examination, active bleeding from the cervical mass was confirmed (Figure 1). Given the magnitude of the bleeding and her hemodynamic condition, an urgent surgical intervention was decided for

selective vascular control.

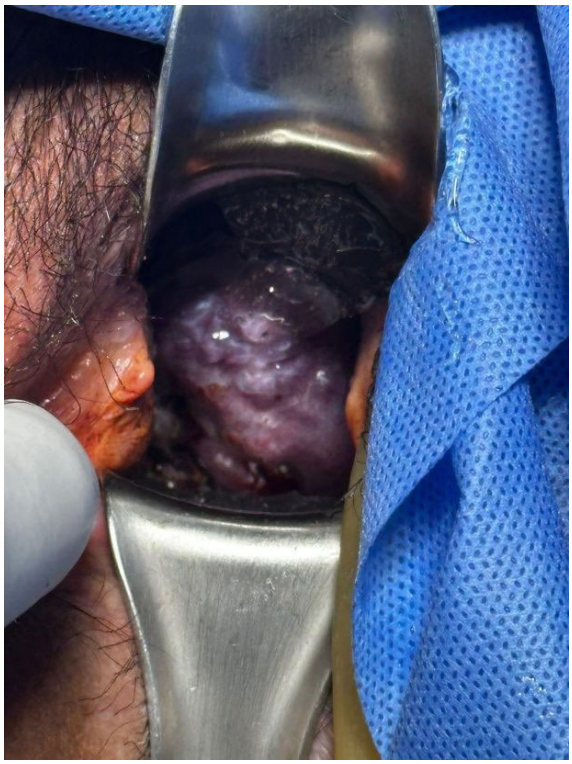

Figure 1: Cervical mass

Under general anesthesia, laparoscopic approach was initiated. Abdominal insufflation was performed through the insertion of a Veress needle at Palmer 's point (Figure 2), followed by the placement of an umbilical trocar as the main port and two accessory trocars.

Figure 2: Insufflation Palmers Point

During the exploration, the right hypogastric artery was identified, locating its anterior division. Ligature was performed with 4-0 chromic suture, with no intraoperative incidents or associated injuries (Figure 3). The total estimated blood loss was 50 ml. Prior to the procedure, the fetal heart rate was 130 beats per minute; at the end, it was recorded at 140 beats per minute. The patient was transferred to the recovery area with stable vital signs, no active bleeding, and adequate peripheral perfusion.

Figure 3A: Window to identify the hypogastric artery

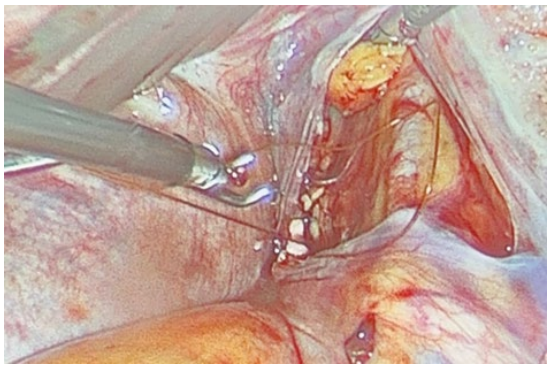

Figure 3B: Ligation of the artery

Discussion:

In the presented case, a 40-year-old

female patient, G4P3, at 17.2 weeks' gestation and with a cervical mass under investigation, was admitted with profuse vaginal bleeding and signs of hypovolemia. Haemostatic control was achieved with selective laparoscopic ligation of the right hypogastric artery, resulting in minimal blood loss and preservation of the pregnancy, with no intraoperative complications. The pregnancy ended in a successful delivery at 38 weeks without complications, and the cervical mass was ultimately diagnosed as a cervical polyp. The available evidence supports hypogastric artery ligation as an effective procedure for the management of severe obstetric haemorrhage, as it preserves the uterus and, in many cases, preserves fertility. However, Tokgöz Çakır et al. (2024) identified that, although this technique does not increase the risk of spontaneous abortion or compromise reproductive capacity, it may be associated with a higher rate of premature birth and low neonatal weight in subsequent pregnancies, which underlines the need for close obstetric follow-up in patients with a history of this procedure, even when performed unilaterally and during ongoing pregnancy (7). Regarding alternatives, several conservative strategies have been described. Paredes-Contreras et al. (2023) reported a case of increased myometrial vascularity in pregnancy treated with bilateral laparoscopic temporary ligation of the uterine arteries, followed by uterine aspiration, which allowed effective control of bleeding, preservation of the uterus, and recovery of vascularisation of the uterus . This option is presented as a useful alternative when embolization is not possible and the objective is to maintain reproductive potential (8). Similarly, Bai et al. (2023) evaluated the efficacy of uterine and internal iliac artery ligation in 199 patients with placenta previa, finding that prophylactic ligation of the internal iliac artery significantly reduced intraoperative bleeding, transfusion needs, and ICU admission rate compared to therapeutic ligation. Furthermore, uterine artery ligation was associated with a lower hysterectomy rate and shorter surgical times, particularly in cases without deep placental invasion. The authors conclude that the choice of technique should be individualized according to the degree of placental invasion and the experience of the surgical team, prioritizing uterine ligation in less invasive scenarios and internal iliac ligation in cases of penetrating implants or bladder invasion (9). Likewise,

previous reports reinforce the relevance of this type of approach. Pezzuto et al. (2009) described a spontaneous hemoperitoneum at 15 weeks of gestation, successfully treated laparoscopically in a 40- year-old patient (10). The bleeding, originating from uterine vessels of the broad ligament, was controlled with diathermic coagulation, achieving evacuation of 4.5 L of blood and preserving the pregnancy, which culminated in a Cesarean delivery of a healthy newborn at 38 weeks. This report shares similarities with the current case, in which severe obstetric bleeding in the second trimester was treated with selective laparoscopic ligation of the hypogastric artery, achieving effective haemostatic control and preserving the pregnancy. Both cases reinforce the idea that, in expert hands, laparoscopy represents a safe and effective tool for the management of severe pelvic haemorrhage in early or intermediate stages of pregnancy, avoiding more invasive procedures and improving the maternal-fetal prognosis.

Conclusion:

Laparoscopic hypogastric artery ligation during pregnancy represents an innovative surgical alternative for the management of severe obstetric haemorrhage. In the case presented, this technique allowed effective haemorrhage control with minimal blood loss, a low risk of complications, and preservation of pregnancy, demonstrating its feasibility and safety in expert hands. Unlike other procedures such as selective arterial embolization or balloon occlusion, whose availability and applicability may be limited in emergency settings, the laparoscopic approach offers additional advantages by being minimally invasive, promoting faster recovery, and reducing postoperative morbidity. The absence of previous reports in the literature on the performance of this procedure during pregnancy underscores the uniqueness of this case and reinforces the need for future studies and clinical series to support its efficacy, safety, and applicability in different obstetric settings.

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Spontaneous Heterotopic pregnancy with Twin Live Intrauterine Gestation and Ovarian Ectopic: A Case Report

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Abstract

Heterotopic pregnancy (HP) is a rare form of pregnancy, defined by the coexistence of an ectopic and an intrauterine pregnancy as described by Reece et al in 1983 in a review of 589 cases, and is extremely rare (1). The diagnosis of heterotopic pregnancy remains one of the greatest challenges of the gynecological- obstetrical emergencies. HP is the coexistence of living or dead intrauterine pregnancy, single or multiple, and extrauterine pregnancy located in the fallopian tube, ovary, uterine cornu, cervix or peritoneal cavity. This condition is very rare (1:30000 pregnancies). Its occurrence after natural conception is scarcely documented in the literature. The case of a spontaneous HP in a 27 years old patient is presented with resolution of the ovarian pregnancy ending in a Cesarean delivery of the intrauterine twin pregnancy at term.

Key message: Heterotopic pregnancy can occur in natural conception irrespective of usage of ovulation induction. Routine early pregnancy ultrasound can promote early detection with prompt surgical intervention to mitigate its complications.

Key words: heterotopic pregnancy (HP), ectopic pregnancy, salpingectomy, Caesarean section and laparotomy, Emergency, Hemoperitoneum.

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Introduction:

Case Presentation:

The case of a 27-year-old primiparous women who presented at 7 weeks with features of hyperemesis in a routine pregnancy follow up is presented. No previous ultrasonographic imaging was done. Current ultrasound scan showed

a twin live intrauterine pregnancy with thick separating membrane giving a lambda sign. Crown Rump Length (CRL) of fetus A measured 1.32 mm with Fetal Heart Rate (FHR) at 166 Beats Per Minute (BPM) and the CRL of fetus B was 1.15 mm with FHR 154 BPM. It also showed a gestational sac with a fetal pole with CRL 10 mm in the right ovary complicated by a surrounding peri-ovarian hematoma forming a right adnexal mass measuring 57x35 mm. No cardiac activity was seen in this fetal pole (Figure 1 A/B).


A

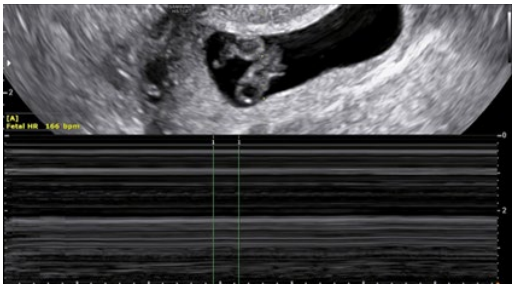
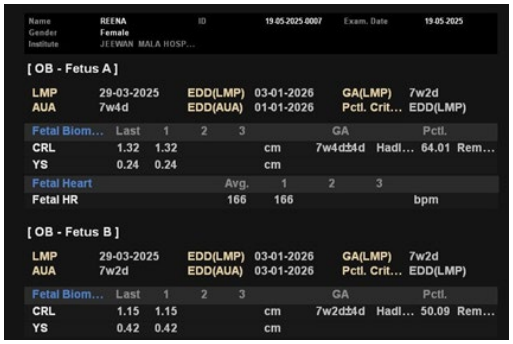

B

Figure 1A and B: Fetus A intrauterine fetal pole with FHR: 166 BPM


A



B

Figure 2A and B: Fetus B intrauterine fetal pole with FHR:154BPM and fetal biometry chart

The left ovary showed a corpus luteal cyst (Figure 3). The findings were consistent with a twin intrauterine live dichorionic diamniotic pregnancy and a right ovarian pregnancy without cardiac activity.

Figure 3: Right side intra-ovarian cystic mass with fetal pole measuring 11x5 mm showing no cardiac activity measuring 57x35 mm.

On performing a physical examination her vitals were stable and no significant findings were noted except for an enlarged uterus corresponding to seven weeks pregnancy with right posterior forniceal fullness. Her beta-hCG performed at 4.5 weeks gestation

was 3535 IU/ml. Since the patient had a normal intrauterine twin pregnancy and no fetal cardiac activity in the right ovarian gestation, the patient was kept under close follow up. There was a resolution of the right adnexal ovarian gestation with shrinkage of the cystic mass size to 30 mm and resolution of the peri-ovarian hematoma. She was later followed up to term and successfully delivered by elective Caesarean section.

A brief narrative of the challenges in the management, clinical presentation and limitation in the management is highlighted in the present case report. The diagnosis is possible only in cases when there is a high index of suspicion by the treating clinician. The adnexa must be inspected carefully in the confirmatory ultrasound. The early timely diagnosis gives a good maternal outcome and hence is crucial in the management.

Discussion:

Heterotopic pregnancy (HP) refers to a dual coexistence of both extra-uterine and intrauterine pregnancy. It represents an extremely rare obstetric condition with distinct documented clinical presentations and complications. The documented occurrence rates are estimated to be 1 to 30000 deliveries with high occurrence (1 in 100) in women undergoing assisted reproductive techniques ART (2,3). The majority of the documented reports in the literature are ART-related cases with natural conceived HP reports being virtually non-existent (4–6). The presentation of ruptured HP constitutes a clinical challenge in diagnosis and optimal management. Its presentation in resource constrained setting poses additional intricacy in diagnosis, given the unavailability of high-resolution imaging and expertise to offer timely diagnosis and management. The most common site for ectopic in HP is ampullary similar to the isolated ectopic pregnancy. The clinical symptoms do vary: early first trimester abdominal pain, vaginal bleeding that occasionally results in abortion, which has been reported in the literature (5). A considerable proportion (60–70%) of the HP may proceed to term and deliver normally. Delayed diagnosis may result in significant maternal and fetal morbidity that can be fatal if unattended timely. Reece et al reported the condition first and it included cases conceived spontaneously (1). The condition is extremely rare. But in the millennium years with considerable

development of infertility treatment, the incidence is showing a rising trend. The major risk factors for heterotopic pregnancy are chronic pelvic inflammatory disease, use of intrauterine disease, previous history of ectopic, previous tubal surgeries, assisted reproductive techniques. The causes attributed to an independent ectopic gestation are also considered as a risk factor for heterotopic pregnancy. The most frequent location are the fallopian tubes followed by the ovaries. There are many more case reports to show the locations in the cervix, the peritoneal cavity and the uterine cornua. There are also reported cases of tubal ectopic associated with pathological intrauterine pregnancy like blighted ovum or early intrauterine demise. Many case reports and studies have thrown light on this topic. But more systematic reviews are required to follow definite consensus for management. The transvaginal ultrasound for confirmation of pregnancy around 4-6 weeks period of gestation is the best tool for diagnosis. The adnexa should be imaged in the early ultrasound. The quantitative serum beta hCG values are the prime tool for managing an ectopic pregnancy as diagnostic and post treatment response indicator. But in case of an HP the beta hCG values cannot be trusted for diagnosis as there is presence of a viable intrauterine pregnancy. The monitoring of beta hCG post conservative measures also proves difficult in this case. The many conservative measures described by various authors are local methotrexate injection (a minimal of systemic absorption is noted as risk to the developing intrauterine fetus), local KCl injection (resulted in hematosalpinx), placing hemostatic sutures, prostaglandins (causes teratogenicity). Many other studies support conservative management with favorable outcomes.

Conclusions:

The diagnosis is possible only in cases when there is a high index of suspicion by the treating clinician. The clinical presentation is like that of an ectopic pregnancy where the patient presents with abdominal pain and bleeding per vaginam. The adnexa must be inspected carefully in the confirmatory ultrasound. The early timely diagnosis gives a good maternal outcome and hence crucial in the management.

Acknowledgements:

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

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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

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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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A Novel Way to Manage Lost Needle in Laparoscopic Surgery (Video article)

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Abstract

Background: Losing a needle during Laparoscopic surgeries presents a significant challenge due to the limited visual field, small size of the needle and potential risk for complications.

Objective: To demonstrate the use of a hysteroscope as an alternative way to retrieve a lost needle at the port site during laparoscopic surgery.

Materials and Methods: A 34-year-old woman, with two previous caesarean deliveries, had severe dysmenorrhea and heavy menstrual bleeding. Ultrasonography was suggestive of a posterior wall adenomyoma of 5 cm. She did not respond to medical management, hence a laparoscopic adeno-myomectomy was planned. During the retrieval from the lateral port, the needle was lost. An hysteroscope with CO_2 insufflation was introduced through the port wound, and the needle was seen lying within the abdominal wall layers. A 5 Fr hysteroscopic grasper was introduced into the operative channel of the hysteroscope, and the needle was held with it. The whole assembly was then withdrawn together from the port site under vision.

Results: A 30-degree 5 mm Operative hysteroscope was successfully used to retrieve the lost needle in our case from the abdominal wall layers at the port site wound. The patient was discharged in good clinical condition. No post-operative complications were encountered.

Conclusion: A 5 mm operative hysteroscope with CO2 insufflation can be an alternative addition to the armamentarium to find a lost needle at the port site in Laparoscopic Surgeries.

Keywords: Insufflation, Hysteroscopic grasper, Needle, Laparoscopy, Radiography.

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Introduction:

Needle loss during minimally invasive surgeries is rare but significant. Reported incidence ranges from 0.06% to 0.11% (1). Factors contributing to needle loss include high body mass index, multiple surgical teams, equipment failure, inadequate communication among surgical team members, and the complexity and duration of the surgery (2). While the occurrence is uncommon, it poses challenges due to potential patient injury, prolonged operative time, and medicolegal implications.

Aim: The aim of this article is to present a unique and effective technique for retrieving a lost needle during laparoscopic surgery using a 5 mm operative hysteroscope. By sharing this case the aim is to demonstrate an alternative approach that is safe, minimally invasive, and practical, especially in situations where conventional retrieval methods are unsuccessful.

Value: This video highlights an alternative, minimally invasive approach to retrieving a lost needle during laparoscopic surgery using a 5 mm operative hysteroscope. The visual format allows for clear demonstration of a technique not commonly described in literature, showcasing adaptability and the use of readily available instruments. It serves as a practical educational tool for surgeons facing similar intraoperative challenges.

Material and Methods:

A 34-year-old woman, with previous two caesarean deliveries, had severe dysmenorrhea and heavy menstrual bleeding. Ultrasonography was suggestive of posterior wall adenomyoma of 5 cm. She did not respond to medical management, hence laparoscopic adenomyomectomy was planned. After excision of the adenomyoma, the myometrium was

repaired in 2 layers using No. 1-0 polydioxanone barbed suture. The needle was lost during retrieval from the 5 mm lateral port. A systematic search of the abdomen for the needle was performed. Simultaneously, a re-play of the surgical video was done. A decision was made for intraoperative X-ray examination. In the meantime, it was decided to use a 30-degree 5 mm operative hysteroscope. The assembled hysteroscope was attached to the laparoscopic CO2 gas tubing and introduced into the trocar wound, we saw the needle with the thread attached in the abdominal layers. It was possible to successfully retrieve the needle with the help of hysteroscopic grasper. The patient included in this video gave consent for publication of the video and posting of the video online including social media, the journal website, scientific literature websites (such as PubMed, ScienceDirect, Scopus, etc.) and other applicable sites.

Results:

A 30-degree 5 mm Operative hysteroscope was successfully used to retrieve the lost needle in our case from the abdominal wall layers at the port site wound. The patient was discharged in good clinical condition. We did not encounter any post-operative complications.

Discussion:

The loss of a needle during laparoscopic surgery is uncommon but significant (3). It is a complication that can extend operative time, increase the risk of injury to surrounding structures, and pose medicolegal concerns (4, 5). Despite advancements in laparoscopic instruments and techniques, the retrieval of lost needles remains a challenging scenario, particularly when the needle becomes embedded within the abdominal wall layers or deeper tissues (6). Traditional methods for retrieving lost needles include systematic visual inspection, laparoscopic exploration, and the use of specialized retrieval instruments such as laparoscopic magnets, graspers, and even intraoperative radiography in certain cases (7,8). However, these approaches can be time-consuming, particularly if the needle migrates into the abdominal wall layers or fascia, making it difficult to locate and retrieve without additional incisions. In this case, the needle was embedded within the abdominal wall layers, not easily

accessible through conventional laparoscopic instruments. The limited visual field and confined space of the port site further complicated the retrieval process. The introduction of a 5 mm operative hysteroscope into the port site provided a direct visual pathway to identify the lost needle within the abdominal wall layers. The hysteroscope's 30- degree viewing angle facilitated enhanced visualization of the needle's location, allowing precise manipulation and retrieval (9). The use of CO_2 insufflation provided the necessary pneumoperitoneum, ensuring adequate working space while minimizing the risk of injury to surrounding structures during the retrieval process (10). The use of a 5 Fr hysteroscopic grasper through the operative channel proved effective in securely grasping the needle without causing additional tissue damage.

Conclusions:

This case illustrates the potential of a 5 mm operative hysteroscope with CO_2 insufflation as an alternate and effective technique for retrieving a lost needle during laparoscopic surgery. The approach offers a minimally invasive, efficient, and safe alternative to traditional methods, highlighting the importance of adaptability and innovation in surgical practice.

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En Bloc Laparoscopic Hysterectomy for Deep Infiltrating Endometriosis with #Enzian C3 Bowel Nodules: A Natural Orifice Specimen Extraction (NOSE) Technique (Video Article).

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Abstract

Background: Deep infiltrating endometriosis with intestinal involvement occurs in up to one-third of patients and is often incompletely excised, with high symptom recurrence when managed in several steps. Standard laparoscopy frequently requires a mini-laparotomy for specimen retrieval, prolonging operative time and exposing patients to morbidity. Innovative combinations of en bloc resection and natural-orifice extraction aim to overcome these limitations by uniting radical clearance with a fully minimally invasive workflow.

Methods: A multidisciplinary advanced-endoscopic approach applied to a 40-year-old woman with extensive DE staged P0 O2/2 T3/3 A3 B3/3 C3 FA on the #ENZIAN system is described. The operation began with an en bloc hysterectomy–segmental colorectal resection in which the uterus remained attached to the bowel nodule until colpotomy, the intact “pelvic block” was then delivered transvaginally via natural orifice specimen extraction.

Results: Removing the uterus and rectosigmoid as a single specimen prevented inadvertent luminal opening and ensured generous margins, eliminating visible residual disease. The natural orifice specimen extraction (NOSE) pathway avoided an accessory mini-laparotomy, shortening operative time, reducing abdominal wall trauma, and producing less post-operative pain and faster bowel recovery. No intraoperative complications occurred, and the patient was discharged uneventfully. Final pathology confirmed full-thickness bowel invasion with negative margins.

Conclusions: Combining en bloc hysterectomy-colorectal resection with transvaginal NOSE extraction is technically feasible and safe in complex intestinal DE. The strategy achieves comprehensive disease clearance while preserving the functional advantages of

advanced endoscopic surgery, including quicker mobilization and patient comfort, and may lower perioperative morbidity and long-term recurrence risk.

Keywords: Deep Infiltrating Endometriosis, Intestinal Endometriosis, Laparoscopy, Natural Orifice Specimen Extraction Surgery (NOSE), Operative Time.

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Introduction:

Endometriosis is a chronic, systemic and estrogen-dependent inflammatory disorder in which endometrial-like tissue implants are seen outside the uterus. It affects about 10 % of reproductive-age women worldwide, yet diagnosis typically lags 5–12 years after symptom onset (1). Deep infiltrating endometriosis (DE), one of the most aggressive variants, is defined by infiltration of more than 5 mm below the peritoneum and can involve organs such as the bladder, ureters, and frequently, the intestines. Intestinal involvement occurs in up to 37% of women with endometriosis, mainly affecting the rectosigmoid colon, and may present with nonspecific symptoms such as chronic pelvic pain, dyschezia, or clinical pictures that mimic irritable bowel syndrome or inflammatory bowel disease, making diagnosis challenging (2,3). The management of intestinal DE represents both a clinical and surgical challenge due to its complex anatomy and the potential risk for complications such as bowel obstruction, perforation, or fistulas (4). The #Enzian classification is currently a fundamental tool for describing the extent and location of deep endometriosis, complementing the prior ASRM classification. This system assigns letters to anatomical compartments: A (vagina/rectovaginal septum), B (utero-sacral ligaments), and C (intestine), further subdividing intestinal involvement into C1, C2, and C3, according to depth and size. A C3 nodule refers to a lesion involving the rectosigmoid colon larger than 3 cm or compromising more than 50% of the bowel circumference (5). The surgical approach to intestinal nodules depends on both the depth and extent of the intestinal wall involvement and the size of the lesion. When the lesion

is limited to the serosa or partially involves the muscular layer and is smaller than 3 cm, a shaving procedure or superficial excision can be performed, avoiding opening the bowel lumen. If the nodule is larger than 3 cm but does not compromise the entire circumference, or if infiltration affects the full thickness of the muscular layer and reaches the submucosa, a discoid resection is recommended. This technique removes a circular or "disc" segment of the affected intestinal wall while preserving the remaining circumference. However, when the nodule involves the mucosa or affects more than 50% of the bowel circumference, a segmental intestinal resection with anastomosis is necessary, as the risk of stenosis or perforation is higher with conservative treatment attempts (6,7). When deep infiltrating endometriosis involves multiple pelvic structures as a single anatomical block—such as the rectovaginal septum, uterus, ureters, and intestines—a surgical strategy known as en bloc resection is recommended. This technique consists of resecting all involved structures simultaneously in a single surgical procedure, respecting safety margins, with the goal of reducing recurrence risk and avoiding multiple surgeries (8). En bloc resection provides a more radical and safer approach when there is multifocal involvement, reducing the risk of residual disease dissemination and improving long-term functional outcomes (8). Additionally, the NOSE technique (Natural Orifice Specimen Extraction) has become increasingly used for the safe removal of surgical specimens. It allows the extracted tissue to be removed through natural orifices such as the rectum or vagina, avoiding additional abdominal incisions, reducing postoperative pain, minimizing wound complications, and improving cosmetic outcomes (4).

Material and Methods:

The case of a 40-year-old woman with clinically suspected deep endometriosis who underwent pelvic magnetic resonance imaging (MRI) using an endometriosis-dedicated protocol with intravaginal and intrarectal gel for compartment-based mapping is presented. The uterus appeared globular and heterogeneous, measuring 82 × 66 × 49 mm (calculated volume ≈ 140 cm^3), findings consistent with concurrent adenomyosis. Disease distribution was coded with the 2021 #ENZIAN

classification as P0 O2/2 T3/3 A3 B3/3 C3 FA, indicating bilateral stage-2 ovarian lesions, full thickness bilateral rectovaginal-septum infiltration, extensive uterosacral-parametrial involvement, deep anterior rectal-wall invasion, and focal adenomyosis. Ovarian assessment revealed two right-sided endometriomas measuring 21 × 18 × 10 mm and 17 × 15 × 9 mm, together with a single left-sided endometrioma of 41 × 36 × 21 mm. Bowel mapping demonstrated two nodular infiltrates situated 11 cm and 17 cm from the anal verge, involving 50 % and <10 % of the luminal circumference and reaching the submucosal and muscularis propria layers, respectively (Table 1). Clinically, the patient reported debilitating symptomatology characterized by severe dysmenorrhoea (visual-analogue-scale score 8–9/10), cyclic abdominal and pelvic pain that clearly intensified during menses, pronounced dyschezia, and intermittent haematochezia coinciding with the menstrual period, all of which markedly impaired her quality of life and work capacity. These imaging and clinical findings provided the anatomical and symptomatic framework for pre-operative planning and constitute the index case for the present study.

Parameter	Lesion 1	Lesion 2
Lesion length	4.5 cm	1.1 cm
Distance from anal verge	11 cm	17 cm
Intestinal wall layer involved	SBM*	MP*
Percentage of bowel circumference involved	50%	<10%
Reduction of intestinal lumen caliber	No	No

**SBM= Submucosa, MP= Muscularis Propria.*

Table 1: Result of the intestinal mapping

Table 1: Results of intestinal mapping

Results:

The procedure lasted 110 minutes. Both ovaries were preserved, and the endometriomas were drained followed by complete capsule excision to minimize recurrence risk. The patient was closely monitored postoperatively with procalcitonin and C-reactive protein levels as surrogate markers for colorectal anastomotic integrity, which remained within normal limits. Food by mouth tolerance was achieved early, and she was discharged on the third postoperative day with adequate recovery and no immediate complications. At the one-month follow-up, she reported marked improvement of pelvic pain and bowel-related symptoms. Final pathology demonstrated proliferative endometrium and active adenomyosis in both uterine walls, the left ovary contained a 4 × 3 × 2.6 cm endometriotic cyst with intraparenchymal deep endometriosis, fibrosis, and chronic inflammation, the right ovary contained two endometriotic cysts, overall ovarian dimensions were approximately 4.2 × 2.2 × 1.4 cm; and the resected intestinal segment (total 10.5 cm) showed mural and serosal deep endometriosis with active bleeding, hemosiderophages-α, granulation tissue, and dense fibrotic adhesions firmly attaching the colonic wall to the posterior uterine serosa, with viable resection margins and nonspecific chronic inflammation. Overall, these findings showed a favourable correlation with the preoperative #ENZIAN mapping (P0 O2/2 T3/3 A3 B3/3 C3 FA): FA was fully corroborated by active adenomyosis; C3 aligned with deep mural/serosal intestinal infiltration across the resected segment with dense adhesions; the O component was partially confirmed (left-sided endometrioma with intraparenchymal deep endometriosis consistent with O2, without side-specific confirmation on the right), A3 (retro cervical/rectovaginal) and B3/3 (bilateral uterosacral/parametrial) were compatible with intraoperative findings but lacked directed sampling for definitive histology; and, as expected, T3/3 reflects a severe tubo-ovarian adhesion condition that typically lacks a direct histologic counterpart (Table 2).

#ENZIAN	Code	Preoperative mapping description	Intraoperative Findings	Histopathology	Remarks
P	P0	No superficial peritoneal disease.	No superficial peritoneal disease.	No superficial peritoneal disease.	Imaging shows no superficial implants; which correlates with intraoperative findings
O (Left)	O2	Endometrioma of 41 × 36 × 21 mm	Correlates with preoperative findings	Endometriotic cyst, 4 × 3 × 2.6 cm, with deep intraparenchymal endometriosis, fibrosis, and chronic inflammation.	High concordance
O (Right)	O2	Two endometriomas: 21 × 18 × 10 mm and 17 × 15 × 9 mm	Correlates with preoperative findings	Two endometriotic cysts; overall ovarian dimensions were approximately 4.2 × 2.2 × 1.4 cm.	High concordance
T (Left)	T3	Severe adhesional tubo-ovarian condition	Correlates with preoperative findings	No direct histopathologic correlate	The T component is confirmed surgically; histology rarely confirms T
T (Right)	T3	Severe adhesional tubo-ovarian condition	Correlates with preoperative findings	No direct histopathologic correlate	Correlates with intraoperative findings
A	A3	Deep retrocervical/rectovaginal septum lesion >3 cm	Correlates with preoperative findings	Dense adhesions between the colon and the posterior uterine serosa	Correlates with intraoperative findings
B (Left)	B3	Deep involvement of the right uterosacral ligament/parametrium >3 cm	Correlates with preoperative findings	No directed sampling of the USL/parametrium	Depends on intraoperative assessment, which was concordant
B (Right)	B3	Compromiso profundo en USL/parametrio derecho >3 cm	Correlates with preoperative findings	No directed sampling of the USL/parametrium	Depends on intraoperative assessment, which was concordant
C	C3	Deep rectal/sigmoid infiltration (Details are provided in Table 1)	Correlates with preoperative findings	Deep mural and serosal endometriosis in a 10.5-cm resected segment; viable resection margins.	High concordance with C3
FA	FA	Adenomyosis (extra-compartmental)	Correlates with preoperative findings	Proliferative endometrium and active adenomyosis in both uterine walls.	Complete concordance for FA.

Table 2: Concordance between Preoperative # Enzian classification, Intraoperative findings and histopathology

Discussion:

Deep infiltrating endometriosis that welds the rectosigmoid to the posterior uterus challenges surgeons to balance radical clearance with acceptable morbidity. The surgical findings support a sequential strategy: first, an en bloc hysterectomy-segmental colorectal resection in which the uterus remains completely attached to the bowel nodule until colpotomy allows the entire fibrotic complex to be delivered intact. This "single-specimen" manoeuvre secures wide margins, prevents inadvertent bowel opening during stapled resection, and maximizes removal of microscopic endometrial-like implants factors known to lower symptomatic recurrence. Second, routing the specimen through a natural orifice specimen extraction (NOSE) pathway preserves the minimally invasive character of laparoscopy by eliminating an accessory mini-laparotomy and any fascial extension. In the en bloc laparoscopic approach for uterine–rectosigmoid disease, transvaginal NOSE reduces abdominal wall trauma

and pain, hastens bowel recovery, and enables one-piece delivery of the uterus–rectosigmoid complex, preserving orientation to assess depth and margins more faithfully; in our case, this translated into shorter operative time, negative margins, and an uncomplicated discharge. Beyond this case, comparative evidence in intestinal endometriosis shows that versus mini-laparotomy extraction, NOSE reduces length of stay and blood loss without increasing major complications or operative time; in fully laparoscopic resections it also shortens operative duration (9). A randomized controlled trial in rectal endometriosis reported similar functional and pain outcomes between NOSE and conventional laparoscopic resection, supporting that the principal advantage of NOSE is avoidance of an abdominal incision without a functional penalty (10). From a balanced perspective, a NOSE has route-specific limitations: these include colpotomy-related complications and pelvic infection, although uncommon, these are real. Pooled analyses place vaginal cuff dehiscence after minimally invasive hysterectomy at 0.7% (11). Comparative meta-analysis shows that, versus transabdominal extraction, transvaginal extraction lowers wound morbidity without increasing anastomotic complications when protective measures (specimen bag, irrigation) and careful selection are used (12). A large prospective study (n=4.565) also demonstrates a learning-curve effect: about 82% of conversions occurred within a surgeon's first 50 cases, underscoring the need for structured training and proctoring (13). Finally, nulliparity is not an absolute contraindication; feasibility has been reported even in virginal patients when vaginal access is adequate and plans for conversion are in place (14). When combined, these techniques achieve comprehensive disease clearance while preserving the functional advantages of advanced endoscopic surgery, showing how multidisciplinary collaboration can modernize a historically morbid procedure. Extracting the intact en bloc specimen transvaginally also maintains the native orientation of the uterine–bowel complex, enabling the pathologist to evaluate depth and lateral spread of infiltration with greater fidelity; this more precise clinicopathologic correlation strengthens postoperative surveillance planning and guides subsequent therapeutic decisions. For reproducibility, this en bloc–NOSE approach should be embedded in a multidisciplinary

program. Colorectal and gynecologic minimally invasive surgeons should jointly select cases, review imaging, and agree on the operative strategy (shaving, discoid, or segmental; en bloc when indicated). Standardized team briefings, shared ERAS pathways, joint morbidity-and-quality review, and cross-specialty proctoring during adoption support consistent outcomes.

Conclusions:

An operative approach that unites en bloc hysterectomy-colorectal resection with transvaginal NOSE extraction offers a compelling solution for the most complex forms of intestinal endometriosis. The en bloc step secures radical disease clearance and safeguards against intraoperative bowel injury, while NOSE preserves the advantages of minimally invasive surgery, collectively reducing operative time, perioperative morbidity, and the risk of long-term recurrence. These findings position the combined technique as a best practice option in high volume centres, prospective studies with extended follow-up are now warranted to confirm its durability and impact on quality of life.

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Isthmocele - Bladder Perforation: Management of a Complicated Case (Video article)

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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.

Case: 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.

Keywords: Isthmocele, Cesarean scar defect, Hysteroscopic repair, Bladder perforation, Laparoscopic repair.

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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 the 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 (G2P2) with two previous Cesarean sections presented with irregular uterine bleeding and discharge per vaginam. 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 defect. 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 similar 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. A 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 the lower segment Cesarean scar was 4.8 mm. The patient was asymptomatic on subsequent follow up and was planned for assisted reproduction therapy.

Discussion:

Surgical correction of an isthmocele has been shown to relieve symptoms, improve endometrial receptivity, and enhance fertility potential (6,7). The choice of the surgical route depends primarily on RMT and the extent of the 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 advocate 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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Laparoscopic Excision of Cesarean Scar Pregnancy and Repair of the Uterine Defect (Video Article)

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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

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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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