Diagnostic performance of the #Enzian classification via ultrasound compared to laparoscopic findings in endometriosis: a retrospective cohort study

Zahra Asgari[1a], Aynaz Boostan[1a], Reyhaneh Hosseini[1], Behnaz Ghavami[1], Behareh Khakifirooz[2], Leila Bayani[3], Reza Mardani[3], Amirhossein Hajialigol[4], Pegah Rashidian[5]

[1]Department of Obstetrics and Gynecology, Arash Women's Hospital, Tehran University of Medical Sciencess, Tehran, Iran

[2]Department of Obstetrics and Gynecology, Kamali Hospital, Alborz University of Medical Sciences, Karaj, Iran

[3]Research Development Center, Arash Women's Hospital, Tehran University of Medical Sciences, Tehran, Iran

[4]Alborz Office of Universal Scientific Education and Research Network (USERN), Alborz University of Medical Sciences, Karaj, Iran

[5]Vali-e-Asr Reproductive Health Research Center, Family Health Research Institute, Tehran University of Medical Sciences, Tehran, Iran

[a]*Both authors contributed equally to this work and share first authorship*

Abstract

Objective: To assess the diagnostic performance of the ultrasound-based #Enzian classification in comparison with laparoscopic surgical findings in patients with endometriosis.

Material and Methods: This retrospective cohort study included patients who underwent laparoscopic excisional surgery for endometriosis between September 2023 and October 2024. Preoperative transvaginal ultrasound assessments were performed using the International Deep Endometriosis Analysis protocol, with findings recorded according to the updated #Enzian classification. Diagnostic performance was evaluated through sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy. Statistical analyses were conducted using SPSS version 26.0.0.0, with statistical significance set at $p<0.05$.

Results: The study included 66 patients. The #Enzian classification demonstrated the highest diagnostic accuracy in compartments FA and FB (98.82% and 98.59%, respectively), both with perfect sensitivity and minimal false positives. The left ovary (O left) also showed strong performance (92.87% accuracy). In contrast, compartment A had low sensitivity (12.12%) despite a low false-positive rate. Compartments B left and C exhibited good accuracy (86.82% and 91.88%), with minimal false positives and moderate sensitivity. Variable results were observed in compartments O right and T. Although sensitivity was incomplete for FU, FI, and FO, specificity remained high across these subgroups.

Conclusion: The #Enzian ultrasound classification provides a reliable diagnostic framework, demonstrating high accuracy across multiple compartments. It is recommended that future studies include larger sample sizes and longitudinal design to further validate these findings. [J Turk Ger Gynecol Assoc. 2025; 26(4): 276-83]

Keywords: #Enzian, ultrasound, endometriosis, deep infiltrative endometriosis, laparoscopic surgery

Received: 08 July, 2025 **Accepted:** 22 October, 2025 **Publication Date:** 03 December, 2025

Address for Correspondence: *Pegah Rashidian*
e-mail: *pegah.rashidian@rocketmail.com* ***ORCID:*** *orcid.org/0000-0002-9167-9172*

DOI: *10.4274/jtgga.galenos.2025.2025-7-2*

Cite this article as: *Asgari Z, Boostan A, Hosseini R, Ghavami B, Khakifirooz B, Bayani L, et al. Diagnostic performance of the #Enzian classification via ultrasound compared to laparoscopic findings in endometriosis: a retrospective cohort study. J Turk Ger Gynecol Assoc. 2025; 26(4): 276-83*

Introduction

Endometriosis is a chronic inflammatory disorder characterized by the presence of ectopic endometrial-like tissue. It affects an estimated 10% of women of reproductive age, corresponding to approximately 190 million individuals worldwide (1,2). Clinically, the condition manifests with a spectrum of symptoms, such as severe dysmenorrhea, deep dyspareunia, persistent pelvic pain, gastrointestinal and urinary disturbances, and fatigue. Importantly, there is often a poor correlation between symptom severity and the extent of disease involvement (3). Furthermore, endometriosis can impair fertility by disrupting the peritoneal environment or causing anatomical distortion of the pelvic organs. Approximately 30% of individuals with endometriosis experience infertility, with this impact being more pronounced in advanced stages of the disease, akin to other pathologies that necessitate considerations for fertility preservation (4-6).

Given its significant prevalence and impact on quality of life, there is a clinical need to improve approaches for predicting and diagnosing endometriosis (7-9). However, the diagnostic process remains inherently challenging because of the broad spectrum of often non-specific symptoms experienced by patients and the diverse anatomical locations in which endometriotic lesions may develop (7,10).

Historically, the diagnosis and classification of endometriosis have relied predominantly on surgical evaluation. The American Society for Reproductive Medicine (ASRM) introduced an initial classification system in 1979 (11), with the most recent revision released in 1997 (12). This system is based on intraoperative visual assessment of lesion location, size, and extent. As a result, invasive surgical procedures remain the primary method for staging endometriosis in both clinical practice and academic research (12). However, the revised ASRM classification has several limitations; it is complex, does not adequately capture deep infiltrating endometriosis (DIE), and shows poor correlation with symptom severity, surgical complexity, and postoperative outcome. Large-scale studies have further highlighted its limitations in characterizing DIE, with a substantial proportion of patients classified as early-stage exhibiting uterosacral or rectal involvement. These shortcomings have prompted the development of alternative systems, such as the #Enzian classification, which provides greater anatomical granularity and more accurately reflects lesion severity (13,14).

The #Enzian classification, initially introduced in 2003, was developed to address the limitations of existing systems by offering a more precise description of the location and severity of DIE (15). Recognizing the need for a more comprehensive and standardized framework, the updated #Enzian classification was introduced in January 2021 (16). This revised system extends beyond DIE to include the evaluation of peritoneal and ovarian endometriosis, as well as adhesions involving the ovaries and fallopian tubes. Notably, the #Enzian classification facilitates preoperative assessment through imaging modalities, including transvaginal sonography (TVS) and magnetic resonance imaging (MRI), with the exception of compartment P (peritoneal lesions), which remains challenging to detect via imaging (16). Emerging evidence has highlighted the utility of the #Enzian classification as a valuable tool for mapping endometriotic lesions in both radiological and surgical settings (17,18). However, published evidence concerning the diagnostic accuracy of the #Enzian ultrasound classification remains limited, particularly as most studies evaluating its reliability and generalizability in routine clinical practice have been conducted in Europe. Therefore, to the best of our knowledge, this is the first study conducted in Iran that aimed to evaluate the diagnostic performance of the #Enzian ultrasound classification by systematically comparing preoperative imaging findings with surgical observations in patients with histologically confirmed endometriosis, thereby contributing to the geographic generalization of the findings.

Material and Methods

Design and participants

This retrospective cohort study included patients with a confirmed diagnosis of endometriosis who underwent laparoscopic excisional surgery between September 2023 and October 2024. The cohort was composed of individuals who had undergone a standardized TVS examination using the #Enzian classification protocol within the three months preceding surgery. The primary aim was to assess the diagnostic performance of the #Enzian classification by evaluating its ability to predict intraoperative findings. All patients were followed from the time of preoperative imaging (exposure) to the point of surgical diagnosis (outcome), enabling a comparison of preoperative and intraoperative assessments. Patients were excluded if the TVS was not performed using the #Enzian protocol, if they were referred for MRI due to inconclusive ultrasound results, if malignancy was suspected, or if they had a history of colorectal surgery. The present study followed the Standards for Reporting of Diagnostic Accuracy Studies checklist to ensure methodological quality and consistency throughout (Supplementary 1) (19). This study was approved by the Tehran University Medical Sciences Research Ethics Committee (approval number: IR.TUMS.MEDICINE.REC.1403.581, date: 11.02.2025).

Measures

Data collection

Clinical data were retrospectively collected for all eligible patients, including preoperative baseline characteristics, such as age, body mass index, reproductive history, duration and type of endometriosis-related symptoms, and history of infertility and/or previous surgical intervention. Preoperative evaluation of endometriotic lesions was performed by an experienced gynecology radiologist (L.B.) with substantial experience in diagnosis of endometriosis. The imaging assessments were conducted using the International Deep Endometriosis Analysis protocol (20), supplemented by the #Enzian classification (16) system to ensure standardized lesion characterization. TVS was the primary imaging modality, complemented by transabdominal and transanal sonographic examinations, when indicated.

Surgical procedures were conducted by three experienced gynecologic surgeons (Z.A., R.H., and B.G.), all of whom have substantial expertise in minimally invasive techniques for the management of endometriosis. The surgical team was not blinded to the preoperative TVS findings, as integration of imaging results into surgical planning is standard clinical practice and is intended to improve lesion identification, surgical safety, and patient outcomes. Any disagreements were resolved via discussion. Intraoperative findings were systematically documented in operative reports, from which relevant data were extracted. The diagnosis and anatomical mapping of deep endometriosis were classified according to the #Enzian criteria (16), ensuring consistency between preoperative imaging and surgical staging.

#Enzian classification

The #Enzian classification system categorizes and describes the spread of deep endometriosis by dividing the affected areas into distinct compartments. These compartments include A (vagina, rectovaginal space), B (uterosacral ligaments, cardinal ligaments, pelvic sidewall), and C (rectum). The system also accounts for distant or extragenital locations, referred to as F, which includes the urinary bladder (FB), ureters (FU), and other atypical sites (FO), as well as peritoneal involvement (P). Furthermore, this classification system incorporates the involvement of the ovaries (O), other intestinal regions, such as the sigmoid colon and small bowel (FI), and adhesions affecting the tubo-ovarian unit (T). Each compartment or organ affected is designated by capital letters (P, O, T, A, B, C, F), which are arranged in a specific order. The extent of endometriosis within each compartment is quantified using a scale of 1 to 3, indicating the severity of involvement (Figure 1) (16).

Statistical analysis

Patient demographics, as well as radiologic and surgical findings, were systematically recorded and subjected to analysis. Descriptive statistics were calculated for each group, with continuous variables reported as mean ± standard deviation, and categorical variables expressed as frequencies and percentages.

The diagnostic performance of the #Enzian classification was evaluated in relation to both ultrasound and laparoscopic findings. For each Enzian compartment, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated together with 95% confidence intervals using the Wilson method. In compartments without any positive reference cases, sensitivity and PPV could not be estimated and have therefore been reported as “not applicable” (N/A). Similarly, in compartments without negative reference cases, specificity and NPV were also reported as N/A. Comparisons between diagnostic methods were performed using chi-square tests to evaluate differences in categorical variables. All statistical analyses were conducted using SPSS version 26.0.0.0 (IBM Inc., Armonk, NY, USA). Statistical significance was determined at a threshold of $p<0.05$ for all tests.

Results

A total of 66 patients were enrolled in the study, with no instances of withdrawal or loss to follow-up. The demographic and clinical characteristics of the study population are presented in Table 1.

All patients underwent laparoscopic surgery. Among the reported clinical symptoms, dysmenorrhea was the most common, affecting 49.5% of the cohort. A history of prior surgery was documented in 67.7%, with cesarean section being the most commonly reported type.

The diagnostic performance of the #Enzian ultrasound classification system is summarized in Table 2. Among all categories, the highest diagnostic accuracy was observed for #Enzian FA and FB, with accuracy rates of 98.82% and 98.59%, respectively. Both demonstrated perfect sensitivity (100%) and minimal false positives (98.72% for FA and 98.44% for FB). The left ovarian compartment (#Enzian O left) also showed high accuracy (92.87%), with a sensitivity of 78.72% and specificity of 94.44%. In contrast, #Enzian A exhibited a markedly low sensitivity (12.12%) despite minimal false positives (93.75%), suggesting limited ability to detect lesions in this compartment, though its specificity may still aid in ruling out false positives. Other compartments, such as #Enzian B left (accuracy 86.82%) and #Enzian C (accuracy 91.88%), also demonstrated solid diagnostic performance, with high specificities and moderate sensitivities. Categories #Enzian T and O right showed variable

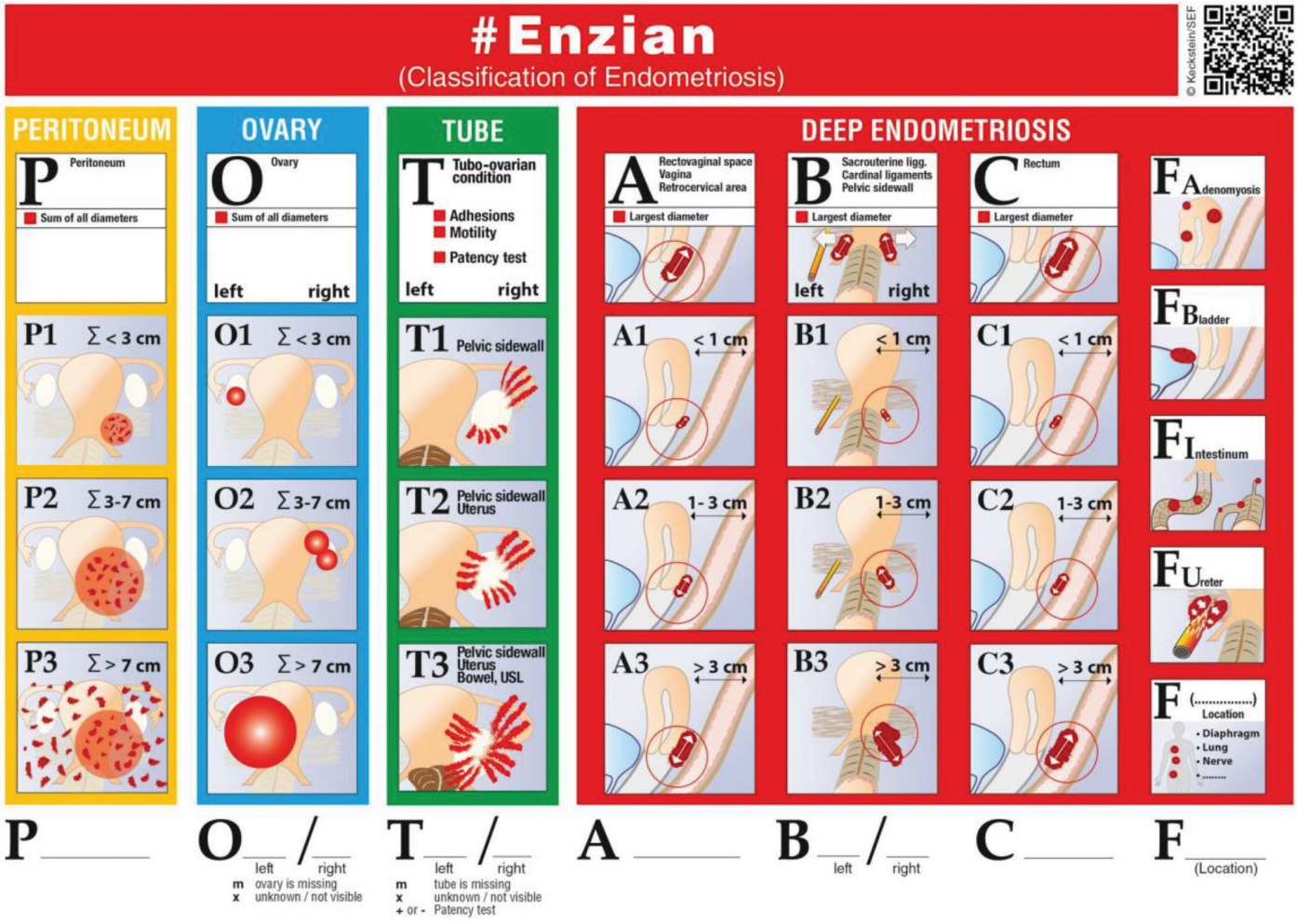

Figure 1. The revised #Enzian classification system for endometriosis[16]

Table 1. Demographic and clinical characteristics of the study population

Demographic characteristic	Summary
Age; y	37.75±6.1
BMI; kg/m²	25.42±2.9
Gravidity	1.10±1.2
Parity	0.81±0.8
Prior surgery	44 (67.7)
Duration of symptoms	34.41 (36.9)
Gastrointestinal symptoms	0 (0.0)
Dysmenorrhea	32 (49.5)
Dyspareunia	23 (29.8)
Infertility	24 (31.2)

All the data in this table are expressed as mean ± standard deviation or number (percentage)
BMI: Body mass index, y: Year

results, with #Enzian O right yielding high sensitivity (95.12%) but lower specificity (81.82%), and #Enzian T compartments exhibiting modest accuracy due to lower PPVs.

Discussion

This study evaluated the diagnostic performance of ultrasonography (US) using the updated #Enzian classification for detecting endometriotic lesions, with imaging findings compared against laparoscopic results. Overall, the diagnostic accuracy of this combination of US with #Enzian classification was high, ranging from 80% to 100% across most compartments, except for the T compartment, the tubo-ovarian unit. Notably, compartments such as #Enzian FB, FA, and the left ovarian (O) compartment demonstrated high sensitivity and specificity, underscoring their reliability as diagnostic targets. Among these, #Enzian FB exhibited the highest diagnostic accuracy,

Table 2. Diagnostic performance of #Enzian ultrasound classification

#Enzian category	Sensitivity	Specificity	PPV	NPV	Accuracy	p value
#Enzian O left	78.72 (68.23-86.49)	94.44 (85.29-98.16)	61.16 (48.16-72.91)	97.56 (90.88-99.46)	92.87 (85.38-96.71)	0.001
#Enzian O Right	95.12 (83.54-98.74)	81.82 (67.33-90.67)	36.76 (25.44-49.91)	99.34 (88.50-99.90)	83.15 (72.45-90.23)	0.001
#Enzian T left	93.33 (70.18-98.81)	50.00 (30.04-69.96)	17.18 (8.61-31.14)	98.54 (79.83-99.87)	54.33 (36.73-71.06)	0.001
#Enzian T right	71.74 (52.36-85.44)	68.42 (52.13-81.36)	20.15 (11.08-33.69)	95.61 (82.54-99.08)	68.75 (54.78-80.14)	0.001
#Enzian A	12.12 (6.71-20.93)	93.75 (86.47-97.33)	17.73 (9.38-30.99)	90.57 (82.89-95.00)	85.59 (77.13-91.41)	0.001
#Enzian B left	24.49 (15.20-37.08)	93.75 (85.59-97.64)	30.33 (18.52-45.45)	91.79 (84.15-96.10)	86.82 (77.78-92.65)	0.001
#Enzian B right	21.43 (8.50-45.16)	91.30 (81.02-96.33)	21.50 (8.53-44.68)	91.27 (80.97-96.33)	84.32 (73.36-91.34)	0.001
#Enzian C	57.89 (37.22-76.03)	95.65 (86.57-98.85)	59.67 (38.79-77.57)	95.34 (85.78-98.68)	91.88 (82.13-96.62)	0.001
#Enzian FA	100.00 (77.54-100.00)	98.72 (92.38-99.84)	90.12 (69.32-97.38)	100.00 (93.12-100.00)	98.82 (92.66-99.68)	0.001
#Enzian FB	100.00 (79.62-100.00)	98.44 (91.61-99.74)	87.67 (65.91-96.53)	100.00 (92.89-100.00)	98.59 (92.20-99.78)	0.001
#Enzian FU	N/A	96.92 (84.11-99.46)	N/A	89.72 (74.28-96.36)	N/A	N/A
#Enzian FI	N/A	100.00 (71.51-100.00)	N/A	90.00 (59.58-98.21)	N/A	N/A
#Enzian FO	0.00 (0.00-56.10)	100.00 (71.51-100.00)	N/A	90.00 (59.58-98.21)	90.00 (59.58-98.21)	0.001

All the data in this table are expressed as percentage and (95% confidence intervals)
N/A indicates that the metric or p value could not be calculated due to insufficient cases or lack of variation in that compartment
N/A: Not applicable, NPV: Negative predictive value, PPV: Positive predictive value

reliably identifying pathology while minimizing false positives. In contrast, compartment A demonstrated the lowest sensitivity (12.12%), indicating limited diagnostic utility in detecting subtle or superficial lesions, particularly in anatomical regions where overlapping superficial disease may obscure deeper involvement. This low sensitivity likely reflects several factors, including anatomical complexity, limited sonographic windows, and imaging limitations, such as probe angulation, depth penetration, and operator-dependent interpretation. These challenges underscore the need for careful imaging technique and, when necessary, complementary diagnostic strategies to ensure comprehensive lesion mapping in this compartment. While specificity exceeded 80% in most compartments, tubal involvement posed diagnostic challenges, with relatively low specificities of 50% and 68.42% for the left and right tubes, respectively.

Numerous studies have examined the utility of US in conjunction with the #Enzian classification for assessing endometriosis, providing important context for our findings. In a retrospective study of 50 patients, Bindra et al. (21) reported high diagnostic reliability of structured US using the #Enzian classification, with sensitivities of 86% for peritoneal lesions and 100% for rectovaginal, adenomyosis, and ureteric involvement. NPVs were similarly high, reaching 97% for rectal and 100% for rectovaginal and ureteric lesions. Strong concordance was also observed for ovarian and uterosacral ligament involvement, aligning with intraoperative findings. These results are consistent with the diagnostic trends observed in our study, particularly the strong performance of posterior compartments. Similarly, a prospective diagnostic accuracy study involving 195 women reported TVS sensitivities ranging from 84% to 92% and specificities between 73% and 99% across compartments, with the highest concordance in compartment C (rectosigmoid) (22). Our findings corroborate this pattern, particularly for compartments FB and FA, although we observed significantly lower sensitivity in compartment A. A large multicenter study involving 745 patients using both TVS and transabdominal sonography further validated the #Enzian classification as a standard diagnostic tool. Concordance rates ranged from 86% to 99% for lesion detection and 71% to 92% for severity grading. This study, like ours, found improved diagnostic performance for compartments O, A, B, and C compared to tubal and peritubal adhesions, a pattern mirrored by our findings, of low specificity in tubal compartments (18). Di Giovanni et al. (17) also assessed 93 women and found that compartment C had the highest ultrasound-to-surgical concordance (74%), increasing to 87% when allowing a 3 mm margin of error. Their reported high specificities across compartments are consistent with our results, particularly for FB, where our study found 100% specificity. However, our markedly lower sensitivity in compartment A may reflect differences in lesion size, operator technique, or anatomical variability.

Although most studies have focused on diagnostic accuracy, the prognostic implications of the #Enzian classification have also been explored. Fruscalzo et al. (23) retrospectively evaluated 58 infertile patients and found no significant correlation between #Enzian stage and pregnancy outcomes, whether spontaneous or assisted. This suggests that while

the classification provides excellent anatomic delineation, its prognostic relevance for fertility remains uncertain. In terms of surgical planning, a retrospective analysis involving 151 patients demonstrated that the #Enzian classification could be used to predict laparoscopic operating time, with a mean predictive error of 35.35 minutes (24). Although our study did not assess surgical duration, the strong correlation between US and laparoscopic #Enzian scores implies that structured preoperative imaging may support surgical planning and improve resource allocation, echoing the utility highlighted in that study.

Our findings reinforce the critical role of US, when interpreted through the lens of the #Enzian classification, in the comprehensive preoperative mapping of endometriosis. One major clinical implication is the enhancement of standardization and improvement in communication between imaging specialists and gynecologic surgeons. The broader implementation of structured #Enzian-based reporting may streamline diagnostic pathways, support multidisciplinary collaboration, and potentially reduce the diagnostic delays that frequently complicate endometriosis management (13,25). Early and precise lesion mapping may enable personalized surgical planning, facilitate informed patient counseling, and help minimize intraoperative complications (13,25). However, our study identified low diagnostic accuracy for tubal lesions, which carries significant clinical consequences. Inaccurate or missed tubal involvement may result in underestimation of disease severity, potentially leading to incomplete excision during surgery. This could increase the risk of persistent symptoms, recurrence, or suboptimal fertility outcomes in patients seeking reproductive assistance (26). Moreover, unexpected tubal pathology identified intraoperatively may prolong surgery, increase procedural complexity, or necessitate intraoperative modifications that could have been anticipated with more accurate preoperative imaging. These findings underscore the need for integrated diagnostic strategies, for example combining US with MRI or intraoperative assessment, to ensure comprehensive mapping of all endometriotic compartments. Awareness of this potential limitation for tubal assessment would also allow surgeons to plan adjunctive evaluations, counsel patients regarding possible intraoperative findings, and tailor surgical approaches to minimize complications and improve outcomes.

Study limitations

This study has several strengths. All surgeries were performed by experienced minimally invasive gynecologic surgeons, ensuring procedural consistency and high intraoperative diagnostic accuracy. Moreover, all US was conducted and interpreted by a single expert radiologist, minimizing inter-operator variability and strengthening internal consistency. Importantly, this is the first study of its kind conducted in Iran, thereby extending the generalizability of the #Enzian classification beyond the predominantly European populations studied to date (14,17,18,22-24). However, several limitations must be acknowledged. The retrospective design introduces potential selection and reporting biases. The small sample size limits statistical power and generalizability. Moreover, the single-center nature of the study may not reflect variations in imaging or surgical expertise encountered in broader clinical settings. Patient demographics and disease characteristics in our cohort may differ from those in other regions or healthcare systems, potentially affecting the diagnostic performance of the #Enzian ultrasound classification. This is particularly relevant for compartments with low sensitivity (e.g., #Enzian A), where anatomical complexity or subtle lesions make detection more challenging and more susceptible to variability across populations. The diagnostic accuracy of US is inherently operator-dependent, which could affect reproducibility in routine practice. Finally, in the clinical context of this study, the operating surgeons were not blinded to preoperative TVS results, as their use in surgical planning is part of routine practice. This lack of blinding could have introduced observational bias, as prior knowledge of sonographically suspected lesions may have influenced intraoperative detection, particularly in specific #Enzian compartments where subtle findings might otherwise have been overlooked.

Future research should aim for prospective, multicenter study designs with larger sample sizes to validate these findings further. Moreover, comparative studies integrating different imaging modalities under a unified classification framework, such as the #Enzian system, could help optimize diagnostic workflows and improve the comprehensive management of endometriosis.

Conclusion

The present retrospective cohort study provided further evidence supporting the diagnostic utility of US structured by the updated #Enzian classification in the preoperative assessment of endometriosis. Diagnostic accuracy was high across most anatomical regions except for the T compartment. Notably, compartments FB and FA demonstrated particularly robust performance, affirming the reliability of US for evaluating posterior pelvic disease. In contrast, the low sensitivity in compartment A and reduced specificity for tubal assessments highlight persistent challenges in identifying certain lesion types and support the need for multimodal imaging approaches. As the first study of its kind conducted in

Iran, these findings expand the international applicability of the #Enzian classification and demonstrate practical integration into diverse clinical settings. Future research should aim to validate these findings through prospective, multicenter studies with larger patient populations, while also evaluating the comparative benefits of integrating additional imaging modalities under a unified classification system. Such efforts could lead to more comprehensive diagnostic strategies, improved surgical planning, and ultimately, enhanced clinical outcomes for patients with endometriosis.

Ethic

Ethics Committee Approval: *This study was approved by the Tehran University Medical Sciences Research Ethics Committee (approval number: IR.TUMS.MEDICINE.REC.1403.581, date: 11.02.2025).*

Informed Consent: *Retrospective study.*

Footnotes

Author Contributions: *Surgical and Medical Practices: Z.A., A.B., R.H., B.G., L.B., Concept: Z.A., P.R., Design: Z.A., P.R., Data Collection or Processing: Z.A., A.B., R.H., B.G., L.B., R.M., Analysis or Interpretation: A.H., Literature Search: Z.A., A.B., R.H., B.G., B.K., L.B., R.M., A.H., P.R., Writing: Z.A., A.B., R.H., B.G., B.K., L.B., R.M., A.H., P.R.*

Conflict of Interest: *No conflict of interest is declared by the authors.*

Financial Disclosure: *The authors declared that this study received no financial support.*

References

1. Zondervan KT, Becker CM, Missmer SA. Endometriosis. N Engl J Med. 2020; 382: 1244-56.
2. Rashidian P, Hantoushzadeh S. Bridging the gap: Exploring aspirin prophylaxis for preeclampsia prevention in pregnant women with endometriosis. J Endometr Pelvic Pain Disord. 2025:22840265251343443.
3. Vercellini P, Fedele L, Aimi G, Pietropaolo G, Consonni D, Crosignani PG. Association between endometriosis stage, lesion type, patient characteristics and severity of pelvic pain symptoms: a multivariate analysis of over 1000 patients. Hum Reprod. 2007; 22: 266-71.
4. Prescott J, Farland LV, Tobias DK, Gaskins AJ, Spiegelman D, Chavarro JE, et al. A prospective cohort study of endometriosis and subsequent risk of infertility. Hum Reprod. 2016; 31: 1475-82.
5. Lantsberg D, Fernando S, Cohen Y, Rombauts L. The role of fertility preservation in women with endometriosis: a systematic review. J Minim Invasive Gynecol. 2020; 27: 362-72.
6. Rashidian P. An update on oncofertility in prepubertal females. J Gynecol Obstet Hum Reprod. 2024; 53: 102742.
7. Amro B, Ramirez Aristondo ME, Alsuwaidi S, Almaamari B, Hakim Z, Tahlak M, et al. New understanding of diagnosis, treatment and prevention of endometriosis. Int J Environ Res Public Health. 2022; 19: 6725.
8. Barnard ND, Holtz DN, Schmidt N, Kolipaka S, Hata E, Sutton M, et al. Nutrition in the prevention and treatment of endometriosis: a review. Front Nutr. 2023; 10: 1089891.
9. Rashidian P, Amini-Salehi E, Karami S, Nezhat C, Nezhat F. Exploring the association between dietary fruit intake and endometriosis: a systematic review and meta-analysis. J Clin Med. 2025; 14: 1246.
10. mperiale L, Nisolle M, Noël JC, Fastrez M. Three types of endometriosis: pathogenesis, diagnosis and treatment. State of the Art. J Clin Med. 2023; 12: 994.
11. Classification of endometriosis. The American Fertility Society. Fertil Steril. 1979; 32: 633-4.
12. Revised American Society for reproductive medicine classification of endometriosis: 1996. Fertil Steril. 1997; 67: 817-21.
13. Keckstein J, Hudelist G, Koninckx P, Keckstein S, Keckstein S. The# Enzian classification for the diagnosis and surgery of endometriosis: a narrative review. Gynecol Pelvic Med. 2021; 4.
14. Montanari E, Bokor A, Szabó G, Kondo W, Trippia CH, Malzoni M, et al. Comparison of #Enzian classification and revised American Society for Reproductive Medicine stages for the description of disease extent in women with deep endometriosis. Hum Reprod. 2022; 37: 2359-65.
15. Tuttlies F, Keckstein J, Ulrich U, Possover M, Schweppe KW, Wustlich M, et al. ENZIAN-Score, eine Klassifikation der tief infiltrierenden Endometriose [ENZIAN-score, a classification of deep infiltrating endometriosis]. Zentralbl Gynakol. 2005; 127: 275-81.
16. Keckstein J, Saridogan E, Ulrich UA, Sillem M, Oppelt P, Schweppe KW, et al. The #Enzian classification: a comprehensive non-invasive and surgical description system for endometriosis. Acta Obstet Gynecol Scand. 2021; 100: 1165-75.
17. Di Giovanni A, Montanari E, Hudelist G, Malzoni M, Keckstein J. Comparison between sonography-based and surgical evaluation of endometriotic lesions using the #Enzian classification - a retrospective data analysis. Ultraschall Med. 2023; 44: 290-98.
18. Montanari E, Bokor A, Szabó G, Kondo W, Trippia CH, Malzoni M, et al. Accuracy of sonography for non-invasive detection of ovarian and deep endometriosis using #Enzian classification: prospective multicenter diagnostic accuracy study. Ultrasound Obstet Gynecol. 2022; 59: 385-91.
19. Cohen JF, Korevaar DA, Altman DG, Bruns DE, Gatsonis CA, Hooft L, et al. STARD 2015 guidelines for reporting diagnostic accuracy studies: explanation and elaboration. BMJ Open. 2016; 6: e012799.
20. Guerriero S, Condous G, van den Bosch T, Valentin L, Leone FP, Van Schoubroeck D, et al. Systematic approach to sonographic evaluation of the pelvis in women with suspected endometriosis, including terms, definitions and measurements: a consensus opinion from the International Deep Endometriosis Analysis (IDEA) group. Ultrasound Obstet Gynecol. 2016; 48: 318-32.
21. Bindra V, Madhavi N, Mohanty GS, Nivya K, Balakrishna N. Pre-operative mapping and structured reporting of pelvic endometriotic lesions on dynamic ultrasound and its correlation on laparoscopy using the #ENZIAN classification. Arch Gynecol Obstet. 2023; 307: 179-86.
22. Hudelist G, Montanari E, Salama M, Dauser B, Nemeth Z, Keckstein J. Comparison between sonography-based and Surgical extent of deep endometriosis using the Enzian classification - a prospective diagnostic accuracy study. J Minim Invasive Gynecol. 2021; 28: 1643-49.e1.
23. Fruscalzo A, Dayer A, Londero AP, Guani B, Khomsi F, Ayoubi JM, et al. Endometriosis and Infertility: prognostic value of #Enzian classification compared to rASRM and EFI score. J Pers Med. 2022; 12: 1623.

24. Haas D, Chvatal R, Habelsberger A, Schimetta W, Wayand W, Shamiyeh A, et al. Preoperative planning of surgery for deeply infiltrating endometriosis using the ENZIAN classification. Eur J Obstet Gynecol Reprod Biol. 2013; 166: 99-103.
25. Goncalves MO, Siufi Neto J, Andres MP, Siufi D, de Mattos LA, Abrao MS. Systematic evaluation of endometriosis by transvaginal ultrasound can accurately replace diagnostic laparoscopy, mainly for deep and ovarian endometriosis. Hum Reprod. 2021; 36: 1492-1500.
26. Hill CJ, Fakhreldin M, Maclean A, Dobson L, Nancarrow L, Bradfield A, et al. Endometriosis and the fallopian tubes: theories of origin and clinical implications. J Clin Med. 2020; 9: 1905.

Supplementary 1. https://d2v96fxpocvxx.cloudfront.net/90a4190a-90d9-41a4-a9c9-d78d3fa8efda/content-images/04447691-8b88-48d2-b73e-d4f194fd2e9d.pdf