MIGS 26

55TH GLOBAL CONGRESS ON MIGS

BOSTON, MASSACHUSETTS
NOVEMBER 13-16, 2026

Syllabus

PG-844

Refining Reproductive Healthcare Decisions With Real-Time Ultrasound

HONORARY CHAIR
Charles H. Koh, MD

SCIENTIFIC PROGRAM CHAIR
Nash S. Moawad, MD

PRESIDENT
Michael Hibner, MD, PhD



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PGSIG-844: Refining Reproductive Healthcare Decisions With Real-Time Ultrasound

Chair: Mathew Leonardi
Co-Chair: Sophia N. Palmer
Faculty: Caterina Exacoustos, Yvette S. Groszmann, Mathew Leonardi, Sophia N. Palmer

Course Description

Real-time transvaginal ultrasound is no longer a confirmatory test. In contemporary reproductive care it is a decision-making tool that directly shapes diagnosis, counseling, procedural planning, and outcomes. This two-hour SIG post-graduate didactic course provides a structured, evidence-informed approach to using ultrasound findings consistently and confidently in daily clinical practice, spanning early-career fundamentals through advanced interpretive and procedural applications. Each lecture is designed to translate current evidence into practical workflows, with a final audience-centered Q&A panel to consolidate learning and address real-world implementation challenges.

Learning Objectives: *At the end of this course, the participant will be able to:* 1) Apply a standardized real-time transvaginal ultrasound scanning protocol (including image optimization and documentation) to obtain diagnostic-quality images and reduce inter-operator variability; 2) Diagnose adenomyosis using accepted ultrasound criteria and integrate the findings into patient counseling and reproductive decision-making, including implications for fertility and outcomes; and 3) Use targeted ultrasound evaluation to guide procedural planning in reproductive care, including hysteroscopic surgery planning and ultrasound-based assessment of tubal status and patency.

Course Outline

8:00 am	Welcome, Introduction and Course Overview	M. Leonardi
8:05 am	Standardized Transvaginal Ultrasound: Stepwise Technique and Practical Knobology	M. Leonardi
8:30 am	Ultrasound-to-Hysteroscopy: Preoperative Mapping That Improves Surgical Strategy	S. Palmer
8:55 am	Adenomyosis and Reproduction: Translating Sonographic Findings into Care Pathways	C. Exacoustos
9:20 am	A Modern Approach to Tubal Factor: Patency Assessment by Ultrasound and How to Use the Results	Y. Groszmann
9:45 am	Discussion Questions & Answers	All faculty
10:00 am	Adjourn	

ADA Statement: In accordance with the Americans with Disabilities Act (ADA), please contact CMEsupport@aagl.org should you require any special assistance.

Disclosure of Relevant Financial Relationships

As an ACCME-accredited provider, AAGL is responsible for ensuring that accredited education is fair, balanced, free of commercial bias, and supports safe, effective patient care. AAGL maintains control over all aspects of educational planning, content, faculty selection, delivery, and evaluation.

All individuals in a position to control educational content are required to disclose financial relationships with ACCME-defined ineligible companies within the past 24 months. AAGL identifies and mitigates all relevant financial relationships before individuals assume their respective roles. Educational content is also subject to independent peer review by individuals without relevant financial relationships.

Disclosure information and acknowledgment of any commercial support are provided to learners before the activity to promote transparency and maintain the independence and integrity of the education.

Asterisk (*) denotes no financial relationships with ACCME-defined ineligible companies to disclose.

PLANNER DISCLOSURES

The following members of AAGL have been involved in the educational planning and/or review of this course (listed in alphabetical order by last name).

PROFESSIONAL EDUCATION COMMITTEE

Harold Wu, MD* - Chairman
Adrian Balica, MD*
Jamal Mourad, DO – Proctor: Intuitive Surgical
Jude Okohue, MD*
Steven Radtke, MD*
Anna Reinert, MD*
Jean Uy-Kroh, MD*
Linda Bradley, MD, AAGL Medical Director*
Linda Michels, AAGL Executive Director*
Linda Bell, AAGL Admin Support*
Nancy Williams, COO, CME Consultants*

SCIENTIFIC PROGRAM COMMITTEE

Nash Moawad, MD, MS, Chairman – Consultant (ended 12/2024): Medtronic, Womed, Integra Life Sciences
Amani Harris, MD*
Ted Lee, MD – Advisory/Consultant: Johnson & Johnson, Regeneron Pharmaceuticals
Nucelio Lemos, MD, PhD – Speakers Bureau: Pfizer, Inc., Medtronic; Advisory Board: Knight Therapeutics, Vecfer Pharma
Mario Malzoni, MD*
Emad Mikhail, MD – Consultant: Johnson & Johnson
Hannah Palin, MD*
Megan Wasson, DO*
Michael Hibner, MD, PhD*
Jose "Tony" Carugno, MD*
Angela Chaudhari, MD - Consultant: Tag/Dream Medical, Johnson & Johnson; Speakers Bureau: Johnson & Johnson
Linda D. Bradley, MD, Medical Director*
Linda Michels, Executive Director, AAGL*

COURSE CHAIR DISCLOSURE

Mathew Leonardi, MD, PhD - Speakers Bureau: AbbVie, Canon, GE Healthcare, Knight Therapeutics, Pfizer, Samsung

COURSE CO-CHAIR DISCLOSURE

Sophia N. Palmer, MD – Clinical Events Committee Chair (FINALE Clinical Trial): Femsys, Inc.

FACULTY DISCLOSURES

The following faculty have agreed to support their presentations and clinical recommendations with the best available evidence from the medical literature (in alphabetical order by last name).

Caterina Exacoustos, MD, PhD*
Yvette S. Groszmann, MD, MPH – Speakers Bureau: GE Healthcare
Mathew Leonardi, MD, PhD - Speakers Bureau: AbbVie, Canon, GE Healthcare, Knight Therapeutics, Pfizer, Samsung
Sophia N. Palmer, MD – Clinical Events Committee Chair (FINALE Clinical Trial): Femsys, Inc.

MITIGATION OF RELEVANT FINANCIAL RELATIONSHIPS

All relevant financial relationships have been mitigated.

Drs. Lee, Lemos, Mikhail, and Chaudhari's planning decisions, as part of the Scientific Program Committee (SPC), were peer reviewed by other planners on the SPC who had disclosed no financial relationships with ineligible companies, and found to be fair, balanced, and free of commercial bias. Dr. Moawad's financial relationships ended 12/2024, thus mitigating them. For most of his AAGL Professional Education Committee service, Dr. Mourad had no financial relationships to disclose. He recently disclosed a new relationship as a Proctor for Intuitive Surgical. Since then, he has not participated in activities involving control or influence over accredited educational content; therefore, no additional mitigation was necessary.

Drs. Leonardi and Palmer's roles as Course Chair and Co-Chair were limited primarily to course oversight and moderation, rather than development of educational content. Any planning decisions or content under their influence were subject to independent peer review by individuals without relevant financial relationships.

The presentation content for course faculty, Drs. Groszmann, Leonardi, and Palmer, has been peer reviewed and found to be fair, balanced, and free from commercial bias.

Standardized Transvaginal Ultrasound

Stepwise Technique and Practical Knobology

Mathew Leonardi, MD, PhD
Department of Obstetrics and Gynecology, McMaster University

AAGL 2026 · PGSIG-844 · Saturday, November 14, 2026

1

Objectives

- Follow the same stepwise sequence for every transvaginal scan
- Use the machine controls to get a diagnostic-quality image
- Save and report images the same way every time to reduce differences between operators

2

Consensus terminology

- Findings depend on the operator, the machine settings, and the words used to describe them
- A fixed sequence and shared terms make scans comparable

Area	Consensus
Uterine wall and masses	MUSA
Endometrium and intrauterine lesions	IETA
Adnexal masses	IOTA
Endometriosis	IDEA

3

Preparing for the scan

- Explain the exam, obtain consent, and offer a chaperone
- Bladder empty
- Patient supine with the hips elevated
- Probe cleaned and covered, gel inside and outside the cover
- Record cycle day, last menstrual period, and hormonal treatment
- Confirm patient ID, date, and the gynecology preset

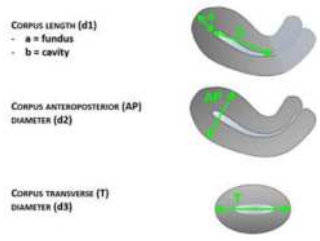
4

The scan, step by step

1. Uterus and cervix
   Sagittal plane, cervix to fundus
2. Uterus
   Transverse plane, sweep from cervix to fundus
3. Endometrium
   Thickness, echogenicity, midline
4. Right ovary and adnexa
   Size, morphology, mobility
5. Left ovary and adnexa
   Size, morphology, mobility
6. Posterior compartment
   Cul-de-sac and sliding sign
7. Targeted assessment
   Tenderness, mobility, Doppler as needed

5

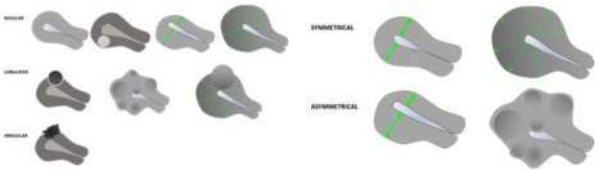
Measuring the uterus



- Corpus length (d1): fundal wall plus cavity
- Anteroposterior diameter (d2): largest
- Transverse diameter (d3): largest
- Add cervical length for total uterine length
- Volume (cm^3) = d1 × d2 × d3 × 0.523

6

Uterine contour and wall symmetry

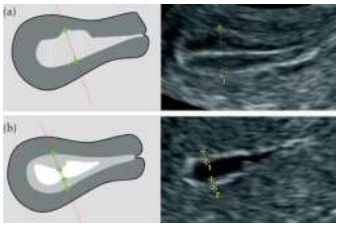


Serosal contour

Wall symmetry

7

Measuring the endometrium



- Sagittal plane
- Measure where the endometrium is thickest
- With fluid, measure both single layers and add them
- If asymmetrical, report anterior and posterior separately
- Record “not measurable” when it cannot be delineated

8

Describing the endometrium

Thickness	Millimeters, or not measurable
Echogenicity and pattern	Uniform or non-uniform
Midline	Linear, non-linear, irregular, not defined
Endo-myometrial junction	Regular, irregular, interrupted, not defined
Intracavity fluid	Absent or present

9

Grayscale controls

Control	Effect	How to use it
Preset	Starting machine settings	Begin with the gynecology preset
Depth	How far the image reaches	Fill the screen with the organ examined
Gain	Overall brightness	Fluid black, myometrium mid-gray
Focus	Sharpest zone of the image	Place it at the level of the target
Frequency	Detail versus penetration	Higher for detail, lower for a large uterus
Zoom	Magnifies the region of interest	Use before placing calipers

10

Color Doppler controls

- Velocity scale (PRF): 0.3 to 0.6 kHz, or 3 to 6 cm/s, for uterine vessels
- Gain: as high as possible without background noise
- Box: small, over the target only
- Pressure: light, since probe pressure can hide flow
- Keep the probe and the image steady
- Score flow 1 to 4: none, minimal, moderate, abundant

11

Grayscale and color Doppler



12

Dynamic assessment

- Sliding sign: uterus and ovaries glide over the bowel when pressed with the probe and the abdominal hand
- Site-specific tenderness: press on each structure and ask where it hurts
- Mobility: note ovarian fixation and any fixed uterus
- Save a short clip of the sliding sign

13

Documentation and reporting

Images to save

- Uterus, sagittal, with cervix
- Uterus, transverse, at the fundus
- Endometrium with thickness measured
- Each ovary, labeled and measured
- Any lesion in two planes, with Doppler
- Clip of the sliding sign

Report

- Same order as the scan
- Consensus terms
- State what could not be assessed
- Answer the clinical question

14

Reducing variability

- One protocol and one report template across the unit
- Shared machine presets
- Second-reader review of saved images
- Feedback to trainees against the checklist

15

Summary

- Same sequence and same terms, every scan
- Optimize the image before measuring
- Save a defined image set and report it in consensus language

16

Questions

Mathew Leonardi, MD, PhD · leonam@mcmaster.ca · @drmathewleonardi

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References

1. Van den Bosch T, Heremans R, Landolfo C, et al. ISUOG Consensus Statement on sonographic assessment of the endometrium: how to perform a gynecological ultrasound scan and report the findings. Ultrasound Obstet Gynecol. 2026;67(2):241-258. doi:10.1002/uog.70163
2. Leone FPG, Timmerman D, Bourne T, et al. Terms, definitions and measurements to describe the sonographic features of the endometrium and intrauterine lesions: a consensus opinion from the International Endometrial Tumor Analysis (IETA) group. Ultrasound Obstet Gynecol. 2010;35(1):103-112. doi:10.1002/uog.7487
3. Van den Bosch T, Dueholm M, Leone FPG, et al. Terms, definitions and measurements to describe sonographic features of myometrium and uterine masses: a consensus opinion from the Morphological Uterus Sonographic Assessment (MUSA) group. Ultrasound Obstet Gynecol. 2015;46(3):284-298. doi:10.1002/uog.14806
4. Timmerman D, Valentin L, Testa AC, et al. Terms, definitions and measurements to describe the sonographic features of adnexal tumors: updated consensus opinion from the International Ovarian Tumor Analysis (IOTA) Group. Ultrasound Obstet Gynecol. 2026;67(5):702-724. doi:10.1002/uog.70191
5. Guerriero S, Condous G, Van den Bosch T, 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(3):318-332. doi:10.1002/uog.15955

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Ultrasound-to-Hysteroscopy:

Preoperative Mapping That Improves Surgical Strategy

Sophia N. Palmer, MD
Complex Benign Gynecology
Advanced Gynecologic Ultrasound & Imaging

NOVEMBER 13-16, 2026 · BOSTON · #AAGL26

1

Disclosure

- Clinical Events Committee, *Femsys* FINALE trial.

2

Objectives

- Describe the components of the STEPW classification system and risk-stratification tool.
- Be able to identify submucosal fibroids that are at higher risk for incomplete resection and intraoperative complications.

3

Fibroid Classification

Traditional Descriptive & General Fibroid Terminology:

- Submucosal
- Intramural
- Subserosal
- Pedunculated
- Transmural
- Cervical
- Broad ligament

Submucosal classification by Wamsteker,et al 1993

Transcervical hysteroscopic resection of submucous fibroids for abnormal uterine bleeding: results regarding the degree of intramural extension

1993

Adoption by the **European Society for Gynecologic Endoscopy (ESGE)**

ESGE classification of submucous myomas

Type	Degree of intramural extension
0	No intramural extension
1	Intramural extension <50%
2	Intramural extension ≥50%

Lasmar et al. 2012

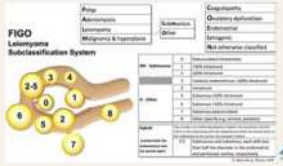
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Fibroid Subclassification - FIGO

2011 FIGO Abnormal Uterine Bleeding (AUB) System 2:

- Classified potential underlying causes of AUB in the reproductive years.
  - Facilitate research, education, and clinical care.
- Utilized the submucous myoma category according to Wamsteker's classification.
- Added further categorizations for intramural, subserosal, transmural and other (cervical, parasitic, etc.) myomas.





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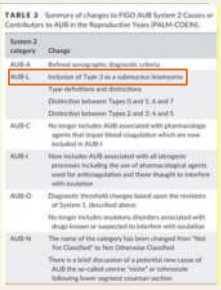
Fibroid Subclassification - FIGO

2018 FIGO Update

- Type 3 myomas considered submucosal **because of contact with the endometrium, a feature that is shared by other submucous myomas (Types 0, 1, and 2).**
- Intramural location, without focal distortion of the endometrial cavity, is a characteristic of Types 4 and higher.
- Types 0 and 7 have a **stalk diameter that is 10% or less** than mean diameter of myoma.
- Hysteroscopy deemed standard for distinguishing between Type 2 and 3 myoma - based on the lowest filling pressure that allows visualization of endometrial cavity.

The two FIGO systems for normal and abnormal uterine bleeding symptoms and classification of causes of abnormal uterine bleeding in the reproductive years: 2018 revisions

DOG 2018



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Submucosal Fibroid Classification

Original articles JMIG 2005

Submucous myomas: A new presurgical classification to evaluate the viability of hysteroscopic surgical treatment—Preliminary report

Ricardo Bassil Lasmar, MD, Paulo Roberto Mussel Barrozo, MD, Rogério Dias, MD, PhD, and Marco Aurélio Pinho de Oliveira, MD, PhD

Table 1 Myoma classification

Points	Penetration	Size	Base	Third	Lateral wall (+1)
0	0	<2 cm	<1/3	lower	
1	<50%	>2 to 5 cm	>1/3 to 2/3	middle	
2	>50%	>5 cm	>2/3	upper	
Score	+	+	+	+	=

0 = score 0 1 = score 1 2 = score 2

Figure 1 The penetration level of the myoma into myometrium.

Figure 2 The extension of the base of the nodule with respect to the wall of the uterus.

Figure 3 Topography. (When the myoma is on the lateral wall, an extra point is added.)

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Submucosal Fibroid Classification

Original articles JMIG 2005

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Figure 3 Topography. (When the myoma is on the lateral wall, an extra point is added.)

8

Submucosal Fibroid Classification

Original Article JMIG 2012

A New System to Classify Submucous Myomas: A Brazilian Multicenter Study

Ricardo Bassil Lasmar, MD, PhD*, Romualdo Portugal Lasmar, MD, Roger Keller Celeste, DR, PhD, Daniela Bahar da Rosa, MD, Daniella de Barros Depes, MD, and Reginaldo Guedes Coelho Lopes, MD, PhD

Size, Topography, Extension of the base, Penetration and lateral Wall position

	Size (cm)	Topography	Extension of the base	Penetration	Lateral Wall	Total
0	> 2 to 5	Low	≤ 1/3	0	+1	
1	> 2 to 5	Middle	>1/3 to 2/3	≤ 50%		
2	> 5	Upper	> 2/3	> 50%		
Score	+	+	+	+	+	

STEPW Score

Score	Group	Complexity and therapeutic options
0 to 4	I	Low complexity hysteroscopic myomectomy.
5 to 6	II	High complexity hysteroscopic myomectomy. Consider GnRH use? Consider Two-step hysteroscopic myomectomy.
7 to 9	III	Consider alternatives to the hysteroscopic technique

9

Myometrial assessment - MUSA

Terms, definitions and measurements to describe sonographic features of myometrium and uterine masses: a consensus opinion from the Morphological Uterus Sonographic Assessment (MUSA) group

UOG 2015

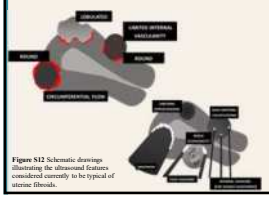


Figure S12 Schematic drawings illustrating the ultrasound features considered currently to be typical of uterine fibroids.

10

Myometrial assessment - MUSA

Outer lesion-free margin (OFM)†‡ (Figure S5)	—	Minimum distance between serosal surface and outermost border of lesion†‡
Inner lesion-free margin (IFM)†‡ (Figure S5)	—	Minimum distance between endometrium and inner border of lesion†‡



Figure S5 Schematic drawings illustrating measurement of the inner lesion free margin (IFM) (green arrow and dotted line) and outer lesion free margin (OFM) (yellow arrow and dotted line) of a lesion.

11

Imaging

- **ULTRASOUND -** First line imaging modality.
  - Transabdominal
  - Transvaginal
  - 2D/3D
- **SALINE INFUSION SONOGRAPHY**
  - 2D/3D
- **MRI**



2D TVUS



3D SIS

Images courtesy of Dr. Yvette Grazmann

12

Saline Instillation; Type 0



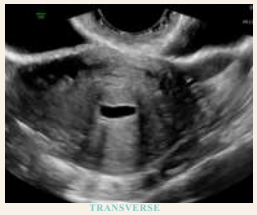
Media courtesy of Dr. Caterina Exacoustos

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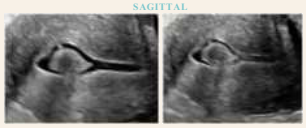
Type 1 and 2 Submucosal Fibroids



SAGITTAL



TRANSVERSE

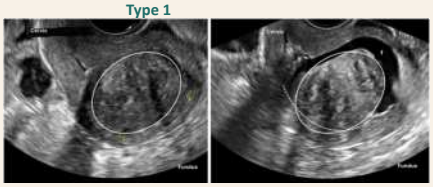




Media courtesy of Dr. Scott Young

14

Type 1



Alphonse 2025

Add more images

Adhesion



15

STEPW score

Score 0–4: **Low complexity**
Single procedure with complete resection is likely.

Score 5–6: **High complexity hysteroscopic myomectomy**
Increased risk of incomplete resection
Prolonged operative times
Elevated fluid deficit.

Consider preoperative medical management
Possible staged procedure.

Score 7–9: **Consider alternative route.**
Hysteroscopic removal carries a high risk of failure or severe complications (such as uterine perforation or fluid overload).

	Size (cm)	Topography	Extension of the base	Penetration	Lateral Wall	Total
0	< 2 to 5	Low	≤ 1/3	0	✱ 1	
1	> 2 to 5	Middle	>1/3 to 2/3	≤ 50%		
2	> 5	Upper	> 2/3	> 50%		
Score	✱		✱	✱	✱	

Score	Group	Complexity and therapeutic options
0 to 4	I	Low complexity hysteroscopic myomectomy
5 to 6	II	High complexity hysteroscopic myomectomy. Consider GnRH use? Consider Two-step hysteroscopic myomectomy.
7 to 9	III	Consider alternatives to the hysteroscopic technique

Lasmar 2005. Lasmar 2011
Lasmar 2012. Camanni 2012

16

From SIS Findings to Surgical Plan

Other Considerations:

- Outer lesion-free Margin (OFM)
- Location: Isthmus; cornua; lateral; fundus
- Serosal adhesions to viscera
- Multiple submucous myomas
  - Relationship to each other
- Multiple other myomas including Type 3
- Other ultrasound findings: ex adenomyosis, isthmocele

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From SIS Findings to Surgical Plan



- **Outer lesion-free Margin (OFM)**

Minimum distance between the uterine serosal surface and the outermost border of the lesion.

Concern:
- Thin OFM increases the risk of uterine wall perforation & risk of injury to surrounding structures.

The margin decreases with cavity distension but can also increases with each hysteroscopic resection phase.

10 mm : Minimum margin set during a cold loop series
5 mm: Accepted by other authors; intraoperative ultrasound advised when the margin is very thin
*** Hysteroscopic surgical expertise ***

Casadio 2011
Loddo 2024

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From SIS Findings to Surgical Plan

Isthmus/ Lower uterine segment

- Wall thinner than the mid-corpus
- Bladder in front, uterine vessels at each side
- Narrow segment

Consider
- Partially filled bladder
- Short passes, less energy use
- Ultrasound guidance

Cornua

- Thinnest wall of the uterus
- Ostium and interstitial tube laterally
- Uterine and ovarian arterial anastomosis nearby

Consider
- Cold loop or 5 Fr instruments at the base
- Staged procedure
- Ultrasound guidance

Fundus

- The loop meets the myoma end-on, so slicing may be difficult and awkward
- Wall thickness ~ 10–11 mm in a normal uterus

Consider
- Consider tissue removal device
- cold loop for the base
- Free margin in both planes

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From SIS Findings to Surgical Plan

Posterior Wall

- Rectum and sigmoid lie behind the wall
- Deep resection & use of electrosurgery can injure adherent bowel without perforation & delayed presentation/diagnosis.

Consider
- Bipolar electrosurgery
- Avoid deep resection and coagulation at the base

Review **sliding sign** on the pre-op scan and assess uterine mobility on EUA.

Lateral

- Uterine vessels along this wall
- Higher risk when the myoma is low or large
- STEPW adds one point

Consider
- Avoid deep resection
- Consider intra-operative ultrasound

Color Doppler of the fibroid base

20

Multiple myomas and adhesions

31.3% Adhesions after removal of one myoma
Monopolar resection
Second look after the first menses (Taskin 2000)

45.5% Adhesions after multiple myomas (Taskin 2000)

4.2% Adhesions with Cold loop
688 women, one to five myomas each
No barrier used (Mazzon 2014)

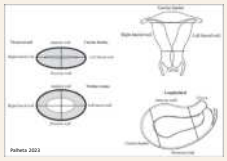
12.8% vs 39.1%
Lower risk of adhesions with Hyaluronic acid gel use vs. against no gel
Randomized trial of 70 women(Huang 2020)

Taskin, 2000 Huang 2020
Mazzon,2014 ISGE, EJOG 2022

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SIS Report

- **Procedure:** Cycle day, catheter type, volume instilled, quality of distension
- **Number: List each submucosal myomas**
  - Note if myomas are opposing(opposite) or apposing (next to).
- **Size**
  - Largest diameter, in three planes.
- **Location**
  - Wall: Fundal/Anterior/Posterior/Right Lateral/Left Lateral
  - Topography,, distance to the internal os and to each tubal ostium.
- **Site/FIGO type**
  - Intracavitary portion: line joining the two endo-myometrial edges
  - Assess in sagittal & transverse views
- **Free margin**
  - Shortest distance from myoma to serosa (MUSA outer lesion-free margin)
- **Other:**
  - Endometrium, polyps, adenomyosis, scars, niche, adhesions, vascularity, etc.
- **STEPW score. Flags for the surgeon; other guidance.**





Van den Bosch 2015
Leone 2010
Pelkets 2023

22

When SIS is not enough

SIS Considerations

- 75% agreement with hysteroscopy for **Type 2** myomas vs. 92% for **Types 0 and 1**
- Six of 32 **Type 3** fibroids on 3D ultrasound were **Type 2** at surgery.
- Pressure at SIS is unmeasured; distension and lesion protrusion varies.

When to consider MRI

- Enlarged uterus
- Multiple myomas
- High body mass index
- Lesion of uncertain nature
- Other pelvic lesions

Salim 2005
Loddo 2024
ISGE, EJOG 2022

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From Initial Ultrasound to the OR

Finding at SIS	Plan
Type 0, STEPW 4 or less	One step; tissue removal device or slicing
Type 1 or 2, STEPW 4 or less	One step expected; slice the dome, then cold loop in the capsule plane
STEPW 5 or 6	Prepare (Ex. GnRH analogue,); ultrasound guidance; consent for two steps
STEPW 7 to 9	Consider a non-hysteroscopic route
Thin margin; isthmic or cornual site	Intraoperative ultrasound; limited or no energy at the base; stage early
Posterior wall; fixed bowel on scan	Treat as a thin margin; bipolar; no deep coagulation
Multiple or opposing myomas	Stage if needed; hyaluronic acid gel; early second look
Large or deep myomas: fluid risk	Vasopressin; pressure below MAP; agree on max deficit limit w/ Anesthesia team
Large uterus, many myomas, high BMI	Add MRI before choosing the route (ISGE, grade 1A)

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From Initial Ultrasound to the OR

Scan → **SIS** → **Map** → **Plan** → **Check**

- **Scan**: Transvaginal scan; Submucous myoma suspected
- **SIS**: Two planes in 2D & 3D volume with cavity distension
- **Map**: STEPW score; Identify areas of anatomical concern
- **Plan**: Choose route; Instruments Electrosurgery Tissue morcellation Fibroid ablation; US guidance
- **Check**: SIS after surgery: - Residual myoma - Adhesions

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Conclusion

- Saline infusion sonography, particularly 3D, is a useful imaging tool for evaluation of the endometrial cavity and mapping of submucosal myomas, their intramural relationship and proximity to the uterine serosa
- The STEPW (Size, Topography, Extension of the base, Penetration and lateral Wall position) classification system for submucosal myomas is recommended to better predict surgical complexity:
  - One-step complete resection
  - Patient counseling for possible staged procedures
  - Consider alternative or combined surgical approaches.
- Use of office/diagnostic hysteroscopy remains essential when direct cavity assessment is needed, particularly to confirm intracavitary anatomy and fibroid accessibility that will affect the final operative procedure.

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Acknowledgments

- Board members of Advanced Gynecologic Ultrasound & Imaging SIG
  - *Mathew Leonardi*
  - *Alessandra DiGiovanni*
  - *Caterina Exacoustos*
  - *Yvette Groszmann*
  - *Scott Young*
- Dr. Linda Bradley
- Linda Michaels
- Seth Spirrison
- AAGL staff

27

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PC 844: Refining Reproductive Healthcare Decisions With Real-Time Ultrasound

ADENOMYOSIS
the correct US diagnosis and impact on reproductive outcome

Caterina Exacoustos
University of Rome "Tor Vergata" ITALY
Faculty of Medicine
Department of Surgical Sciences
Obstetric and Gynecologic Unit

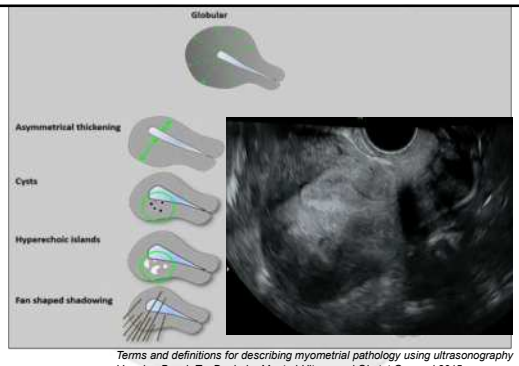
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PC 844: Refining Reproductive Healthcare Decisions With Real-Time Ultrasound

I have no financial relation to disclose

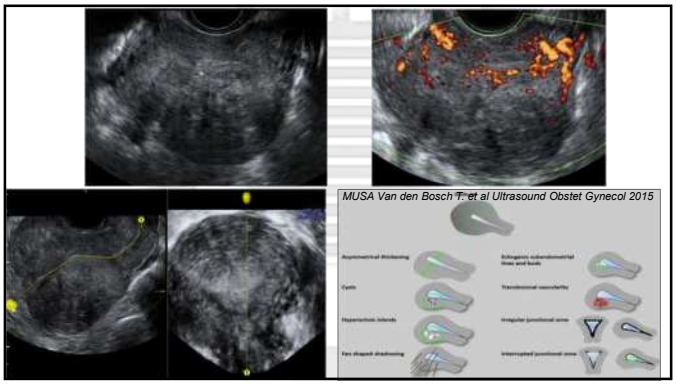
Caterina Exacoustos
University of Rome "Tor Vergata" ITALY
Faculty of Medicine
Department of Surgical Sciences
Obstetric and Gynecologic Unit

2



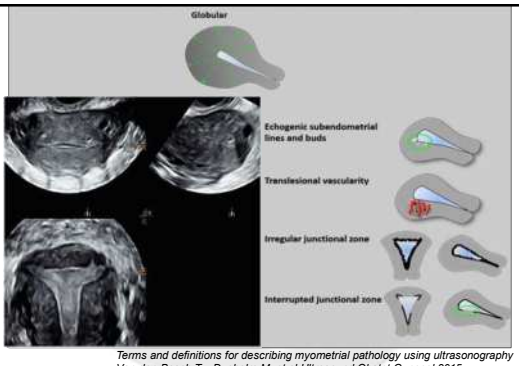
Terms and definitions for describing myometrial pathology using ultrasonography
Van den Bosch T. , Dueholm M. et al Ultrasound Obstet Gynecol 2015

3



MUSA Van den Bosch T. et al Ultrasound Obstet Gynecol 2015

4



Terms and definitions for describing myometrial pathology using ultrasonography
Van den Bosch T. , Dueholm M. et al Ultrasound Obstet Gynecol 2015

5

3D-Transvaginal ultrasound

Adenomyosis: three-dimensional sonographic findings of the junctional zone and correlation with histology

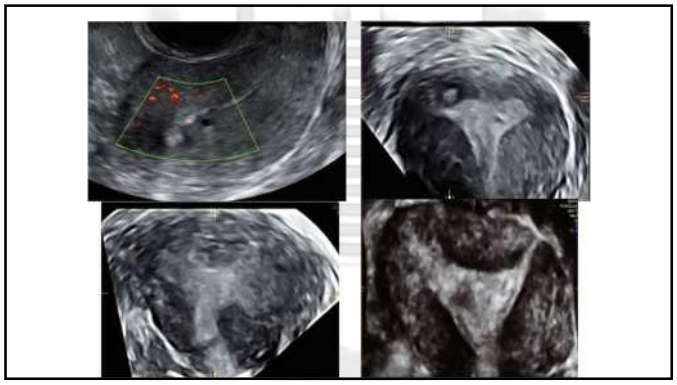
C. EXACOUSTOS, L. BRIENZA, A. DI GIOVANNI, B. SZABOLCS, M. E. ROMANINI, E. ZUPI and D. ARDUINI

TVS finding	Sens. (% (95% CI))	Spec. (% (95% CI))	PPV (% (95% CI))	NPV (% (95% CI))	LR+ (95% CI)	LR− (95% CI)	Accuracy (% (95% CI))
Overall*							
2D-TVS	71 (56–83)	90 (74–97)	86 (66–95)	82 (68–91)	7.5 (2.9–19.4)	0.28 (0.15–0.51)	83 (73–90)
3D-TVS	91 (74–97)	88 (72–95)	83 (68–94)	92 (78–98)	7.3 (3.2–16.6)	0.11 (0.03–0.31)	89 (80–94)

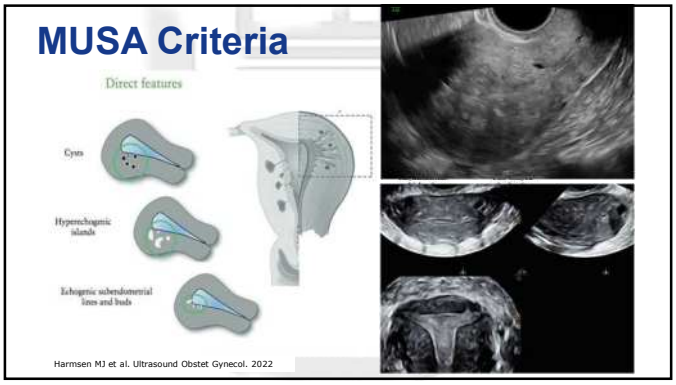
The coronal section of the uterus by 3D-TVS permits accurate evaluation and measurement of the JZ, and its alteration has good diagnostic accuracy for adenomyosis

Ultrasound Obstet Gynecol 2011

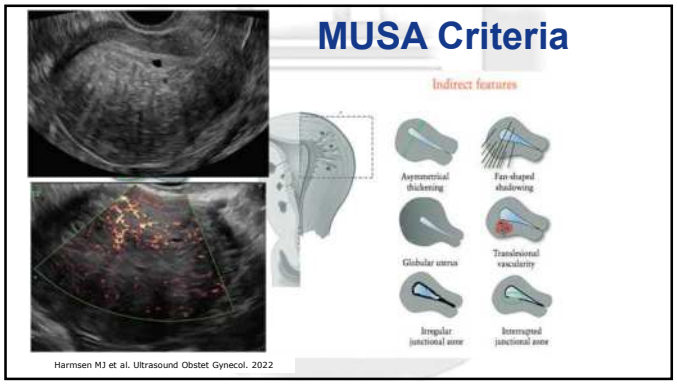
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MUSA Criteria
Direct features
Cysts
Hyperechogenic islands
Echogenic subendometrial lines and buds
Harmsen MJ et al. Ultrasound Obstet Gynecol. 2022

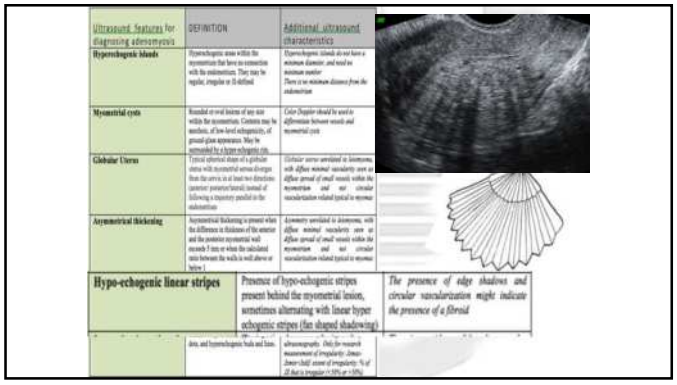
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MUSA Criteria
Indirect features
Asymmetrical thickening
Fan-shaped shadowing
Globular uterus
Translesional vascularity
Irregular junctional zone
Interrupted junctional zone
Harmsen MJ et al. Ultrasound Obstet Gynecol. 2022

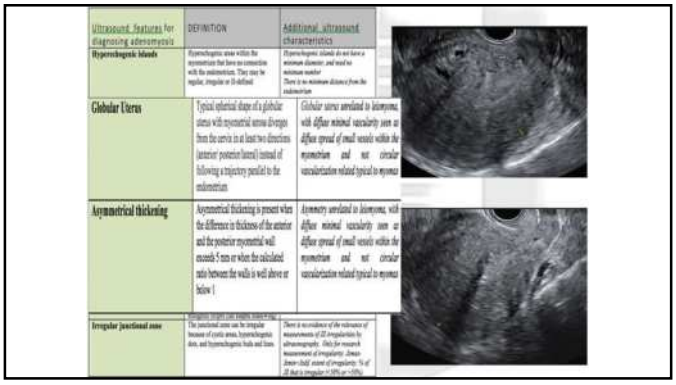
9


Histopathology
Standardizing the histopathological diagnosis of adenomyosis: an international Delphi consensus
Table 2. Recommendations for assessment of hysterectomy specimens based on the Delphi consensus guideline
Parameter
Agreed definition
Number of Blocks for Examination
Diagnostic Cut-off
Amount of Glandular/ Stromal Tissue
Descriptors of Adenomyosis
Additional Features

10


Ultrasound features for diagnosing adenomyosis
DEFINITION
Additional ultrasound characteristics
Hyperechogenic islands
Myometrial cysts
Globular Uterus
Asymmetrical thickening
Hypo-echogenic linear stripes
Presence of hypo-echogenic stripes present behind the myometrial lesion, sometimes alternating with linear hyper echogenic stripes (fan shaped shadowing)
The presence of edge shadows and circular vascularization might indicate the presence of a fibroid

11

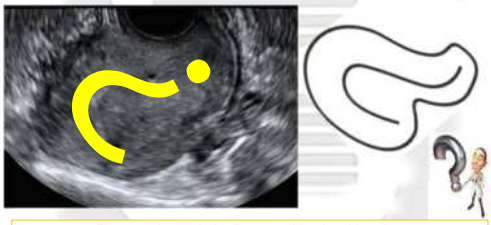

Ultrasound features for diagnosing adenomyosis
DEFINITION
Additional ultrasound characteristics
Hyperechogenic islands
Globular Uterus
Asymmetrical thickening
Irregular junctional zone

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SONOGRAPHIC SIGN ASSOCIATED TO THE PRESENCE OF ADENOMYOSIS

Ultrasound Obstet Gynecol. 2015

Nadine Di Donato, Valentina Bertoldo, Giulia Montanari, Letizia Zannoni, Giacomo Caprara, Renato Seracchioli



The " question mark sign " was considered positive when
the corpus uteri was flexed backwards,
the endometrium of the uterine fundus was deviated
versus the pelvis posterior compartment
and the cervix was directed frontally towards the urinary bladder

13

SONOGRAPHIC SIGN ASSOCIATED TO THE PRESENCE OF ADENOMYOSIS

Ultrasound Obstet Gynecol. 2015

Nadine Di Donato, Valentina Bertoldo, Giulia Montanari, Letizia Zannoni, Giacomo Caprara, Renato Seracchioli

50 fertile women ⇨ elective hysterectomy

Histological evaluation
Prevalence of adenomyosis 48% (24/50)

TVS diagnosis vs histology
sensitivity 83% and the specificity 88
The percentage of agreement between histology and TVS of 86%



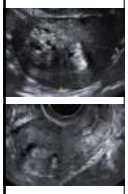
Question mark sign

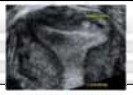


After the introduction of question mark
sensitivity 92% and the specificity 88%
The percentage of agreement between histology and TVS of 90%

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ADENOMYOSIS



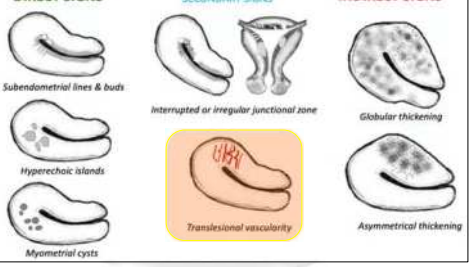




DIRECT SIGNS

SECONDARY SIGNS

INDIRECT SIGNS

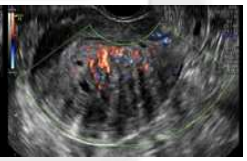


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16

Quantitative ultrasound measurement of uterine contractility in adenomyotic vs. normal uteri: a multicenter prospective study

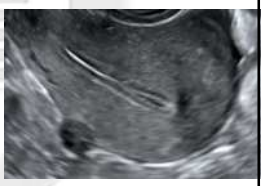
FERTIL STERIL 2024

Connie O. Bess, M.D., M.Sc.,[a,b,c] Sophie Thomas, M.D., M.Sc.,[a] Anna de Boer, B.Sc.,[a] Yizhou Huang, M.Sc.,[a] Brunella Zazzi, M.D., Ph.D.,[a] Virginia Fonzo, M.D.,[a] Attilio di Spiezio di Sardo, M.D., Ph.D.,[a] Nikos Christofolidis, M.D.,[a] Hubertus A. A. M. van Vliet, M.D., Ph.D.,[a,c] Massimo Mischi, M.D.,[a] and Benedictus C. Schoot, M.D., Ph.D.[a,c]

Uterine contractility was evaluated in patients with adenomyosis compared with healthy controls using a quantitative 2D TVUS with a 4 minute recordings and four uterine contractility features extracted using a speckle tracking algorithm.

Uterine contractility differs in patients with adenomyosis compared with healthy controls throughout the phases of the menstrual cycle.

This suggests an etiologic mechanism for the infertility and dysmenorrhea seen in patients with adenomyosis. Moreover, it presents new potential therapeutic targets and diagnostic markers.



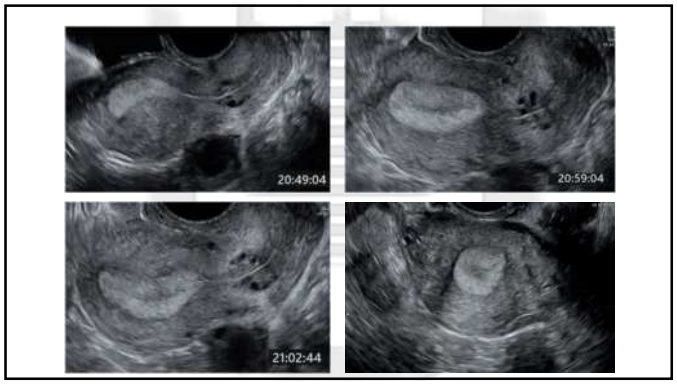
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Ultrasound and myometrial evaluation
ADENOMYOSIS OVER DIAGNOSIS?

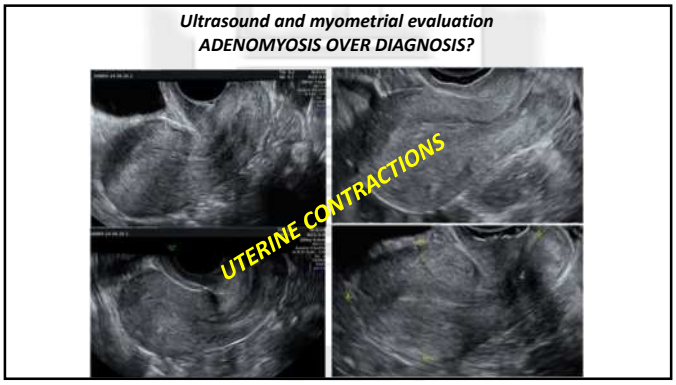




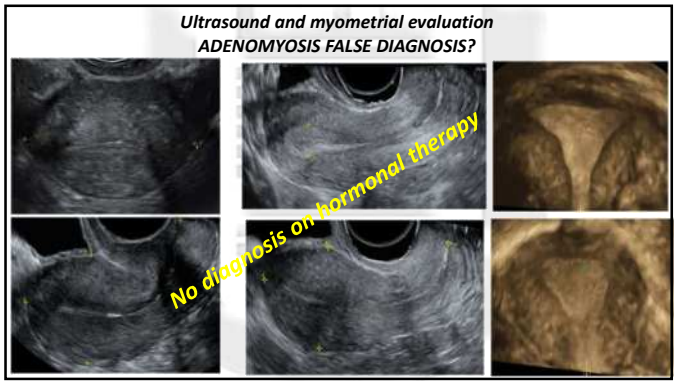
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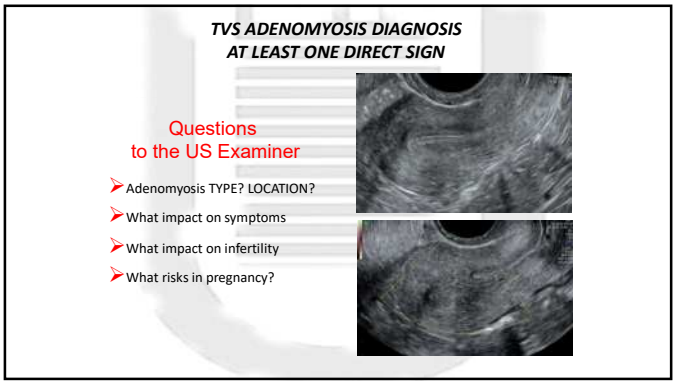
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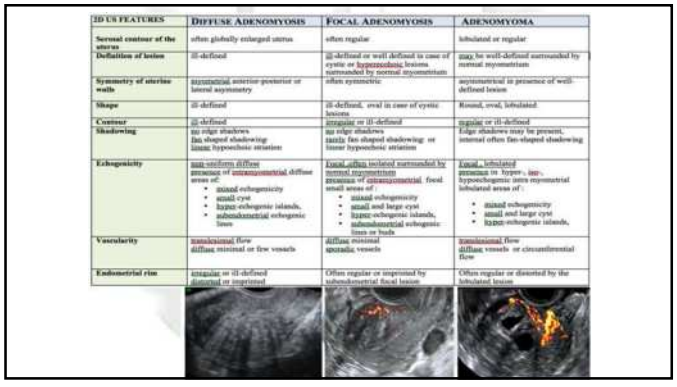
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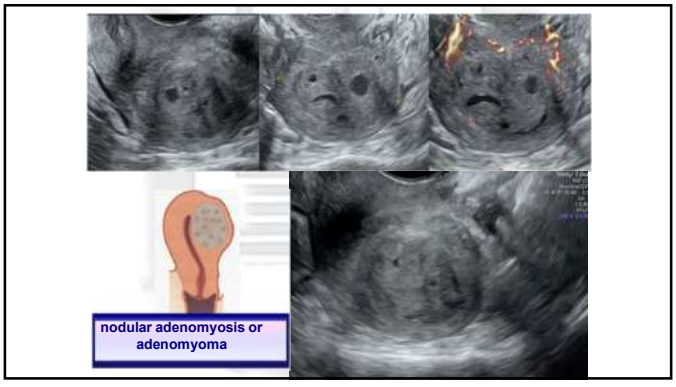
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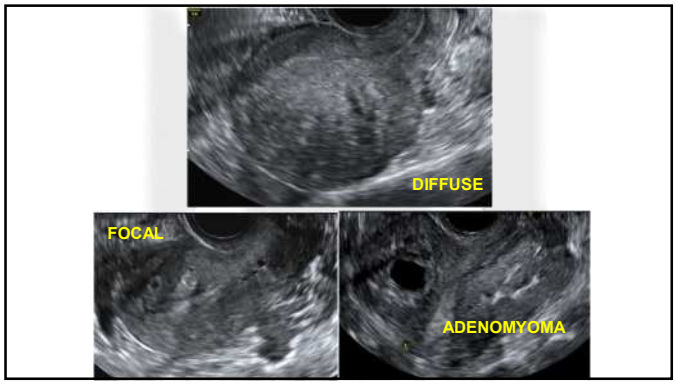
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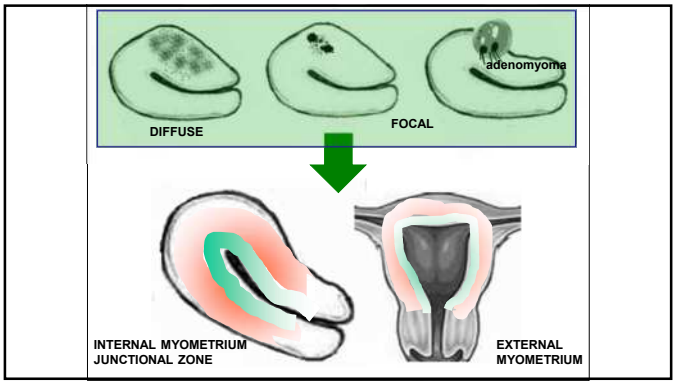
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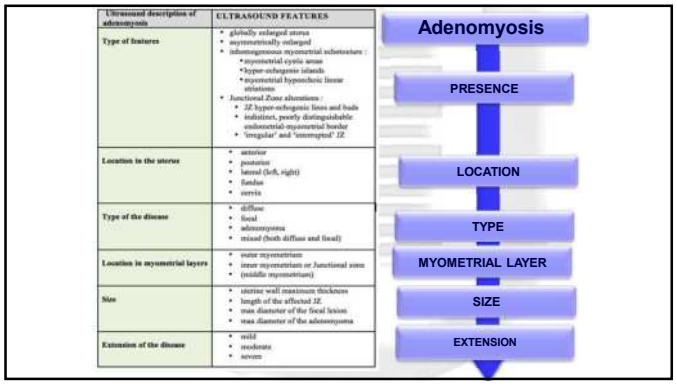
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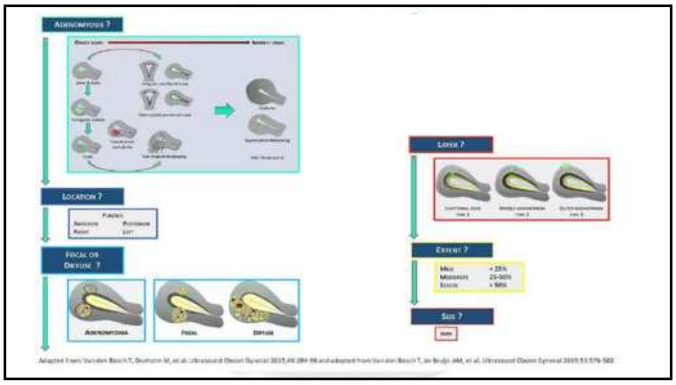
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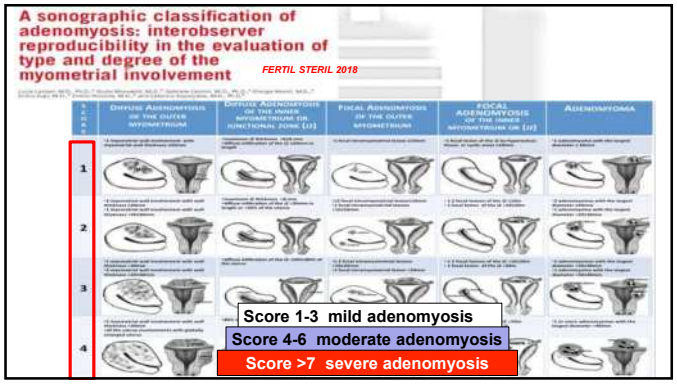
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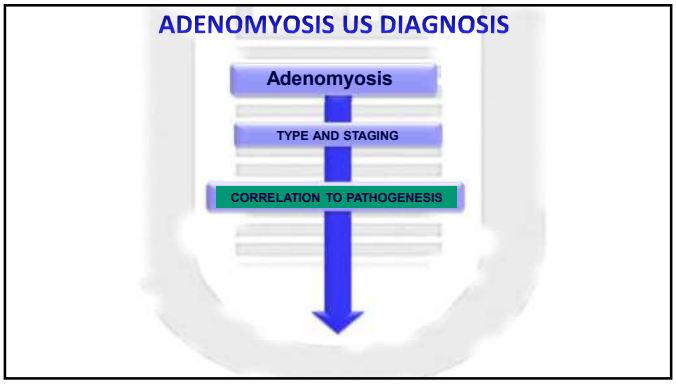
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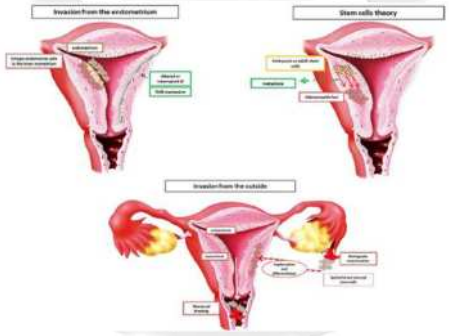


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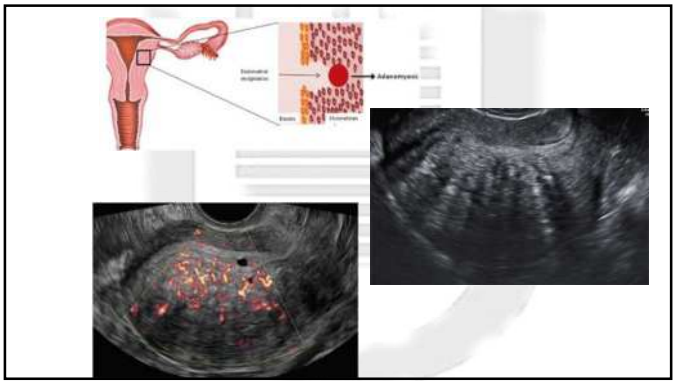


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ADENOMYOSIS PATHOGENESIS



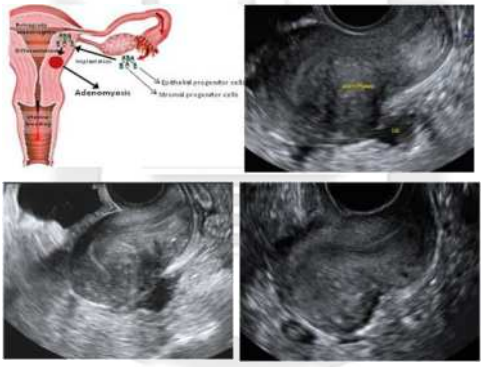
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Reprod Sci. 2014 Feb 14. [Epub ahead of print]

Preoperative and Postoperative Clinical and Transvaginal Ultrasound Findings of Adenomyosis in Patients With Deep Infiltrating Endometriosis.

Lazzeri L.[1], Di Giovanni A, Exacoustos C, Tosti C, Pinzauti S, Malzoni M, Petraglia F, Zupi E.

TVS recognized features of adenomyosis were found in 59/121 patients

48.7%

Distribution of DIE sites	Group A (n=62)	Group B (n=59)	P value
LOCATION	PREVALENCE (%)	PREVALENCE (%)	
Bladder infiltration	6.4% (4/62)	5.8% (3/59)	1.0000
Right uterosacral ligament	46.7% (29/62)	45.7 %(27/59)	1.0000
Left uterosacral ligament	56.4% (35/62)	54.2% (32/59)	0.8560
Torus	48.3% (30/62)	49.1% (29/59)	0.8564
Recto-vaginal septum	35.4% (22/62)	38.9% (23/59)	0.7107
Vagina	24.1% (15/62)	23.7% (14/59)	1.0000
Recto-sigmoid junction	33.8% (21/62)	32.2% (19/59)	1.0000
Caudal rectum	67.7% (42/62)	69.4% (41/59)	0.7024
Obliteration of the Douglas pouch	64.5 %(40/62)	64,4% (38/59)	0.5694

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ADENOMYOSIS US DIAGNOSIS

Adenomyosis

TYPE AND STAGING

CORRELATION TO PATHOGENESIS

CORRELATION TO SYMPTOMS

ADEQUATE MEDICAL OR SURGICAL MANAGEMENT

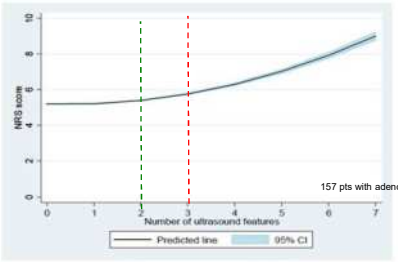
36

Association between ultrasound features of adenomyosis and severity of menstrual pain

Ultrasound Obstet Gynecol 2016; 47: 779–783

J. NAFTALIN, W. HOO, N. NUNES, T. HOLLAND, D. MAVRELOS and D. JURKOVIC

Figure 1– The relationship between the number of ultrasound features of adenomyosis and NRS score



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Adenomyosis and menorrhagia

Is adenomyosis associated with menorrhagia?

Human Reproduction, Vol.29, No.3 pp. 473–479, 2014

J. Naftalin, W. Hoo, K. Pateman, D. Mavrelos, X. Foo, and D. Jurkovic*

Table I Ultrasound features of adenomyosis.

Asymmetrical myometrial thickening not caused by the presence of fibroids
Parallel shadowing
Linear striations
Myometrial cysts
Hyperechoic islands
Adenomyomic ill-defined nodular heterogenous myometrial mass
Irregular endometrial–myometrial junction

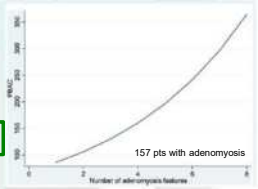
Table X The breakdown of the number of ultrasound features seen in the study population ($n = 157$).

Total number of ultrasound features of adenomyosis seen in women diagnosed with the condition	n (%)
1	18 (11.5)
2	37 (23.6)
3	41 (26.1)
4	31 (19.7)
5	16 (10.2)
6	10 (6.4)
7	3 (1.9)

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Table IX Results of multivariable analyses looking at the associations between demographic and clinical factors and the subjective assessment of menorrhagia.

Model 2			
BMI*	–	1.29 (1.11, 1.73)	0.003
Gravidity	0	1	<0.001
	1	0.31 (0.16, 0.59)	
	2–3	0.91 (0.51, 1.61)	
	4+	2.01 (1.04, 3.92)	
Adenomyosis features (categorical)	None	1	0.002
	1–3	0.73 (0.39, 1.36)	
	4+	3.80 (1.62, 8.91)	
Fibroids (combined)	None	1	<0.001
	Any fibroids	1.49 (0.88, 2.53)	
	Submucous fibroids	6.16 (2.93, 12.9)	
Endometrial polyps	No	1	0.02
	Yes	2.87 (1.16, 7.11)	
Fibroids (combined)	None	1	<0.001
	Any fibroids	1.53 (0.90, 2.58)	
	Submucous fibroids	6.19 (2.96, 12.9)	
Endometrial polyps	No	1	0.02
	Yes	2.99 (1.21, 7.40)	



When severity of adenomyosis was assessed by counting the number of morphological features of adenomyosis in each woman,we found a significant 22% increase in menstrual loss for each additional feature of adenomyosis

There was no significant association between adenomyosis and menorrhagia, but there was a significant positive correlation between the severity of adenomyosis on ultrasound and the amount of menstrual loss estimated using PBAC

Naftalin et al. Hum. Rep 2014

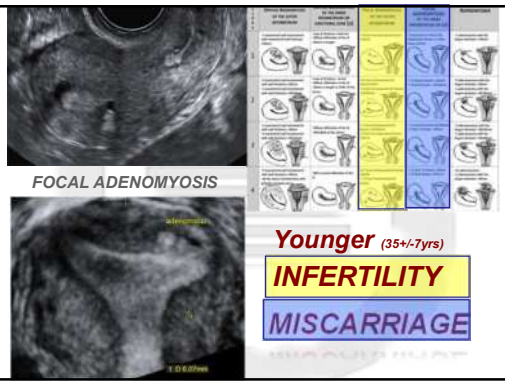
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New Sonographic Classification of Adenomyosis: Do Type and Degree of Adenomyosis Correlate to Severity of Symptoms?

Caterina Exacoustos, MD, PhD, Giulia Morosetti, MD, Francesca Conway, MD, Sara Camilli, MD, Francesco Giuseppe Martire, MD, Lucia Lazzeri, MD, PhD, Emilio Piccione, MD, and Errico Zupi, MD *The Journal of Minimally Invasive Gynecology* 2020



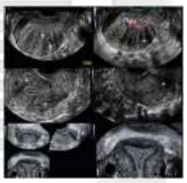
40



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Transvaginal sonographic features of diffuse adenomyosis in 18–30-year-old nulligravid women without endometriosis: association with symptoms

S. PINZAUTI*, L. LAZZERI*, C. TOSTI*, G. CENTINI*, C. ORLANDINI*, S. LUISI*, E. ZUPI*, C. EXACOUSTOS† and F. PETRAGLIA*



- 34.0% of young women showed sonographic features of diffuse adenomyosis
- Dysmenorrhea was reported by 80% of women with adenomyosis
- Diffuse adenomyosis showed a higher incidence of menorrhagia

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Adolescence and endometriosis: symptoms, ultrasound signs, and early diagnosis

Fertil Steril 2020

Francesco G. Martire, M.D.,[a] Lucia Lazzeri, M.D., Ph.D.,[a] Francesca Conway, M.D.,[a] Terry Sviliano, M.D.,[a] Adalgisa Pietropolli, M.D.,[a] Emilio Piccione, M.D., Ph.D.,[a] Eugenio Solima, Ph.D.,[a] Gabriele Centini, M.D., Ph.D.,[a] Errico Zupi, M.D.,[a] and Caterina Exacoustos, M.D., Ph.D.[a]

Retrospective observational study including 270 (12-20yrs) adolescents

2D, 3D and power-doppler examination (trans-vaginal or trans-rectal in adolescents with intact hymen) was performed in all adolescent patients

- 36 (13.3%) adolescents with ultrasound sign of endometriosis
  - 29 (80.5%)dysmenorrhea
  - 13 (36.1%) heavy menstrual bleeding
  - 22 endometrioma
  - 10 DIE
  - 16 ADENOMYOSIS

Adenomyosis was found
- 5.2% in total study population and
- 8.8% in adolescents with dysmenorrhea

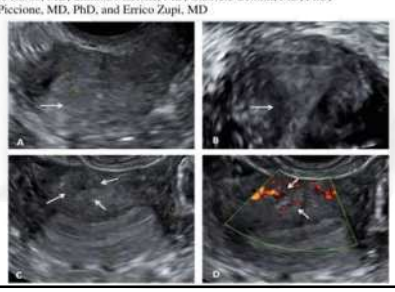
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Original Article

Ultrasound Findings of Adenomyosis in Adolescents: Type and Grade of the Disease

JMIG 2021

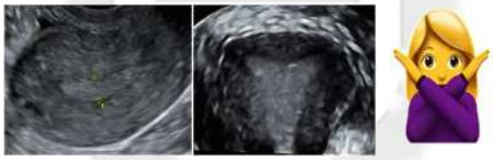
Caterina Exacoustos, MD, PhD, Lucia Lazzeri, MD, PhD, Francesco G. Martire, MD, Consuelo Russo, MD, Simona Martone, MD, Gabriele Centini, MD, PhD, Emilio Piccione, MD, PhD, and Errico Zupi, MD



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Adenomyosis in adolescents

Score 1-3 mild	Score 4-6 moderate	Score >7 severe
93% 40/43	7% 3/43	0% 0/43



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Early noninvasive diagnosis of endometriosis: dysmenorrhea and specific ultrasound findings are important indicators in young women

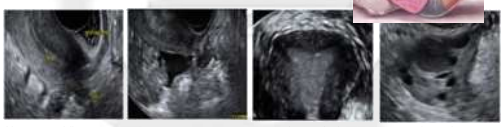
Francesco Giuseppe Martire, M.D.,[a] Consuelo Russo, M.D.,[a] Arkadiusz Sehnalja, M.D.,[a] Elena Nicita, M.D.,[a] Giorgia Sirace, M.D.,[a] Lucia Lazzeri, M.D., Ph.D.,[a] Errico Zupi, M.D.,[a] and Caterina Exacoustos, M.D., Ph.D.[a]

Fertility and Sterility® 2023

Aim of the study:

To assess the prevalence and ultrasound features of pelvic endometriosis in young women (12-25yrs) with severe dysmenorrhea VAS ≥ 7





Utero-sacral ligament | rectum | adenomyosis | endometrioma

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Young women ≤25yrs with severe dysmenorrhea

Retrospective observational study including 371 women ≤25 yrs with severe DYSMENORHEA

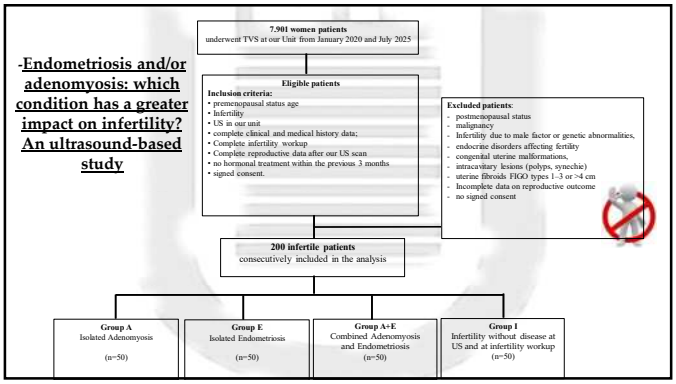
2D, 3D and power-doppler TVS was performed in all patients

- 131 (35.6%) had at least one ultrasound sign of endometriosis/adenomyosis
  - Adenomyosis 51%
  - USL 48%
  - Endometrioma 41%
- Isolated findings in 21%

ULTRASOUND ENDOMETRIOSIS FINDINGS	Pts with at least one US finding for endometriosis	ISOLATED FINDINGS of endometriosis
	131 (35.6%) n (%)	81 (21.9%) n (%)
POSTERIOR DIE	70 (53.4%)	31 (38.3%)
SIGMOID-RECTAL	16 (12.2%)	4 (4.9%)
TORUS	6 (4.9%)	0 (0.0%)
USL	63 (48.1%)	23 (28.4%)
SRV	8 (6.1%)	2 (2.5%)
VAGINA	3 (2.3%)	2 (2.5%)
DIE ANTERIOR	1 (0.8%)	0 (0.0%)
ADENOMYOSIS	67 (51.1%)	28 (34.6%)
anterior	17 (13.0%)	12 (14.8%)
posterior	50 (38.2%)	16 (19.8%)
ENDOMETRIOMA	54 (41.2%)	22 (27.2%)
endometrioma left	29 (22.1%)	14 (17.3%)
endometrioma right	12 (9.2 %)	5 (6.2 %)
bilateral	13 (9.9%)	3 (3.7%)
ADHESIONS	51 (38.9%)	0 (0.0%)
lateral adhesion	41 (31.3%)	0 (0.0%)
posterior adhesion	10 (7.6%)	0 (0.0%)

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-Endometriosis and/or adenomyosis: which condition has a greater impact on infertility? An ultrasound-based study



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INFERTILE PATIENTS						
	Isolated adenomyosis Group A (N= 50)	Isolated endometriosis Group E (N= 50)	Combined adenomyosis/ endometriosis Group A+E (N= 50)	Infertility without any cause and normal scan Group I (N= 50)		
Patients' characteristics	Mean ± SD n (%)	Mean ± SD n (%)	Mean ± SD n (%)	Mean ± SD n (%)	P value	Significant pairwise comparisons P value
Age (years)	37.4 ± 3.9	36.5 ± 3.6	36.4 ± 4.2	35.6 ± 3.5	0.126	
BMI (Kg/m²)	21.4 ± 6.7	21.6 ± 2.7	21.52 ± 5.38	21.9 ± 2.6	0.996	
Menarche (yrs.)	12.0 ± 1.6	12.0 ± 1.6	11.9 ± 1.2	12.6 ± 1.4	0.036	0.049 A vs I 0.041 E vs I 0.005 A+E vs I
Parity	8 (16%) 0,16 ± 0,37	3 (6%) 0,06 ± 0,24	1 (2%) 0,02 ± 0,14	5 (10%) 0,08 ± 0,27	0.074	
Gravidity	16 (32%) 0,68 ± 1,35	12 (24%) 0,26 ± 0,49	9 (18%) 0,20 ± 0,45	18 (36%) 0,34 ± 0,59	0.019	0.03 A vs E 0.016 A vs A+E
Previous Pelvic Surgery	15 (30%)	18 (36%)	26 (52%)	12 (24%)	0.026	0.041 A vs A+E 0.007 A+E vs I
Previous Use of E/P	28 (56%)	25 (50%)	37 (74%)	32 (64%)	0.077	

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	Isolated adenomyosis Group A (N= 50)	Combined adenomyosis/ endometriosis Group A+E (N= 50)	
Ultrasound characteristics of adenomyosis	n (%)	n (%)	P value
TYPE Focal Diffuse Mixed	 20 (40%) 29 (58%) 1 (2%)	 9 (18%) 33 (66%) 8 (16%)	 0.027 0.337 0.031
LOCATION Anterior Posterior Lateral Fundal	 20 (40%) 17 (34%) 11 (22%) 13 (26%)	 8 (16%) 34 (68%) 3 (6%) 5 (10%)	 0.013 0.001 0.041 0.066
MYOMETRIUM INVOLVEMENT External Internal Both	 19 (38%) 19 (38%) 12 (24%)	 13 (26%) 20 (40%) 17 (34%)	 0.284 1.0 0.367
SEVERITY (GRADE) Mild Moderate Severe	 20 (40%) 9 (18%) 21 (42%)	 20 (40%) 14 (28%) 16 (32%)	 1.0 0.342 0.408
DIRECT SIGNS 1 2 >2	 8 (16%) 23 (46%) 19 (38%)	 9 (18%) 17 (34%) 24 (48%)	 1.0 0.307 0.419

	Isolated endometriosis Group E (N= 50)	Combined adenomyosis/ endometriosis Group A+E (N= 50)	
Ultrasound characteristics of endometriosis	n (%)	n (%)	p value
RIGHT ENDOMETRIOMA	14 (28%)	15 (30%)	1.0
LEFT ENDOMETRIOMA	15 (30%)	21 (42%)	0.298
TOTAL ENDOMETRIOMAS	23 (46%)	14 (28%)	0.097
RIGHT USL	15 (30%)	19 (38%)	0.527
LEFT USL	31 (62%)	33 (66%)	0.835
TOTAL USL	40 (80%)	38 (76%)	0.810
TORUS	11 (22%)	18 (36%)	0.186
RECTOSIGMOID	11 (22%)	25 (50%)	0.006
RVS	8 (16%)	11 (22%)	0.611
PARAMETRIUM	4 (8%)	24 (48%)	< 0.001
BLADDER	1 (2%)	0 (0%)	1.0

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	Isolated adenomyosis Group A (N= 50)	Isolated endometriosis Group E (N= 50)	Combined adenomyosis/ endometriosis Group A+E (N= 50)	Without pathology normal US Group I (N= 50)	
Reproductive outcomes	Mean ± SD n (%)	Mean ± SD n (%)	Mean ± SD n (%)	Mean ± SD n (%)	P value
Time to pregnancy (months)	50.38 ± 33.0	36.7 ± 25.31	55.7 ± 36.5	32.7 ± 10.0	< 0.001
Spontaneous pregnancy	2 (4%)	10 (20%)*	5 (10%)	11 (22%)*	0.025
ART pregnancy	42 (84%)	35 (70%)*	46 (92%)	30 (60%)*	< 0.001
Homologous Heterologous	27 (54%) 15 (30%)	28 (56%) 7 (14%)	34 (68%) 12 (24%)	24 (48%) 6 (12%)	0.353
Number of ET	2.8 ± 2.2*	1.57 ± 1.17	2.4 ± 2.1	2.4 ± 1.7	< 0.001
PGT-A	5 (12%)*	15 (43%)	18 (39%)	16 (53%)	< 0.001
Pregnancy after ART	17 (40%)	20 (57%)	26 (57%)	17 (57%)	0.362
Total pregnancies	19 (38%)	30 (60%)	31 (62%)	28 (56%)	0.068
Miscarriages	3 (18%)	8 (29%)	7 (30%)	4 (15%)	0.477
Live births	14 (82%)	20 (71%)	16 (70%)	23 (85%)	0.477
Delivery types TVD pTVD TCS pTCS SA	 8 (42%) 1 (5%) 7 (37%) 0 (0%) 3 (16%)	 12 (40%) 3 (10%) 6 (20%) 0 (0%) 9 (30%)	 7 (23%) 1 (3%) 9 (29%) 4 (13%) 10 (32%)	 16 (57%) 0 (0%) 8 (29%) 0 (0%) 4 (15%)	 0.055 0.413 0.631 0.167 0.283

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-<u>Endometriosis and/or adenomyosis: which condition has a greater impact on infertility?</u>

Adenomyosis, isolated or combined, is associated with:

Longer time to pregnancy

Greater reliance on ART

More complex reproductive pathways

Endometriosis shows:

Shorter time to pregnancy

Higher spontaneous conception than isolated adenomyosis

Total pregnancy rates did not differ significantly among groups (p = 0.068)

Distinct ultrasound patterns confirm the **heterogeneous nature of adenomyosis**

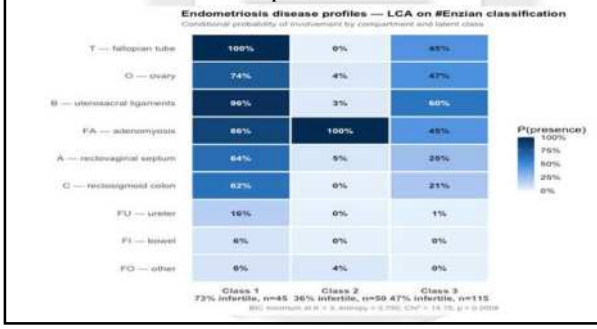
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Infertility and Endometriosis by #Enzian Classification: Which Compartments Are Most Involved?

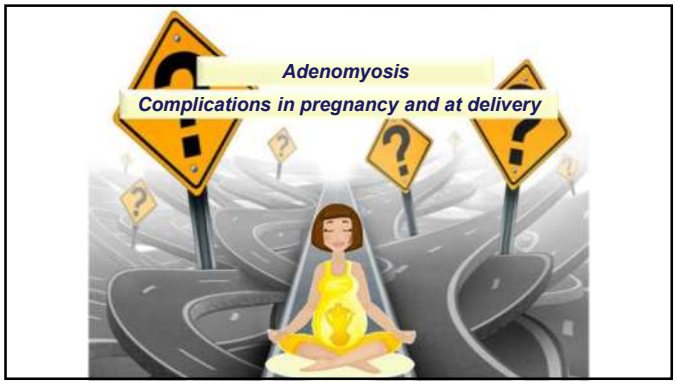
#Enzian Compartments	Study Group (infertile patients with endometriosis) (n=105) n/tot (%)	Control Group (non-infertile patients with endometriosis) (n=105) n/tot (%)	P value
A (anterior central)	38 (36.2)	23 (21.9)	**0.02**
B (lateral right)	33 (31.4)	22 (21.0)	0.08
B (lateral left)	40 (38.1)	41 (39.0)	0.89
B bilateral	13 (12.4)	7 (6.7)	0.15
C (rectum)	35 (33.3)	18 (17.1)	**0.007**
O (right endometrioma)	41 (39.1)	14 (13.3)	**< 0.0001**
O (left endometrioma)	37 (35.2)	26 (24.8)	0.10
O bilateral	22 (21.0)	5 (4.8)	**<0.001**
T (tubes/right adhesions)	42 (40.0)	26 (24.8)	**0.01**
T (tubes/ left adhesions)	45 (42.9)	31 (29.5)	**0.04**
T bilateral	30 (28.6)	15 (14.3)	**0.01**
FA (adenomyosis)	69 (65.7)	72 (68.6)	0.65
FB (bladder)	0 (0.0)	0 (0.0)	/
FU (ureteral ectasia)	9 (8.6)	0 (0.0)	**0.002**
FI (bowel, ileum)	3 (2.9)	0 (0.0)	0.07
FO (others)	2 (1.9)	3 (2.9)	0.63

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Infertility and Endometriosis by #Enzian Classification: Which Compartments Are Most Involved?



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Beyond infertility: obstetrical and postpartum complications associated with endometriosis and adenomyosis

The association between adenomyosis and recurrent miscarriage

Cem Somer Atabekoğlu, Yavuz Emre Şükür*, Erkan Kalafat, Batuhan Özmen, Bülent Berker, Ruşen Aytaç, Murat Sönmezer

Adenomyosis and risk of preterm delivery

Pathophysiologic mechanisms by which adenomyosis predisposes to postpartum haemorrhage and other obstetric complications

Simona Martone*, Gabriele Centini**, Caterina Exacoustos†, Errico Zupi‖, Karolina Afors*, Fabrizio Zullo*, Francesco Maneschi*, Nassir Habbih‖, Lucia Lazzeri*

The Prevalence and Clinical Impact of Adenomyosis in Pregnancy-Related Hysterectomy

Michele Orsi [1,2,3,4*], Edgardo Somigliana [1,2], Fulvia Milena Cribiù [4,5], Gianluca Lopez [4], Laura Buggio [4], Manuela Wally Ossola [1] and Enrico Ferrazzi [1,2]

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Adenomyosis and recurrent pregnancy loss: does different type and localization of adenomyosis correlate to different reproductive outcome?

Caterina Exacoustos[1], Carlo Ticconi[1], Irene Colombi [2], Giuseppe Gabriele Iorio[3], MariaElena Vaquero[4], Aikaterini Selntigia[1], Elvira Nocita [1], Giuseppe Rizzo[4]

Reprod Sciences 2024

[1]Department of Surgical Sciences, Obstetrics and Gynecological Unit, University of Rome 'Tor Vergata', Italy
[2] Department of Molecular and Developmental Medicine, Obstetrics and Gynecological Clinic University of Siena, Italy
[3] Department of Neuroscience, Reproductive Science and Odontostomatology, University of Naples 'Federico II', Italy.
[4] Department of Biomedicine and Prevention, Obstetrics and Gynecological Unit, University of Rome 'Tor Vergata', Italy

	Women with RPL and Adenomyosis (Group 1) [n=40]	Women with RPL without Adenomyosis (Group 2) [n=40]	Women with adenomyosis without RPL (Group 3) [n=40]	p-value
Age [years] at diagnosis	36.5 (26-45)	36.5 (23-42)	35 (27-40)	K-W: H = 3.65 P = 0.16
BMI [Kg/m²]	23.28 (19.22-25.14)	22.86 (18.52-25.16)	21.45 (18.9-25.47)	K-W: H = 5.79 P = 0.06
Number of pregnancy losses	3.22 ± 1.89*	2.5 ± 0.55**	0.15 ± 0.36***	ANOVA: F= 84.26 p<0.001
Number of pregnancies	3.55 ± 1.91§	2.85 ± 0.86§§	1.22 ± 0.48§§§	ANOVA:F= 36.99 p<0.001
Number of Live Births	0 (0-2)	0 (0-2)	1 (1-2)'	K-W: H = 72.71 p<0.001

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	Women with ADENOMYOSIS			
	WITH RPL (Group 1) [n=40]	WITHOUT RPL (Group 3) [n=40]	χ^2	p-value
Localization of Adenomyosis				
Only Inner myometrium	11 (27.5%)	4 (10%)	4.02	0.04
Only Outer myometrium	16 (40%)	26 (65%)	5.01	**0.02**
Inner and Outer myometrium	13 (32.5%)	10 (25%)	0.55	0.46
Focal of inner myometrium	9 (22.5%)	0 (0%)	7.31	0.001
Focal of outer myometrium	3 (7.5%)	10 (25%)	4.5	**0.03**
Diffuse of inner myometrium	2 (5%)	4 (10%)	0.72	0.39
Diffuse of outer myometrium	13 (32.5%)	16 (40%)	0.49	0.48
Severity of Adenomyosis				
Mild	31 (77.5%)	28 (70%)	0.58	0.44
Moderate	6 (15%)	9 (22.5%)	0.74	0.39
Severe	3 (7.5%)	3 (7.5%)	0	1

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Impact of adenomyosis on in vitro fertilization outcomes in women undergoing donor oocyte transfers: a prospective observational study

2024 Fertility and Sterility®

Mauro Cozzolino, M.D., Ph.D.,* Martina Cosentino, M.D.,* Luna Loudiice, M.D.,* Francesco Giuseppe Martire, M.D.,* Daniela Gallanara, M.D., Ph.D.,* Antonio Pellicer, M.D., and Caterina Exacoustos, M.D.*

TABLE 2

IVF outcomes after single embryo transfer in patients with and without adenomyosis.

IVF outcomes	Adenomyosis (n = 114)	No adenomyosis (n = 114)	P value
Implantation rate	65/114 (57.0%)	61/114 (53.5%)	.68
Clinical pregnancy rate	53/114 (46.5%)	56/114 (49.1%)	.11
Miscarriage rate	23/65 (35.4%)	11/61 (18.1%)	.02
Live birth rate	42/114 (36.8%)	50/114 (43.9%)	.34

Note: The only significant value is in bold. IVF = in vitro fertilization.

Cozzolino. IVF outcomes in women with adenomyosis. Fertil Steril 2024.

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TABLE 4

Comparison of the relative risk of maintaining pregnancy in relation to adenomyosis type, location, and severity.

Adenomyosis Characteristics	Ongoing pregnancy N = 42 (64.6%)	Miscarriage N = 23 (35.64%)	RR (95% CI) P-value
Type			
Diffuse (n=34)	21 (50.0%)	13 (56.6%)	1.19 (0.61-2.31) 0.796
Focal (n=25)	17 (40.0%)	8 (34.7%)	0.85 (0.42-1.71) 0.791
Diffuse + focal (n=4)	3 (7.1%)	3 (13.0%)	1.48 (0.61-3.54) 0.657
Location			
[illegible]	[illegible]	[illegible]	[illegible]
Outer myometrium only (n=51)	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Type + location			
Diffuse (n=2)	1 (1.4%)	1 (0.1%)	2.28 (1.23-4.30) 0.015
Focal (n=19)	8 (19.0%)	7 (30.4%)	1.46 (0.74-2.86) 0.381
Diffuse outer myometrium (n=32)	19 (45.2%)	13 (56.5%)	1.34 (0.69-2.61) 0.443
Focal outer myometrium (n=18)	15 (35.7%)	3 (13.0%)	0.39 (0.13-1.16) 0.081
Adenomyoma (n=2)	1 (2.4%)	1 (4.3%)	1.43 (0.34-5.96) 1.000
Severity			
Mild (n=43)	30 (71.4%)	13 (56.5%)	0.67 (0.35-1.27) 0.277
Moderate (n=13)	9 (21.4%)	4 (17.4%)	0.84 (0.35-2.05) 0.758
Severe (n=9)	3 (7.1%)	6 (26.1%)	2.20 (1.19-4.04) 0.005

Data are presented as a percentage of the total number of patients with adenomyosis that achieved an ongoing pregnancy (n=42) or experienced a clinical miscarriage (n=23). Statistically significant odds ratios (with p<0.05) are highlighted in bold. CI, confidence interval; RR, relative risk; IZ, junctional zone.

Cozzolino. IVF outcomes in women with adenomyosis. Fertil Steril 2024.

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Adenomyosis and fertility: are there any differences in ultrasound type and location in patients with different reproductive outcomes? in press

Selntigia Aikaterini [1,2], Mannella Chiara [1], Nocita Elvira [1], Valeriani Sara[1], Monaco Giulia[1], Iorio Giuseppe Gabriele[1], Consuelo Russo[1], Ticconi Carlo[1], Exacoustos Caterina[1]

STUDY DESIGN

- *Single-center retrospective cohort study conducted between January 2020 and April 2025.*
- *Premenopausal patients between 25 and 45 years with a diagnosis of adenomyosis by TVS*

IFL (n=70)

Failure to achieve a clinical pregnancy after 12 months of regular, unprotected sexual intercourse

RIF (n=70)

At least two or more implantation failures of only transfers of euploid blastocyst or oocyte donation

RPL (n=70)

Spontaneous pregnancy with loss of two or more pregnancies before 24 weeks of gestation

Live birth (n=70)

Spontaneous pregnancy resulting in a delivery of a viable newborn

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TVS FEATURES OF ADENOMYOSIS



- More frequent in the **RIF** and **RPL** groups compared to **LB** ($p = 0.037$ and $p < 0.001$, respectively)
- More common in the **LB** group ($p = 0.013$)
- More frequent in **IFL** and **RIF** than in **LB** ($p = 0.01$ and $p = 0.004$, respectively)
- More prevalent in **LB** than in **IFL** and **RIF** ($p < 0.001$ and $p = 0.004$, respectively)

TVS features of Adenomyosis	Patients with Adenomyosis Reproductive outcome groups			
	LB N:70	IFL N:70	RIF N:70	RPL N:70
Isolated Adenomyosis	21 (30.0%)**	32 (45.7%)*	38 (54.3%)*	45 (64.3%)*
Adenomyosis associated to pelvic Endometriosis	49 (70.0%)**	48 (68.6%)*	37 (52.9%)*	24 (34.3%)*
Affected uterine walls				
Anterior	23 (32.9%)	37 (52.9%)	28 (40.0%)	29 (41.4%)
Posterior	47 (67.1%)**	45 (64.3%)**	31 (44.3%)**	39 (55.7%)**
Lateral	23 (32.9%)	23 (32.7%)	27 (38.6%)	29 (41.4%)
Fundus	24 (37.7%)	30 (39.6%)	19 (31.4%)	32 (51.6%)
Isthmic	8 (11.4%)**	17 (24.3%)*	10 (27.1%)*	9 (13.9%)*
Affected uterine myometrial layer				
Inner myometrium (JZ)	4 (5.7%)	13 (21.4%)	18 (25.4%)	18 (25.7%)
Outer myometrium	66 (70.0%)*	55 (78.6%)	55 (78.6%)	52 (74.3%)
Mixed (inner and outer myometrium)	17 (24.3%)	17 (24.3%)	20 (32.9%)	25 (38.6%)
Total Inner myometrium	21 (30.0%)	32 (45.7%)	38 (54.3%)	45 (64.3%)
Total Outer myometrium	66 (94.3%)	55 (78.6%)	55 (78.6%)	52 (74.3%)
Type				
Focal	22 (31.4%)	17 (24.3%)	11 (18.7%)	13 (21.4%)
Diffuse	42 (60.0%)	37 (52.9%)	46 (68.7%)	42 (60.0%)
Mixed (focal + diffuse)	6 (8.6%)	16 (22.9%)	13 (18.4%)	13 (18.6%)
Type and myometrial layer				
Focal of inner myometrium	5 (7.1%) ***	10 (15.7%)*	22 (31.4%)*	22 (31.4%)*
Focal of outer myometrium	15 (32.9%)	16 (22.9%)	10 (22.9%)	13 (24.3%)
Diffuse of inner myometrium	17 (24.3%)**	24 (34.3%)	28 (41.4%)*	34 (48.6%)*
Diffuse of outer myometrium	44 (62.8%)	47 (67.1%)	39 (71.4%)	40 (70%)
Extension inside the uterus				
Mild	49 (70.0%)**	25 (35.7%)*	28 (40.0%)*	42 (60.0%)*
Moderate	17 (24.3%)**	27 (38.6%)	23 (32.9%)	18 (25.7%)
Severe	4 (5.7%)**	18 (25.7%)*	20 (28.6%)*	10 (14.3%)*

*p<0.05 LB vs IFL, *p<0.05 LB vs RIF, * p<0.05 LB vs RPL, * p<0.05 IFL vs RIF, * p<0.05 IFL vs RPL, *p<0.05 RIF vs RPL

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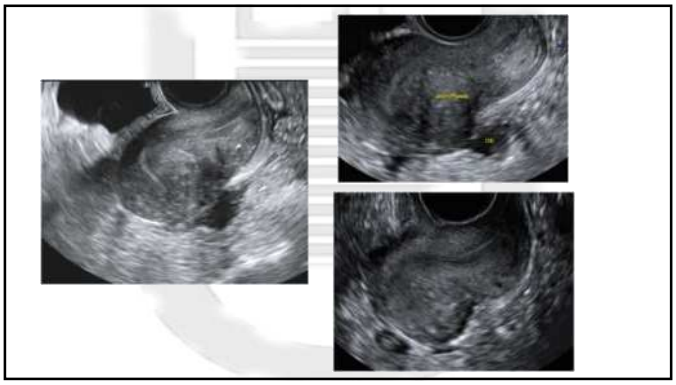
Adenomyosis and fertility: are there any differences in ultrasound type and location in patients with different reproductive outcomes? in press

Selntigia Aikaterini [1,2], Mannella Chiara [1], Nocita Elvira [1], Valeriani Sara[1], Monaco Giulia[1], Iorio Giuseppe Gabriele[1], Consuelo Russo[1], Ticconi Carlo[1], Exacoustos Caterina[1]

Only statistically significant adenomyosis TVS features	Patients with Adenomyosis- Reproductive outcome groups				
	LB n=70	IFL n=70	RIF n=70	RPL n=70	p value
Total Inner myometrium (JZ)	21 (30.0%)	32 (45.7%)	38 (54.3%)	45 (64.3%)	**<0.001**
Total Outer myometrium	66 (94.3%)	55 (78.6%)	55 (78.6%)	52 (74.3%)	**0.013**
Mild	49 (70.0%)	25 (35.7%)	28 (40.0%)	42 (60.0%)	**<0.001**
Severe	4 (5.7%)	18 (25.7%)	20 (28.6%)	10 (14.3%)	**0.001**
Adenomyosis associated to pelvic Endometriosis	49 (70.0%)	48 (68.6%)	37 (52.9%)	24 (34.3%)	**<0.001**

Bonferroni-adjusted analysis : Ultrasound Features Of Adenomyosis With Significant Impact On Reproductive Outcomes

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Ultrasound-defined adenomyosis subtypes and their impact on outcomes following frozen embryo transfer: a propensity score-matched cohort study *Ultrasound Obstet Gynecol 2025*

L. WANG*, H. ZHENG*, C. WENG, Q. SU, F. YANG and F. WANG*

Outcome	With adenomyosis	Controls	χ^2	P	OR (95% CI)
Live birth	311/879 (35.38)	397/879 (45.16)	17.09	< 0.001	0.67 (0.53–0.81)
Implantation	436/1099 (41.49)	532/1094 (48.63)	11.28	0.001	0.73 (0.63–0.89)
Clinical pregnancy	427/879 (48.58)	493/879 (53.97)	6.87	0.002	0.74 (0.62–0.89)
Ectopic pregnancy	11/427 (2.58)	6/493 (1.22)	2.32	0.202	2.14 (0.78–5.84)
Early pregnancy loss	93/427 (22.25)	77/493 (15.61)	6.54	0.011	1.54 (1.10–2.15)
Late pregnancy loss	11/427 (2.58)	12/493 (2.44)	0.02	1.000	1.06 (0.46–2.42)
Multiple pregnancy	26/311 (8.36)	36/397 (9.07)	0.11	0.844	0.91 (0.54–1.51)
Preterm birth	54/311 (17.36)	69/397 (17.38)	< 0.01	0.995	1.00 (0.68–1.48)
Gestational hypertension	15/311 (4.82)	16/397 (4.03)	0.26	0.744	1.21 (0.59–2.48)
Pre-eclampsia	9/311 (2.89)	5/397 (1.26)	2.40	0.201	2.34 (0.78–7.04)
GDM	30/311 (9.65)	29/397 (7.30)	1.25	0.263	1.35 (0.79–2.31)
Placenta previa	10/311 (3.22)	15/397 (3.78)	0.16	0.687	0.85 (0.37–1.91)
PROM	15/311 (4.82)	14/397 (3.53)	0.75	0.422	1.39 (0.66–2.92)
Placental abruption	1/311 (0.32)	1/397 (0.25)	N/A	1.000*	1.28 (0.08–20.51)
Placenta accreta	3/311 (0.96)	8/397 (2.02)	N/A	0.363*	0.47 (0.12–1.80)
Cesarean section	250/311 (80.39)	306/397 (77.08)	1.13	0.331	1.22 (0.85–1.76)
Low birth weight	44/337 (13.06)	54/433 (12.47)	0.06	0.894	1.05 (0.69–1.61)
FGR	2/337 (0.59)	1/433 (0.23)	N/A	0.584*	2.58 (0.23–28.56)

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Ultrasound-defined adenomyosis subtypes and their impact on outcomes following frozen embryo transfer: a propensity score-matched cohort study

INTERNAL ADENOMYOSIS

Reduced :
Live Birth
Clinical pregnancy

Increased:
Early pregnancy loss
Placenta previa

Outcome/adenomyosis subtype	With adenomyosis	Controls	P
Primary outcome			
Live birth			
External	213/476 (44.80)	273/476 (56.93)	0.795
Internal	98/213 (27.64)	91/213 (42.33)	0.002
Mixed	34/188 (18.09)	83/188 (44.15)	< 0.001
Secondary outcomes			
Implantation			
External	292/599 (48.75)	297/586 (50.68)	0.563
Internal	96/265 (36.23)	124/277 (44.77)	0.043
Mixed	68/235 (28.94)	111/231 (48.05)	< 0.001
Clinical pregnancy			
External	270/476 (56.72)	271/476 (56.93)	1.000
Internal	91/213 (42.33)	116/213 (53.95)	0.016
Mixed	46/188 (33.11)	103/188 (53.85)	< 0.001
Ectopic pregnancy			
External	6/270 (2.22)	2/271 (0.74)	0.176*
Internal	3/91 (3.30)	3/116 (2.59)	1.000*
Mixed	2/66 (3.03)	1/103 (0.95)	0.560*
Early pregnancy loss			
External	43/270 (15.93)	40/271 (14.76)	0.707
Internal	25/91 (27.47)	17/116 (14.66)	0.023
Mixed	2/66 (40.91)	20/103 (19.42)	0.002
Late pregnancy loss			
External	4/270 (1.48)	6/271 (2.21)	0.752*
Internal	4/91 (4.40)	5/116 (4.31)	1.000*
Mixed	3/66 (4.55)	1/103 (0.95)	0.300*
Multiple pregnancy			
External	18/218 (8.26)	23/223 (10.31)	0.514
Internal	6/59 (10.17)	7/91 (7.69)	0.768
Mixed	2/34 (5.88)	6/83 (7.23)	1.000*

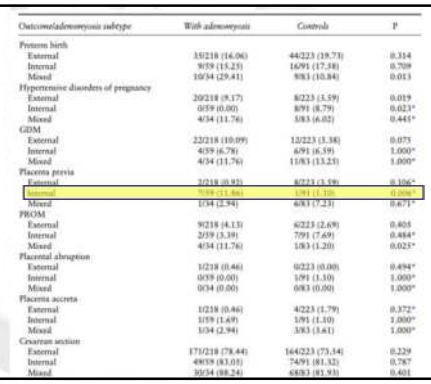
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Ultrasound-defined adenomyosis subtypes and their impact on outcomes following frozen embryo transfer: a propensity score-matched cohort study

INTERNAL ADENOMYOSIS

Reduced :
Live Birth
Clinical pregnancy

Increased:
Early pregnancy loss
Placenta previa



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Adenomyosis and live birth: what obstetric and neonatal complications should we expect?

To **evaluate** obstetric and neonatal outcomes in patients with a sonographic diagnosis of adenomyosis and a subsequent pregnancy resulting in a live birth.

GROUP A

INCLUSION CRITERIA

- Ultrasound diagnosis of adenomyosis prior to pregnancy
- Reproductive age (18–45 years)
- Documented singleton pregnancy within 2 years from the diagnosis of adenomyosis
- Vaginal or cesarean delivery after 24 weeks with live birth
- Spontaneous conception or ART

GROUP B

INCLUSION CRITERIA

- Pre-pregnancy gynecological ultrasound without any pelvic disease
- Reproductive age (18–45 years)
- Documented singleton pregnancy within 2 years from the diagnosis of adenomyosis
- Vaginal or cesarean delivery after 24 weeks with live birth
- Spontaneous conception or ART

Postmenopausal women
Twin pregnancies
Pregnancies resulting in spontaneous abortion or ectopic pregnancy
Presence of other gynecological conditions diagnosed by ultrasound (uterine malformations, fibroids, etc.)

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OUTCOMES

PREGNANCY OUTCOMES	OBSTETRIC OUTCOMES AT DELIVERY	NEONATAL OUTCOMES
GESTATIONAL HYPERTENSIVE DISORDERS	MODE OF DELIVERY	NEONATAL BIRTH WEIGHT
GESTATIONAL DIABETES	PRETERM BIRTH	NEONATAL BIRTH WEIGHT < 10 TH PERCENTILE
THREATENED PRETERM LABOR	URGENT CESAREAN SECTION	ADMISSION TO NEONATAL INTENSIVE CARE UNIT (NICU)
INTRAUTERINE GROWTH RESTRICTION	POSTPARTUM HEMORRHAGE	
PLACENTA PREVIA	PLACENTA ABRUPTION	
	RETAINED PLACENTAL TISSUE	

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Study population

Maternal characteristics	Adenomyosis (n 100)	Controls (n 100)	P value
Maternal age	35.00 (32.00-37.25)	34.00 (30.75-36.00)	0.08
BMI	22.29 (20.20-24.22)	22.00 (21.00-24.00)	0.14
Nulliparous	76 (76.00%)	66 (66.00%)	0.12
Previous Cesarean Section	4 (4.00%)	12 (12.00%)	0.02 [a]
Assisted Reproductive Technology	40 (40.00%)	10 (10.10%)	<0.01 [a]
Pre-pregnancy medical conditions	5 (5.00%)	3 (3.03%)	0.47

Included as **adjustment variables** in the multivariate logistic regression analysis.

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OUTCOMES

Pregnancy outcomes	Adenomyosis (n 100)	Controls (n 100)	P value
Gestational Diabetes	10 (10.00%)	3 (3.00%)	0.04 [a]
Gestational Hypertensive Disorders	6 (6.00%)	1 (1.00%)	0.05
Threatened Preterm Labor	19 (19.00%)	5 (5.00%)	<0.01 [a]
Placenta Previa	13 (13.00%)	1 (1.00%)	<0.01 [a]
Intrauterine growth restriction	16 (16.00%)	6 (6.00%)	0.02 [a]

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TOR VERGATA

OUTCOMES

Birth Outcomes	Adenomyosis (n 100)	Controls (n 100)	P value
Preterm Delivery	14 (14.00%)	5 (5.00%)	0.03 [a]
Spontaneous vaginal delivery Operative vaginal delivery Cesarean Section	41 (41.00%) 8 (8.00%) 51 (51.00%)	51 (51.00%) 16 (16.00%) 33 (33.00%)	0.02 [a]
Urgent Cesarean Section	15 (15.00%)	5 (5.00%)	0.02 [a]
Postpartum Hemorrhage	23 (23.00%)	13 (13.00%)	0.07
Placenta Abruption	8 (8.00%)	1 (1.00%)	0.02 [a]
Retained placental tissue	6 (6.00%)	1 (1.00%)	0.05

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TOR VERGATA

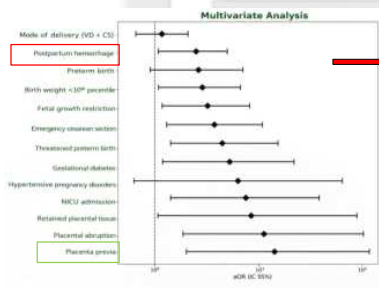
OUTCOMES

Neonatal Outcomes	Adenomyosis (n 100)	Controls (n 100)	P value
Birthweight	3100 (2805-3500)	3275 (3007-3500)	0.05[a]
Birthweight percentile	40.00 (18.00-73.00)	49.00 (29.50-73.50)	0.16
Birthweight < 10° percentile	18 (18.00%)	8 (8.00%)	0.04 [a]
NICU Admission	12 (12.00%)	2 (2.00%)	<0.01 [a]

NICU: Neonatal Intensive Care Unit; [a] p<0.05

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Adenomyosis and live birth: what obstetric and neonatal complications should we expect?



The high number of ART in the control group initially **attenuated** the association between adenomyosis and postpartum hemorrhage

Independent predictive factor for placenta previa, with an aOR of 13.99 (95% CI 1.74–112.39) for **ART** and **previous cesarean section**

Forest plot graph: it shows the adjusted odds ratios (aORs) on a logarithmic scale from the multivariate analysis for ART;

74

Adenomyosis should be considered a condition associated with an **increased obstetric risk**.

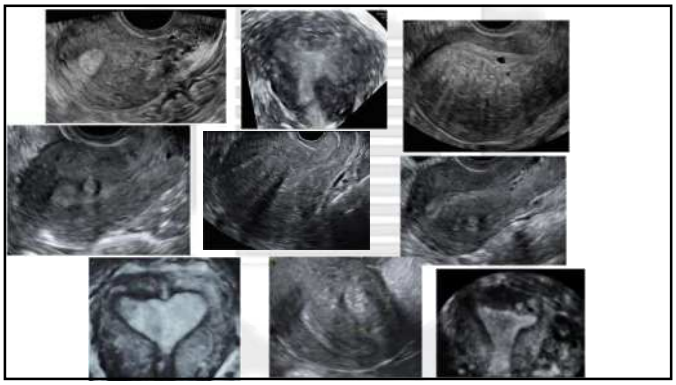
- ✓ *Gestational Diabetes*
- ✓ *Placenta previa*
- ✓ *Threatened preterm labor*
- ✓ *IUGR*
- ✓ *Postpartum Hemorrhage*
- ✓ *Urgent CS*
- ✓ *Placenta abruption*
- ✓ *Neonatal birthweight < 10° pc*
- ✓ *NICU Admission*

PREGNANCY → DELIVERY → NEONATAL PERIOD

Early diagnosis of the disease may represent a useful tool for:

- obstetric risk **stratification**
- **planning** of obstetric follow-up
- **planning** of delivery care

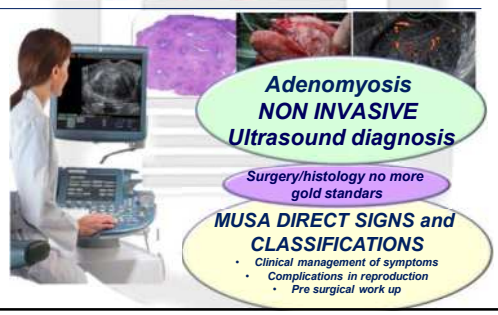
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A new era in diagnosing adenomyosis is coming

Fertil Steril 2018
Exacoustos C. Zupi E



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A new era in diagnosing adenomyosis is coming

Exacoustos C. Zupi E
Fertil Steril 2018



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TUBE VS NOT TUBE

Yvette Groszmann MD MPH FAIUM
Director of Gynecologic Ultrasound
Diagnostic Ultrasound Associates
Lecturer in Obstetrics, Gynecology and Reproductive Medicine
Harvard Medical School

1

Disclosures

Lecturer for GE Healthcare

2

Fallopian Tube Basics

"Trumpets of the Uterus"





Gabriele Falloppio
1561

- **Gabriel Fallopio** (1523-1562), Italian anatomist
- Originate from mullerian ducts
- Length ~ 11 – 12 cm
- Lumen diameter < 1 mm
- NOT USUALLY VISIBLE unless surrounded by fluid or pathologic



Colombi I et al. *J Ultrasound Med* 2024; 9999:1-19

3

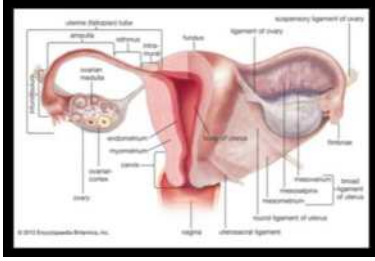
FALLOPIAN TUBES

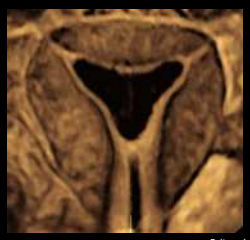


4

Anatomy

- 3 layers inner mucosa covered with cilia, muscular layer (inner circular outer longitudinal) external serosa





Britannica.com

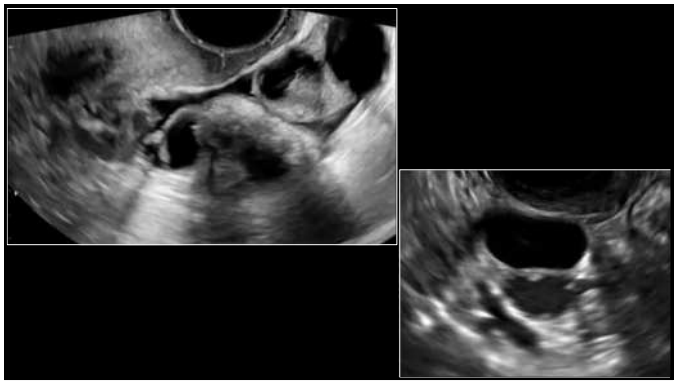
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Hydrosalpinx

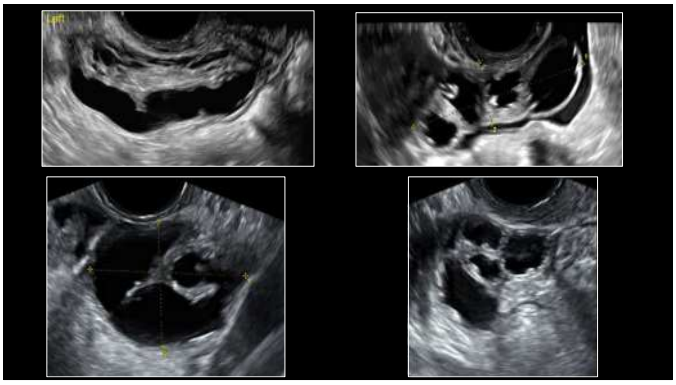
- **Asymptomatic**
- **Incomplete septa**
- **Cog-wheel sign**
- **Clear fluid > low level echoes**



6



7



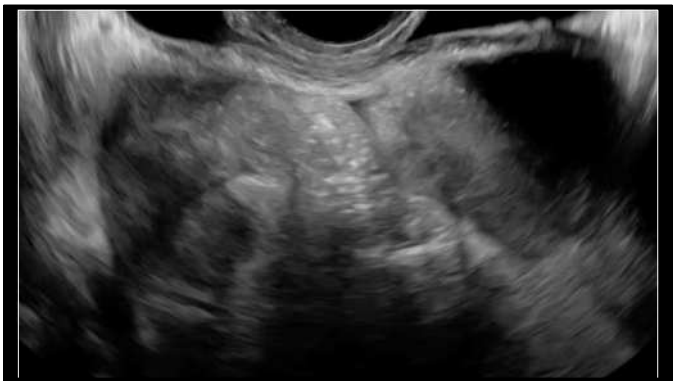
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22 yo G0 on oral contraceptives 1 mos AUB

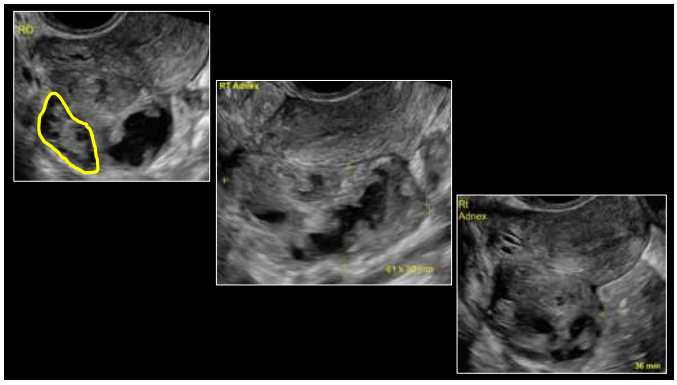
Referred to gyn oncology for bilateral 'complex' adnexal masses suspicious for neoplasia or malignancy on outside US

Symptoms- daily spotting, occasional cramping and diarrhea

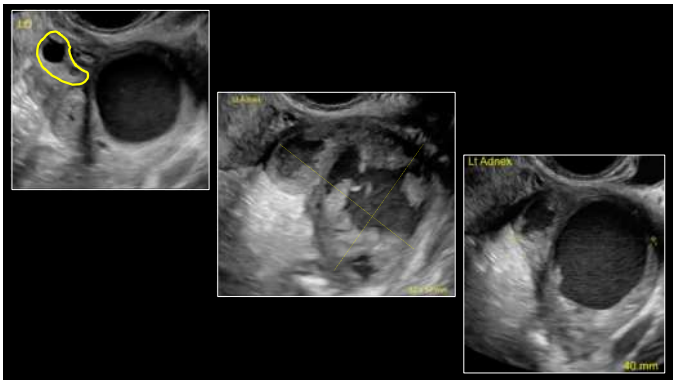
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10



11



12

The diagnosis is …

- Hydrosalpinges
- Salpingitis / Tubo-ovarian complex
- Tubo-ovarian abscess
- Tubal cancer

Chlamydia test was positive

13

Tubo-ovarian complex

- Clinical: symptomatic, abnormal discharge, +/- AUB, pain
- Imaging: able to identify the ovarian and tubal anatomic structures but unable to separate them from each other.

Timor-Trisch I.E et al. *Ultrasound Obstet Gynecol 1998*; 12:56-66.

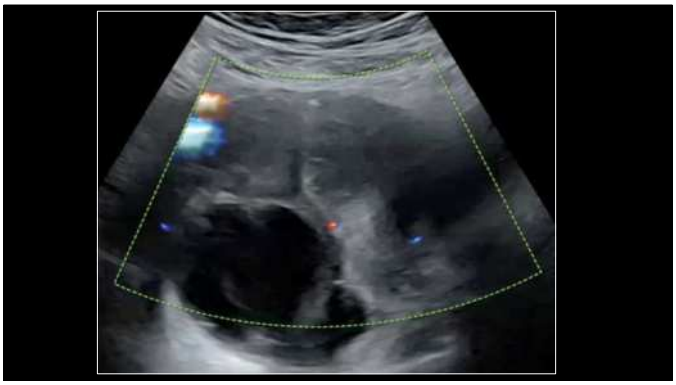
14

51 yo G0 with stage 4 colon cancer with 4w pelvic pain, appears ill

2 weeks ago had CT scan: complex right adnexal mass, consultation with gyn oncology recommended.

- postmenopausal x 3 years, had several days bleeding 4 weeks ago accompanied by severe pain.
- Pain increased with valsalva. Copious, bloody discharge x 2 weeks.

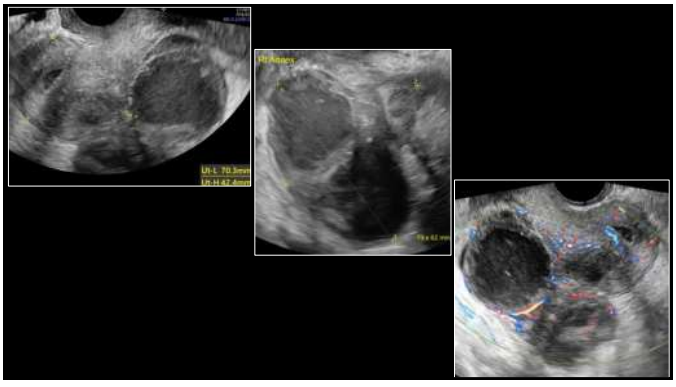
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16



17



18

The diagnosis is …

Tubo-Ovarian Abscess (TOA)

CT scan in ER:

Pericolic inflammation, suspected bowel perforation with TOA and pyometra.

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Tubo-ovarian abscess

Clinical: symptomatic, fever, purulent discharge, +/- AUB, pain, ill-appearing

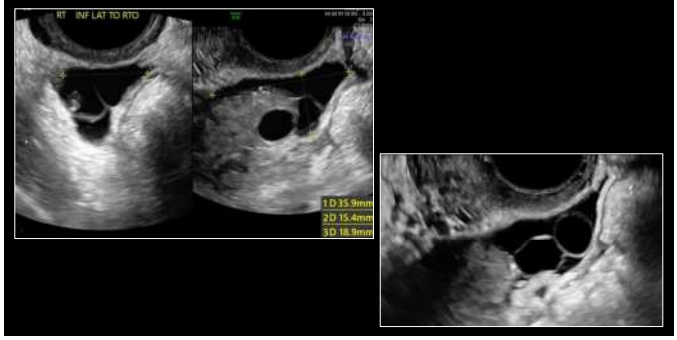
Imaging: Loss of anatomic architecture, unable to recognize a separate ovary or tube

First paper to state that TOC and TOA are different diagnoses in a spectrum, were used interchangeably before

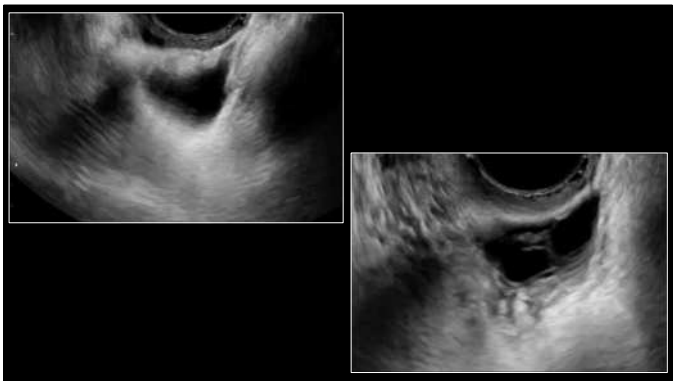
Timor-Trisch I.E et al. *Ultrasound Obstet Gynecol 1998*; 12:56-66.

20

33 yo with infertility, suspected hydrosalpinx



21



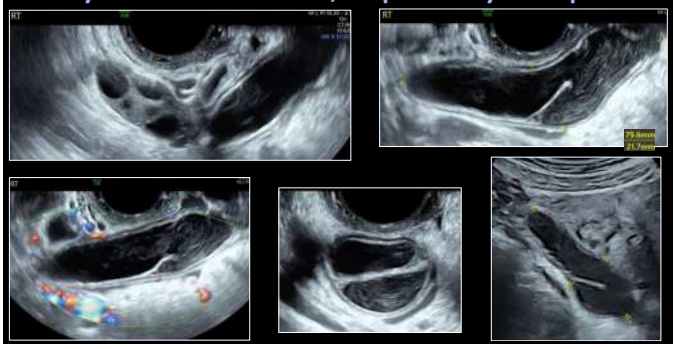
22

The diagnosis is …

Peritoneal inclusion cyst
= mesothelial pseudocysts

23

24 yo G0 AUB with IUCD, suspected hydrosalpinx



24



25



26

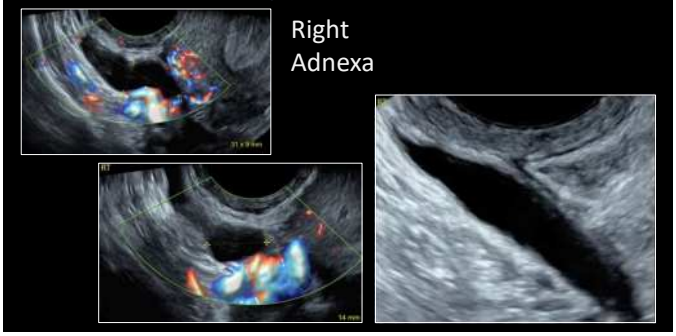
The diagnosis is … NOT TUBE

Low grade appendiceal mucinous neoplasm (LAMN)

- **incidence increasing**
- **advanced stage includes myxoma peritonei**
- **mucin is a jelly-like substance and interferes with normal organ function**

27

28 yo with AUB



Right
Adnexa

28



29

The diagnosis is … NOT TUBE

Hydroureter

Can be congenital, otherwise caused by partial or complete obstruction



30

48 yo s/p ER visit for severe pelvic pain, dx hydrosalpinx



31

The diagnosis is … NOT TUBE



pelvic varicosity

32

TAKE HOME TIPS

- Tubes have characteristic inner wall architecture
- MUST HAVE CLIPS



33

20-30% infertility- tubal factors



Chromopertubation

Not a first line test

34

Non-invasive Tubal Patency Testing in Subfertility

HSG

- X-ray
- Iodinated contrast
- Uses radiation
- More painful
- 77% pooled sensitivity
- 94 % pooled specificity

HyCoSy

- Saline / air bubbles
- Free contrast
- Fast flow; operator dep.
- May show segments of tube
- 99% NPV

HyFoSy

- Exem Foam (FDA approved)
- Purchased contrast
- Slower flow (~5 min)
- Entire Tubal trajectory
- 99% NPV

Transvaginal ultrasound ∞ No radiation

35

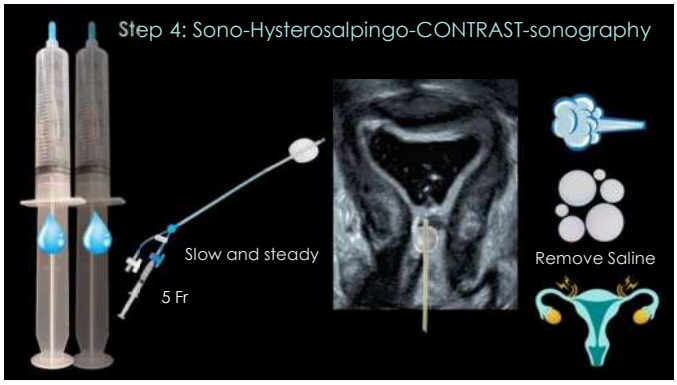
Technique

After SHG, disconnect syringe from tubing and draw up room air or prepare Exem Foam

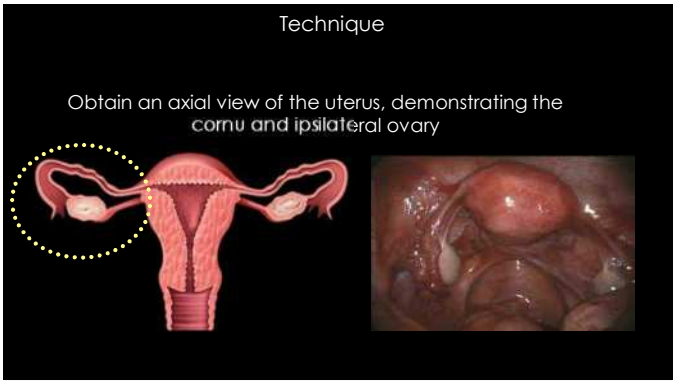




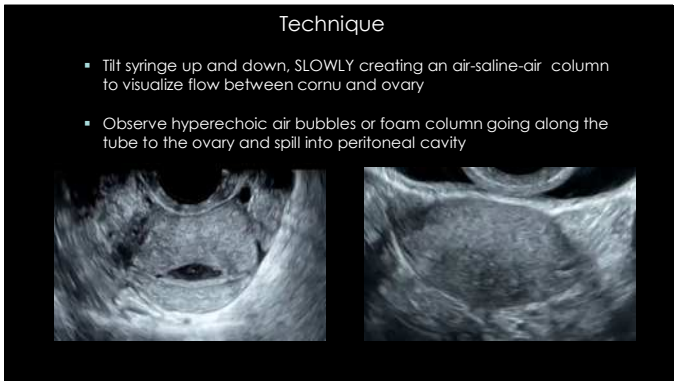
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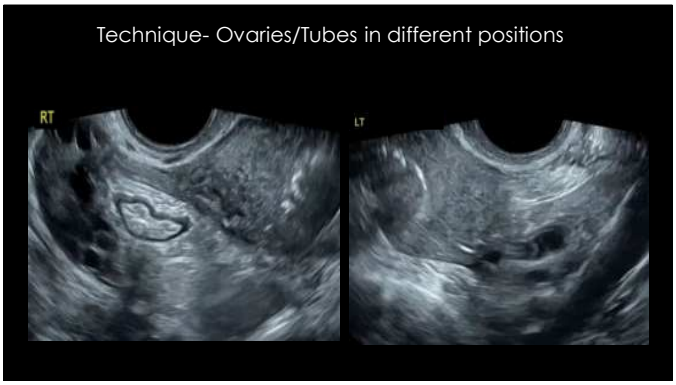
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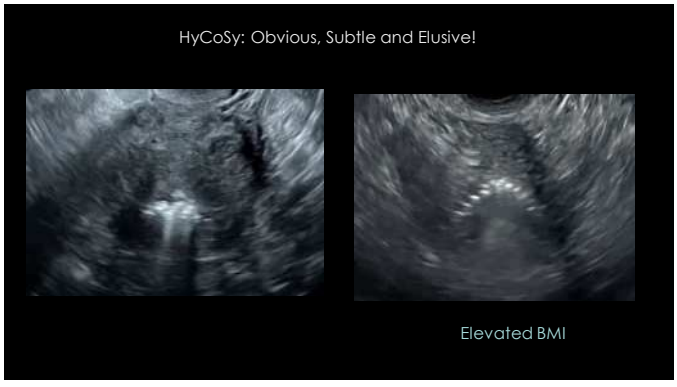
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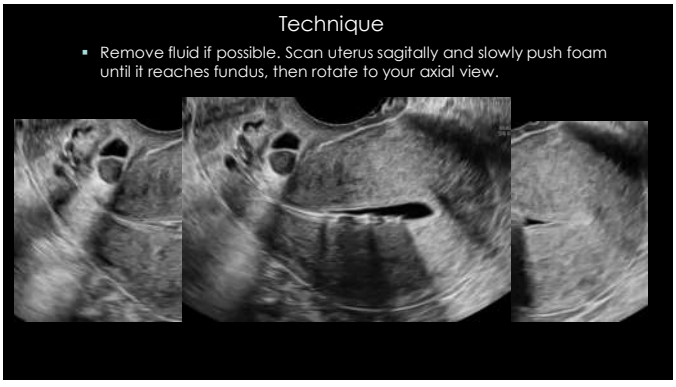
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40



41



42

Technique

- Remove fluid if possible. Scan uterus sagitally and slowly push foam until it reaches fundus, then rotate to your axial view.



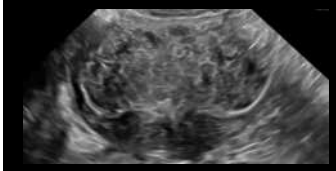


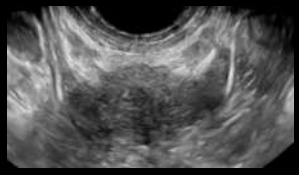
43

Accuracy of hysterosalpingo-foam sonography in comparison to hysterosalpingo-contrast sonography with air/saline and to laparoscopy with dye

2019
ExEm-Foam

U.S. FOOD & DRUG ADMINISTRATION
NDA 212279



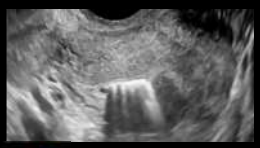


Ludwin et al. HR 2017

44

What does this study tell us?

132 women, 259 tubes, laparoscopy with dye as reference. 18 tubes (6.9%) occluded.



Method	Called occluded	PPV	NPV
2D air / saline HyCoSy	46 (17.8%)	30%	99.5%
2D/3D HyFoSy	27 (10.4%)	48%	99%
2D/3D HDF Doppler HyFoSy	24 (9.2%)	71%	99.6%

A negative study is close to definitive.

In most patients we start with air- free!
Consent obtained for FOAM (potential co-pay)

Ludwin et al. HR 2017

45

What does the study tell us?

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Ludwin et al. HR 2017

46

What is your next step?

Air-saline HyCoSy: after several attempts and maneuvers (rolling the patient, abdominal pressure), no filling is seen in either tube.

A Diagnose bilateral tubal occlusion



B Patency indeterminate; repeat with foam



C Laparoscopy - chromopertubation



D Hysterosalpingogram



47

What is your next step?

Air-saline HyCoSy: after several attempts and maneuvers (rolling the patient, abdominal pressure), no filling is seen in either tube.

A Diagnose bilateral tubal occlusion



B Patency indeterminate; repeat with foam



C Laparoscopy - chromopertubation



D Hysterosalpingogram



A positive study is a hypothesis.



Ludwin et al. HR 2017

48

Foam vs air–saline contrast

Why FOAM helps

- Stable signal for 5+ min
- Longer segment of tube seen
- Increased confidence in patency determination- difficult cases
- Better for limited visualization
- Excellent for standard GYN US use or trainees
- Excellent safety profile
  Water/cellulose/glycerin
- Less pain than HSG

AIR–SALINE *bright but fleeting*

FOAM *persistent pathway*



Key message: Foam turns a brief bubble sighting into a trackable contrast pathway.

49

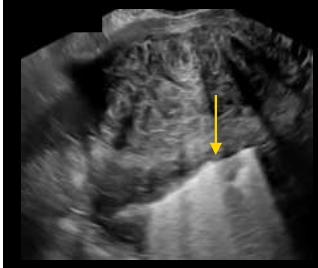
Technical Challenges

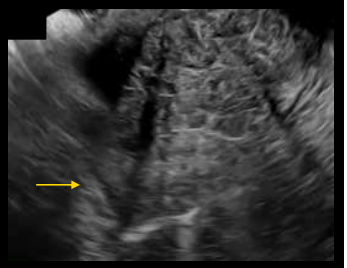
- Can be seen transabdominally in high riding uterus
- Fibroids
- Elevated BMI
- Shadowing
- Utilize 3D



50

Technical Challenges





51

Is this a fallopian tube?

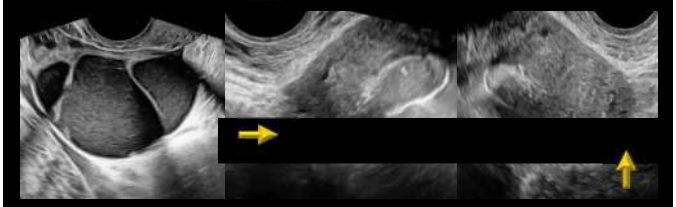




52

HSG bilateral occluded tubes

Right Hydrosalpinx



HyFoSy

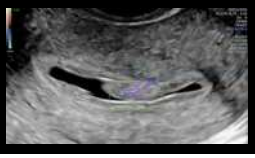
- Bilateral patent tubes
- Ovarian Cyst: Probable Cystadenoma

53

Step 3-4: Sonohysterography/HyCoSy/HyFoSy

Antibiotics- Extrapolated from HSG





ROUTINE antibiotics not recommended

✓ PID after HSG is uncommon (1.4-3.4%)

✓ No data after SIS- very low (< 1%)

Antibiotic prophylaxis recommended

✓ Hx Pelvic Inflammatory Disease

ACOG Practice Bulletin No. 195, June 2018

54

Step 3-4: Sonohysterography/HyCoSy/HyFoSy

Antibiotics- Extrapolated from HSG



ROUTINE antibiotics not recommended
- ✓ PID after HSG is uncommon (1.4-3.4%)
- ✓ No data after SIS- very low (< 1%)

Antibiotics prophylaxis recommended
- ✓ Abnormal fallopian tubes
- ✓ Hx Pelvic Inflammatory Disease

IF dilated tubes noted at procedure
- ✓ Risk of PID 11%

ACOG Practice Bulletin No. 195, June 2018

55

Step 3-4: Sonohysterography/HyCoSy/HyFoSy

Antibiotics- Extrapolated from HSG



Pelvic Inflammatory Disease

If active infection suspected, don't do SIS



56

CULTURAL AND LINGUISTIC COMPETENCY & IMPLICIT BIAS

The California Medical Association (CMA) outlines standards for Cultural Linguistic Competency and Implicit Bias in CME. The goal of the standards is to support the role of accredited CME in advancing diversity, health equity, and inclusion in healthcare. These standards are relevant to ACCME-accredited, CMA-accredited, and jointly accredited providers located in California. AAGL is ACCME-accredited and headquartered in California.

CMA developed the standards in response to California legislation (Business and Professions (B&P) Code Section 2190.1), which directs CMA to draft a set of standards for the inclusion of cultural and linguistic competency (CLC) and implicit bias (IB) in accredited CME.

The standards are intended to support CME providers in meeting the expectations of the legislation. CME provider organizations physically located in California and accredited by CMA CME or ACCME, as well as jointly accredited providers whose target audience includes physicians, are expected to meet these expectations which began on January 1, 2022. AAGL has been proactively adopting processes that meet and often exceed the required expectations of the legislation.

CMA CME offers a variety of resources and tools to help providers meet the standards and successfully incorporate CLC & IB into their CME activities, including FAQ, definitions, a planning worksheet, and best practices. These resources are available on the CLC and IB standards page on the CMA website.

Important Definitions:

Cultural and Linguistic Competency (CLC) – The ability and readiness of health care providers and organizations to humbly and respectfully demonstrate, effectively communicate, and tailor delivery of care to patients with diverse values, beliefs, identities and behaviors, in order to meet social, cultural and linguistic needs as they relate to patient health.

Implicit Bias (IB) – The attitudes, stereotypes and feelings, either positive or negative, that affect our understanding, actions and decisions without conscious knowledge or control. Implicit bias is a universal phenomenon. When negative, implicit bias often contributes to unequal treatment and disparities in diagnosis, treatment decisions, levels of care and health care outcomes of people based on race, ethnicity, gender identity, sexual orientation, age, disability and other characteristics.

Diversity – Having many different forms, types or ideas; showing variety. Demographic diversity can mean a group composed of people of different genders, races/ethnicities, cultures, religions, physical abilities, sexual orientations or preferences, ages, etc.

Direct links to AB1195 (CLC), AB241 (IB), and the B&P Code 2190.1:

Bill Text – AB-1195 Continuing education: cultural and linguistic competency.
Bill Text – AB-241 Implicit bias: continuing education: requirements.
Business and Professions (B&P) Code Section 2190.1

CLC & IB Online Resources:

Diversity-Wheel-as-used-at-Johns-Hopkins-University-12.png (850×839) (researchgate.net)
Implicit Bias, Microaggressions, and Stereotypes Resources | NEA
Act, Communicating, Implicit Bias (racialequitytools.org)
https://www.contemporaryobgyn.net/view/overcoming-racism-and-unconscious-bias-in-ob-gyn
https://pubmed.ncbi.nlm.nih.gov/34016820/
https://hr.ucdavis.edu/departments/learning/certificate/implicit-bias
https://pmc.ncbi.nlm.nih.gov/articles/PMC7011228/