Role of transvaginal sonography in the diagnosis of uterine adenomyosis

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INTRODUCTION:

- Uterine adenomyosis is a benign condition defined by the presence of endometrial glands and stroma within the myometrium
- Although the prevalence of uterine adenomyosis is unknown,
- It is usually diagnosed in multiparous women experiencing bleeding or pelvic pain, mainly during the **late** reproductive period
- The increasing use of ultrasonography (US) and magnetic resonance imaging (MRI) in women with chronic pelvic pain or infertility has contributed to the detection of adenomyosis in younger women
- Recent advances in imaging techniques have had an impact on the detection of uterine adenomyosis and imaging criteria are now part of the diagnostic workup along with histopathological features.
- The aims of this review are to clarify the definition of adenomyosis and to determine the value of the various US and MRI criteria used in the diagnosis of the various subtypes of adenomyosis

Imaging features are variable and in many instances very subtle. Three (some say four) forms can be distinguished:

- diffuse adenomyosis: most common
- focal adenomyosis and adenomyoma: consider these are separate
- cystic adenomyosis and adenomyotic cyst: rare

Adenomyosis is **usually** relatively **generalised**, affecting large portions of the uterus (**typically the posterior wall),** but **sparing the cervix.**

Despite often marked enlargement of the uterus, the **overall contour is usually preserved**

In some cases, adenomyosis are as a **localised**, **forming a mass.** In such cases, the term adenomyoma may be used

A rare variant is **cystic adenomyosis** which is believed to be the result of **repeated focal haemorrhages** resulting in cystic spaces filled with altered blood products

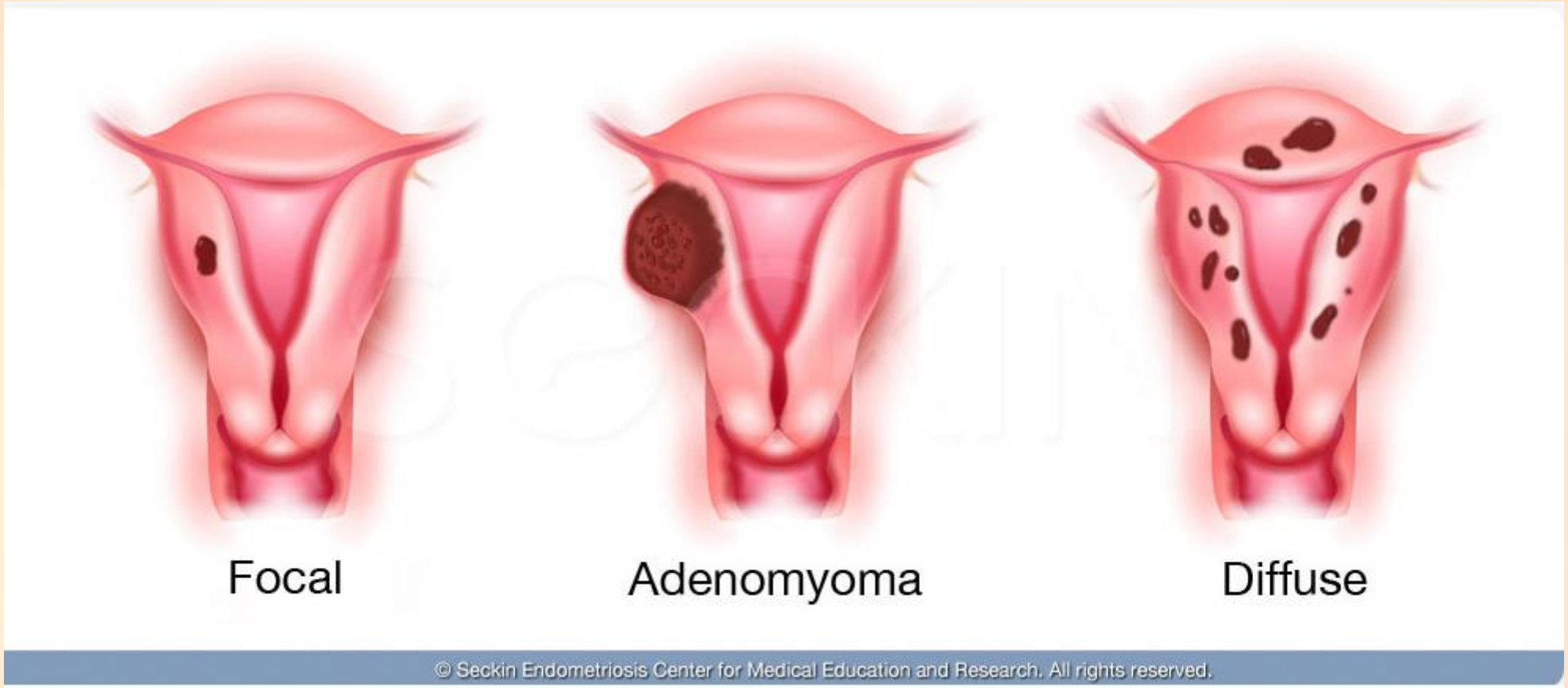

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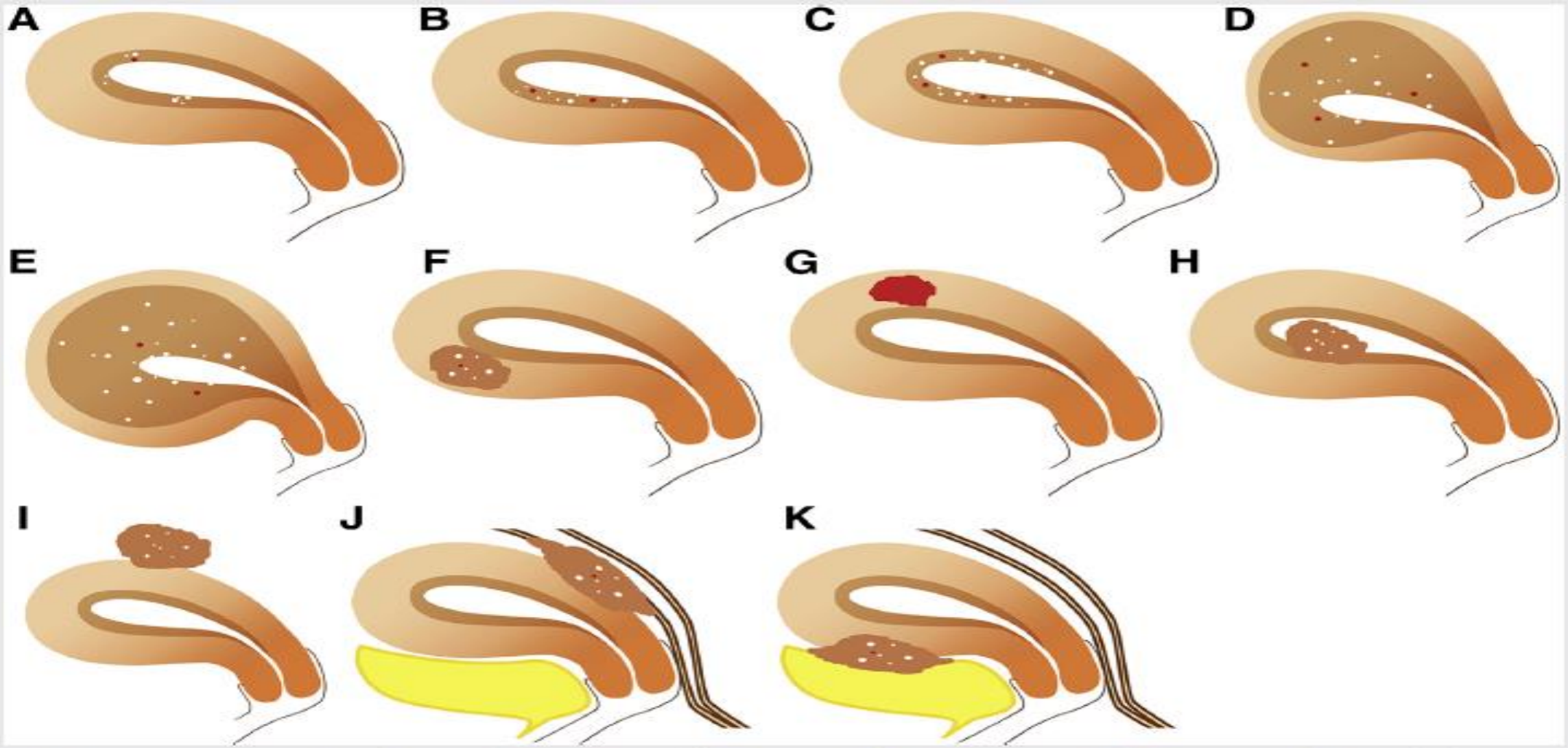
TABLE 1

Classification of adenomyosis.

Adenomyosis subtype	Definition	Figure
Internal adenomyosis (Ai)		
Focal adenomyosis (Ai0)	Localized intramyometrial tiny cystic component with or without JZ bulging (unique or multiple)	1A
Superficial adenomyosis (Ai1)	Disseminated subendometrial tiny cystic component without JZ hypertrophy (symmetric or asymmetric)	1B, 1C
Diffuse adenomyosis (Ai2)	Disseminated intramyometrial tiny cystic component with JZ hypertrophy (symmetric or asymmetric)	1D, 1E
Adenomyomas (Ad)		
Intramural solid adenomyoma (Ad1)	Ill-defined myometrial lesion with tiny cystic component (hemorrhagic or not)	1F
Intramural cystic adenomyoma (Ad2)	Ill-defined myometrial lesion with hemorrhagic cystic cavity	1G
Submucosal adenomyoma (Ad3)	Ill-defined myometrial lesion with tiny cystic component and intracavitary protrusion	1H
Subserosal adenomyoma (Ad4)	Ill-defined subserous myometrial lesion with tiny cystic component	1I
External adenomyosis (Ae)		
Posterior external adenomyosis (Ae1)	Ill-defined subserosal posterior myometrial mass associated with posterior deep endometriosis	1J
Anterior external adenomyosis (Ae2)	Ill-defined subserosal anterior myometrial mass associated with anterior deep endometriosis	1K

Note: asymmetric = predominant disseminated involvement by adenomyosis in one uterine wall; JZ = junctional zone; symmetric = disseminated involvement by adenomyosis in anterior and posterior uterine wall.

Bazot. Adenomyosis and imaging techniques. Fertil Steril 2018.

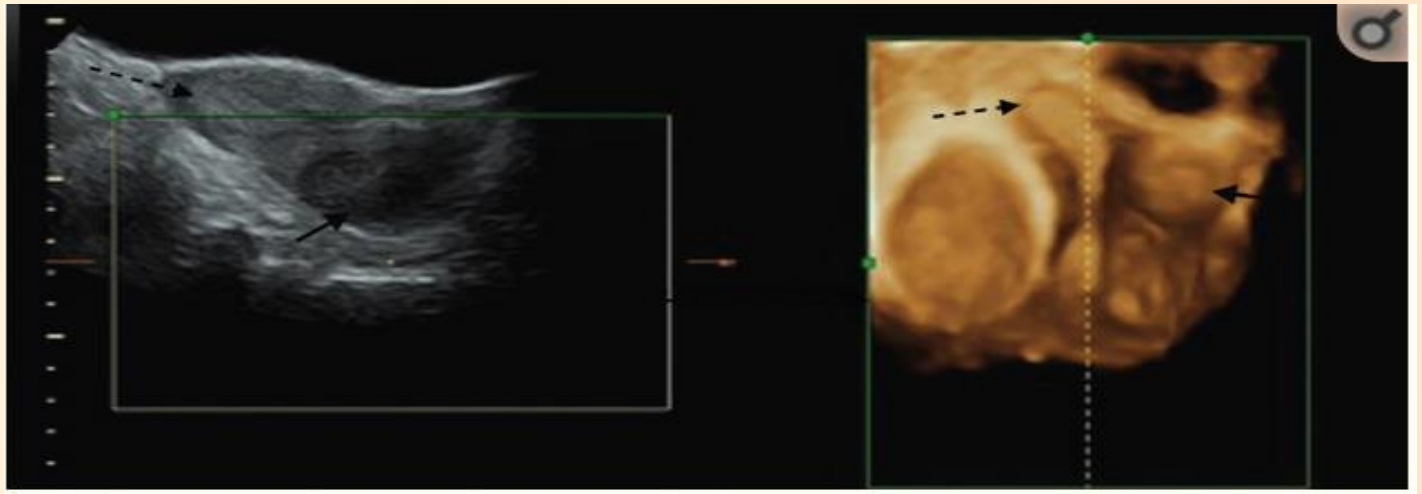


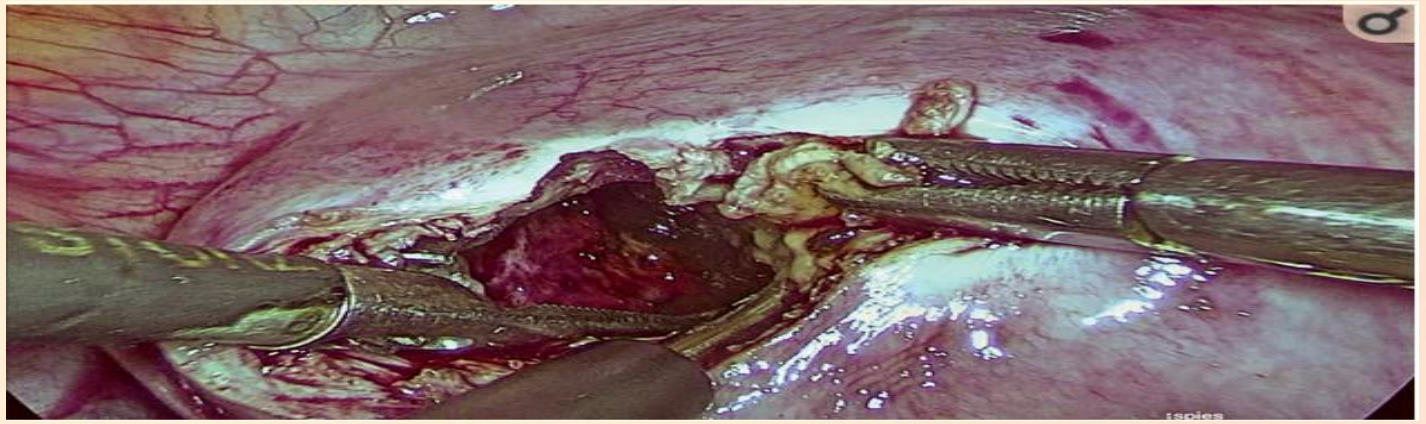
Magnetic resonance imaging classification of adenomyosis: different morphologic and locations of adenomyosis subtypes including internal adenomyosis, adenomyomas, and external adenomyosis. (**A**) Internal adenomyosis comprised focal or multifocal adenomyosis, (**B**) superficial asymmetric or (**C**) symmetric adenomyosis, and (**D**) diffuse asymmetric or (**E**) symmetric adenomyosis. Adenomyomas are related to intramural adenomyoma, (**F**) solid or (**G**) cystic and (**H**) submucosal or (**I**) subserosal adenomyomas. External adenomyosis are represented by (**J**) posterior adenomyosis and (**K**) anteriorassociated respectively with posterior and anterior deep endometriosis. (Modified from Bazot [18]. Pathologie Myométriale. Imagerie de la femme. Lavoisier; 2018).

Bazot. Adenomyosis and imaging techniques. Fertil Steril 2018.

Juvenile cystic adenomyoma is a rare form of adenomyosis and described as a new type of mullerian anomaly in literature

- T١-weighted MRI film in the sagittal section demonstrates a well-circumscribed lesion in the anterior myometrium (solid arrow), which is separately seen from the uterine cavity (broken arrow).
- ٢D and ٣D USG images show a well-circumscribed lesion in the anterior myometrium (solid arrow); the uterine cavity (broken arrow) is seen separately





ULTRASONOGRAPHY AND ADENOMYOSIS:

- This technique can visualize a big, regular, heterogeneous uterus containing tiny cystic lesions of ٢–٧ mm .TUS is useful in patients with bleeding or dysmenorrhea to detect uterine leiomyomas or endometrial disorders.

The spectrum of findings includes:

- **Normal-appearing uterus**
- **Focal** or **diffuse myometrial bulkiness**, typically of the posterior wall
- Thickening of the **transition zone** can sometimes be visualised as a **hypoechoic halo** surrounding the endometrial layer of **≥١٢ mm thickness**
- **Subendometrial** echogenic **linear striations**
- **Subendometrial echogenic nodules or striations** (**specific sign**):
- **Small myometrial cysts** / subendometrial cysts (**specific sign**) (٢ mm–٩ mm) corresponding to cystic or hemorrhagic endometrial glands, mainly located in the superficial myometrium
- **Poor definition of the endometrial-myometrial interface**

- Diffuse asymmetric or symmetric widening of the myometrial wall(s) is secondary to myometrial hypertrophy and mainly related to deep diffuse internal adenomyosis.
- Heterogeneous echogenicity (heterogenous myometrial echotexture) [1-2]
  - **Hyper**echoic: islands of endometrial **glands**
  - **Hypo**echoic: associated muscle hypertrophy
  - A "**Venetian blind**" appearance may be seen due to subendometrial echogenic linear striations and acoustic shadowing where endometrial tissues cause a hyperplastic reaction

When an adenomyoma is present, appearances may closely mimic those of a uterine fibroid, with a coexistence of ٤٠% .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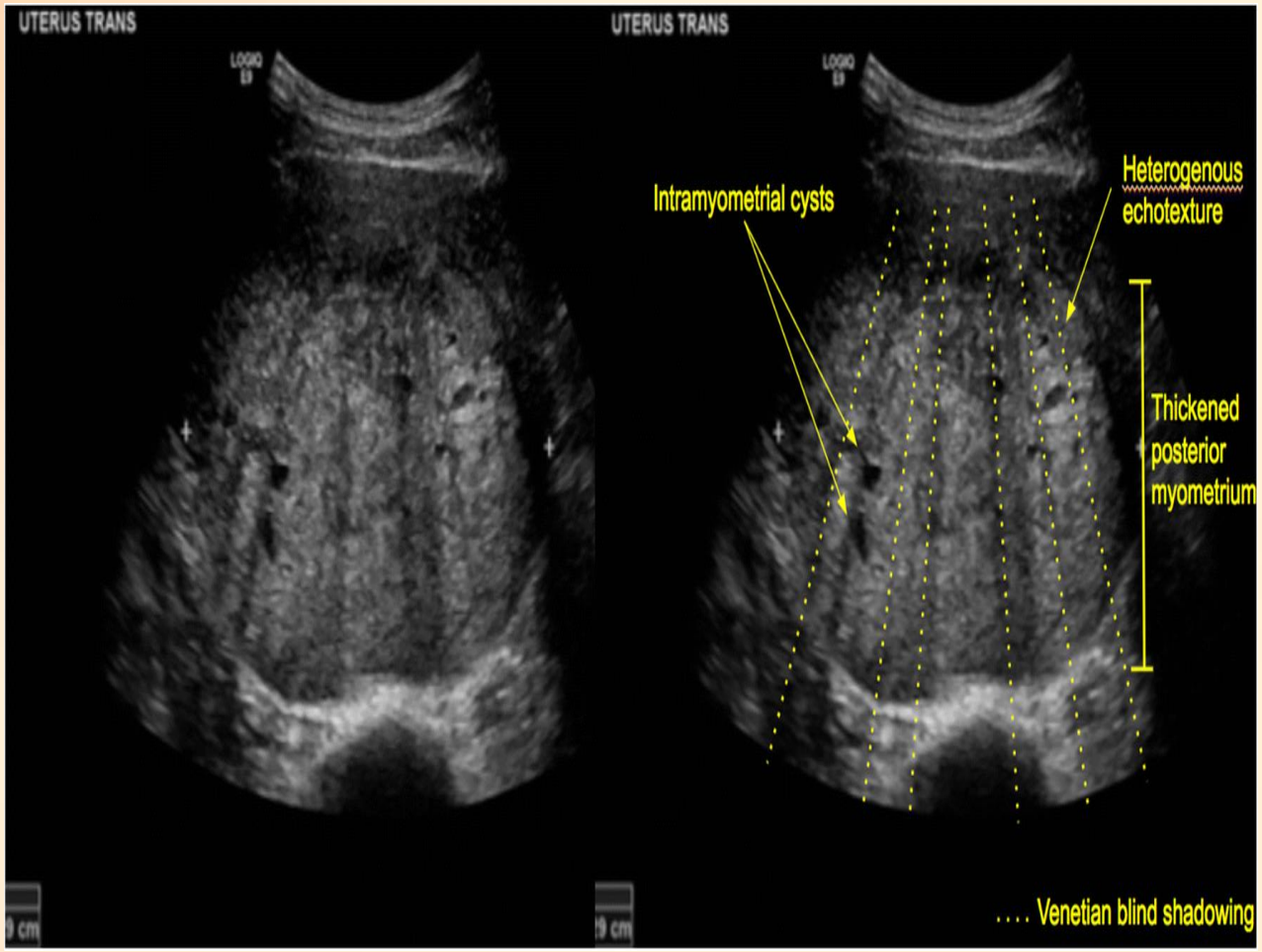
UTERUS TRANS
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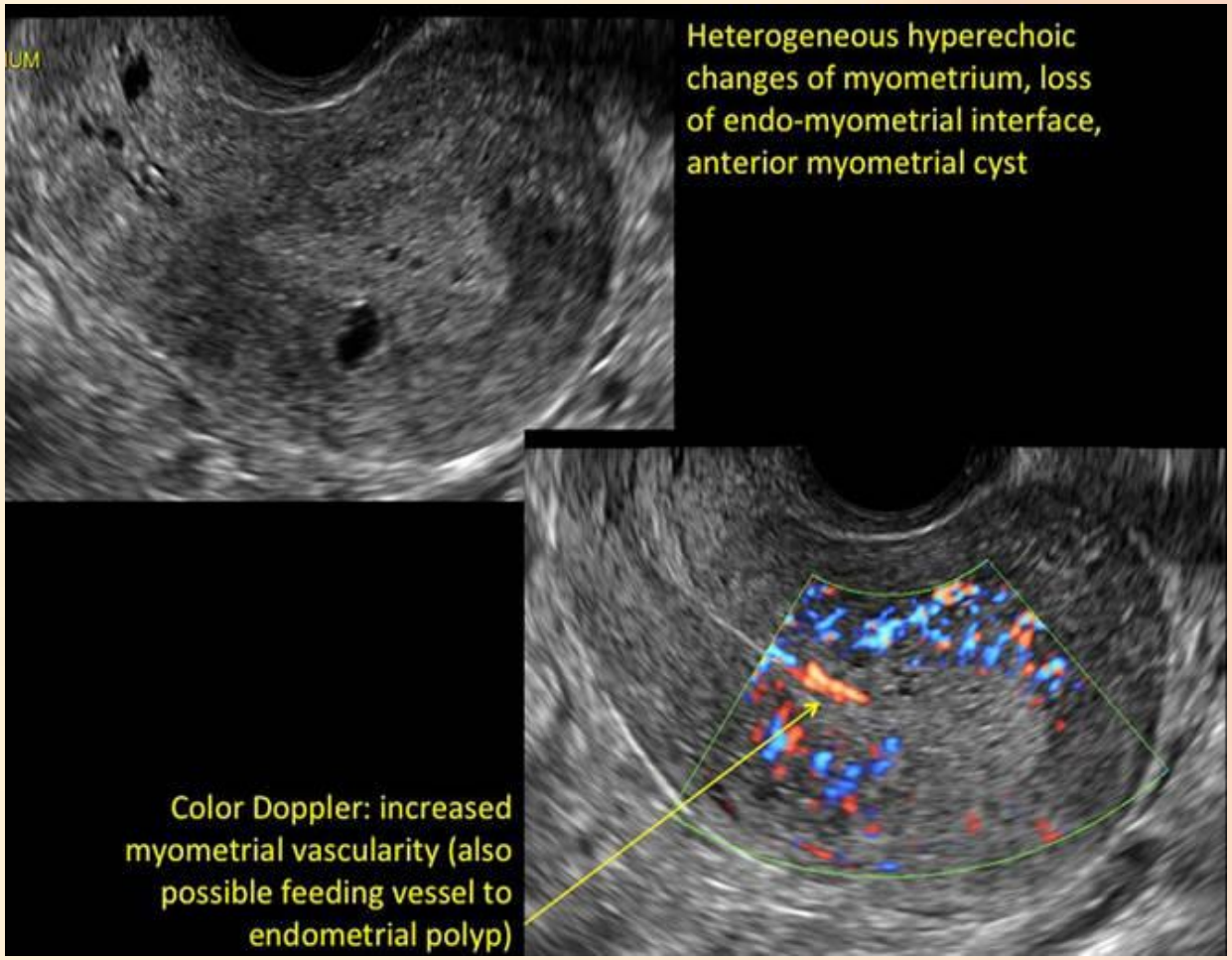
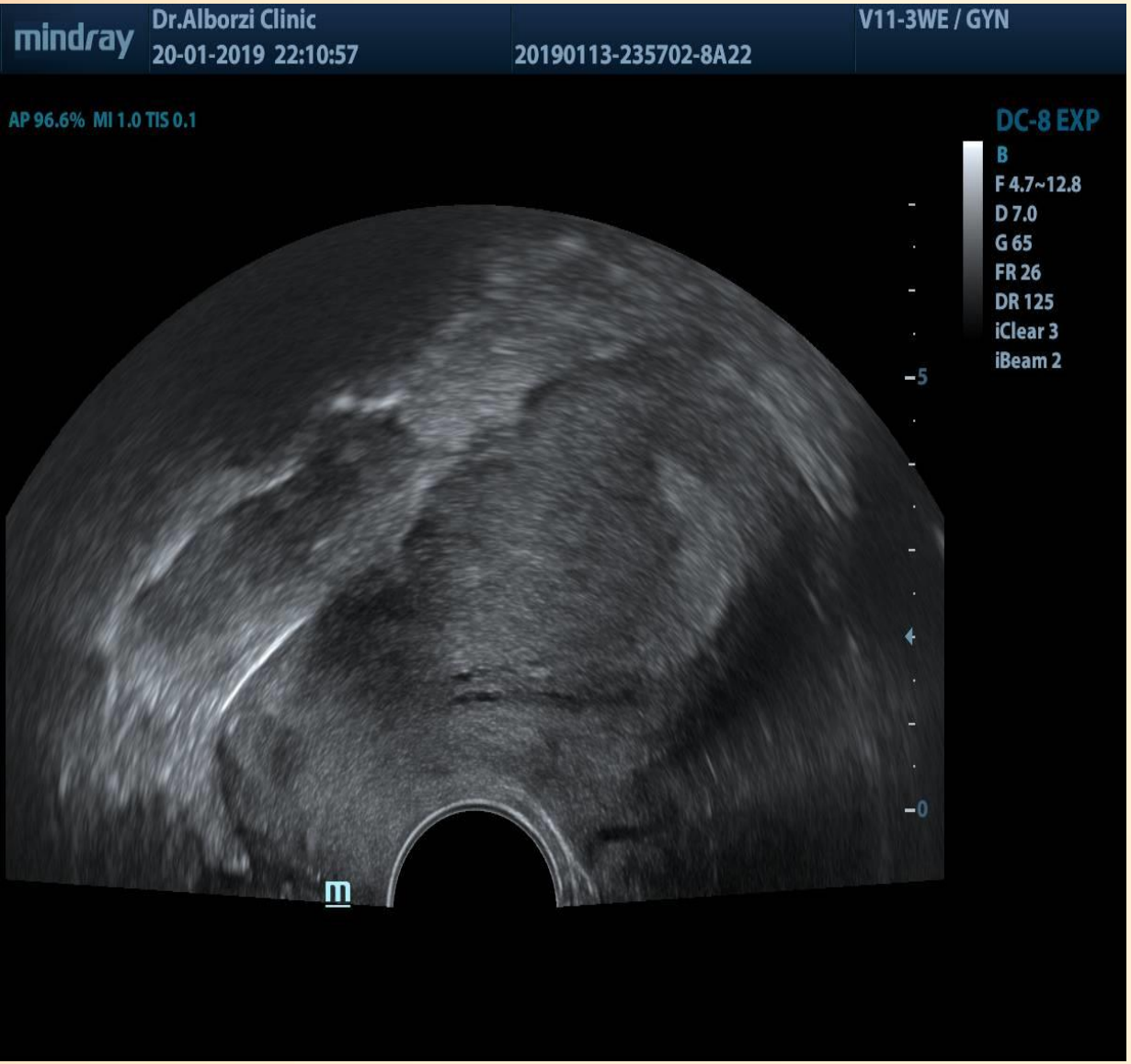
Intramyometrial cysts
Heterogenous echotexture
Thickened posterior myometrium
.... Venetian blind shadowing


Heterogeneous hyperechoic changes of myometrium, loss of endo-myometrial interface, anterior myometrial cyst
Color Doppler: increased myometrial vascularity (also possible feeding vessel to endometrial polyp)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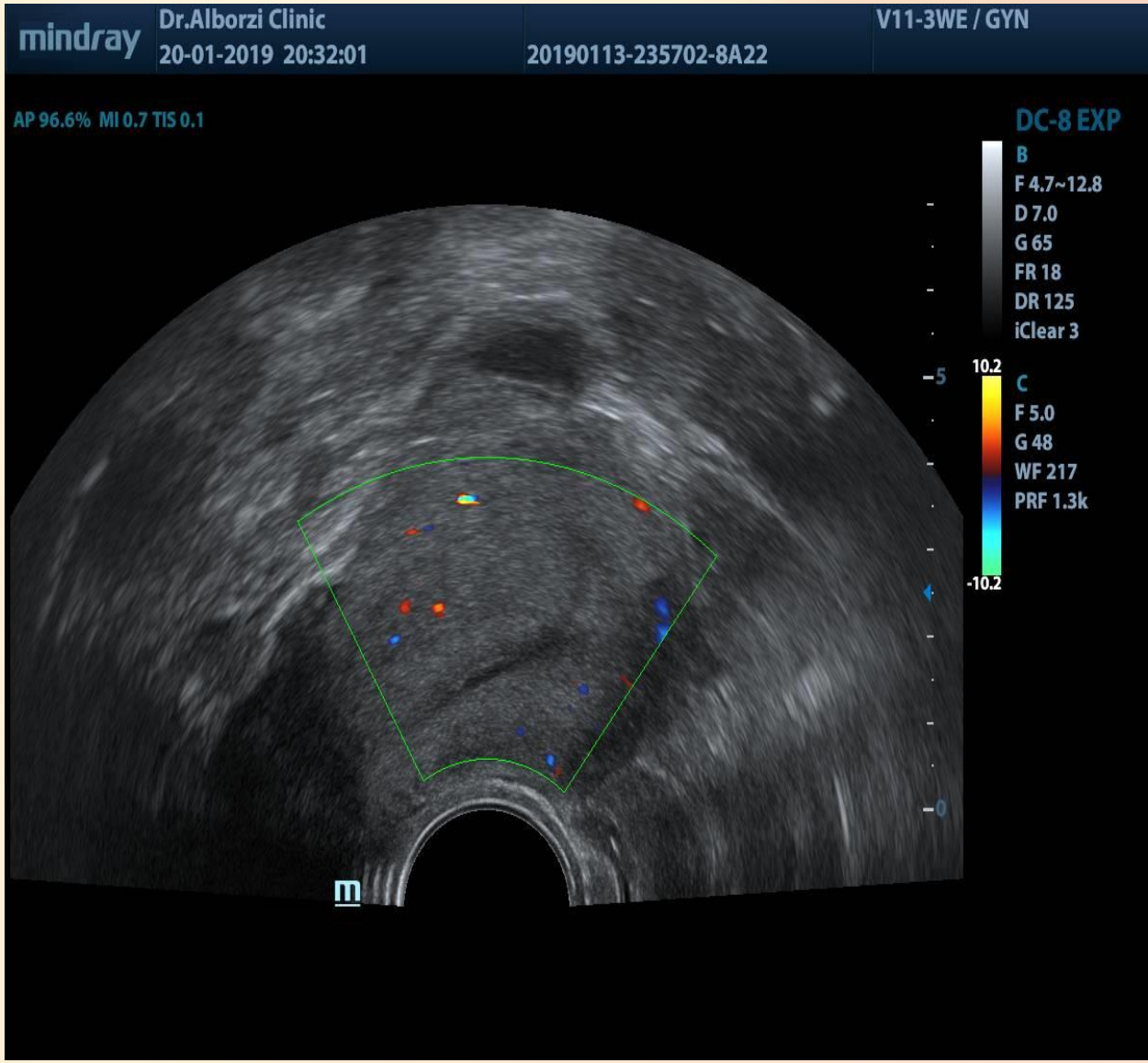
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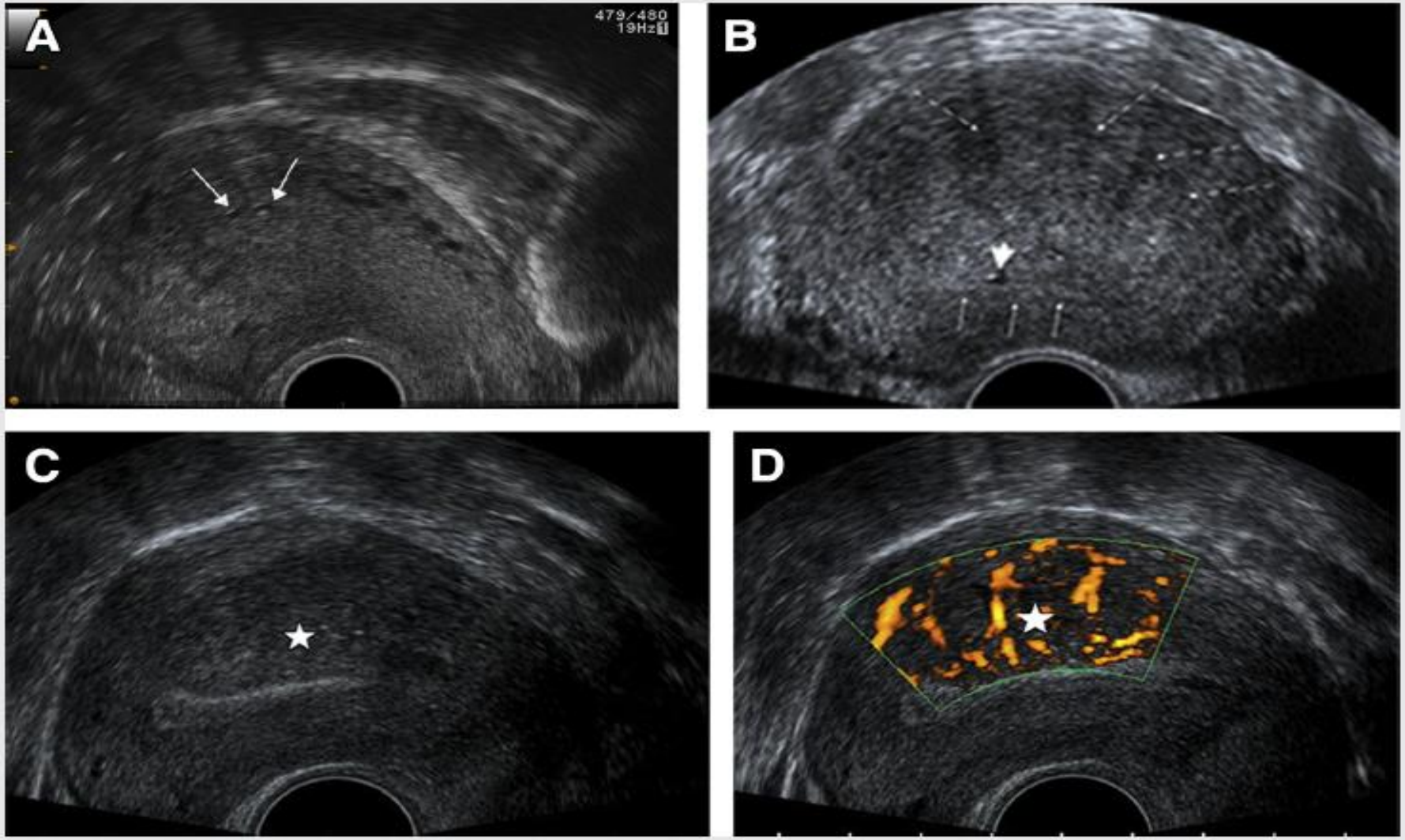
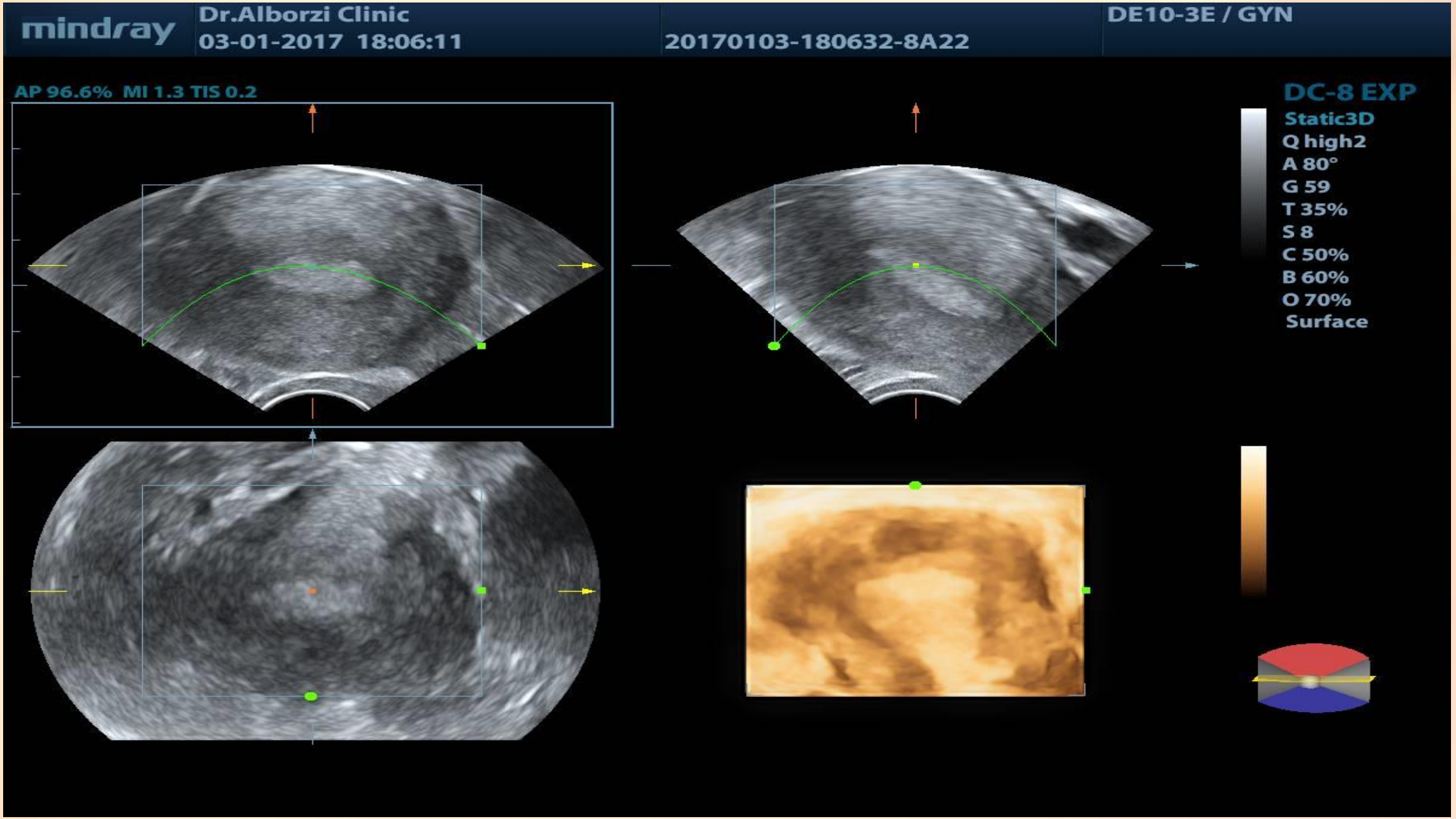
٣D,٢D & Elastography:

- New US techniques are emerging and show promising results for the diagnosis of adenomyosis.
- Color or power Doppler US is useful to rule out the involvement of vascular structures .
- In the presence of features mimicking leiomyomas, power Doppler US displaying vessels perpendicular to the endometrial interface, is suggestive of adenomyosis (C and D)
- Reconstructed **three dimensional TVS** images provide superior visualization of the junctional zone (JZ) on the coronal section, facilitating analysis of the endomyometrial junction.
- Elastography is another emerging US technique and uses slight external tissue compression to quantify the strain produced in the structures examined . Two recent studies suggest significant differences in strain distribution between adenomyosis and leiomyomas .



Transvaginal sonographic examinations in different patients showing (**A**) tiny subendometrial cysts (*arrows*) related to focal internal adenomyosis; (**B**) regular enlarged asymmetric heterogeneous myometrium containing multiple hypoechoic striations (*dotted arrows*), tiny myometrial cystic (*short arrow*) adjacent to poor definition of the endometrial-myometrial interface (*thin arrows*) related to diffuse adenomyosis; and (**C, D**) large posterior hypoechoic myometrial area (*star*) containing vessels following their course perpendicular to the endometrial interface due to diffuse adenomyosis.

Bazot. Adenomyosis and imaging techniques. Fertil Steril 2018.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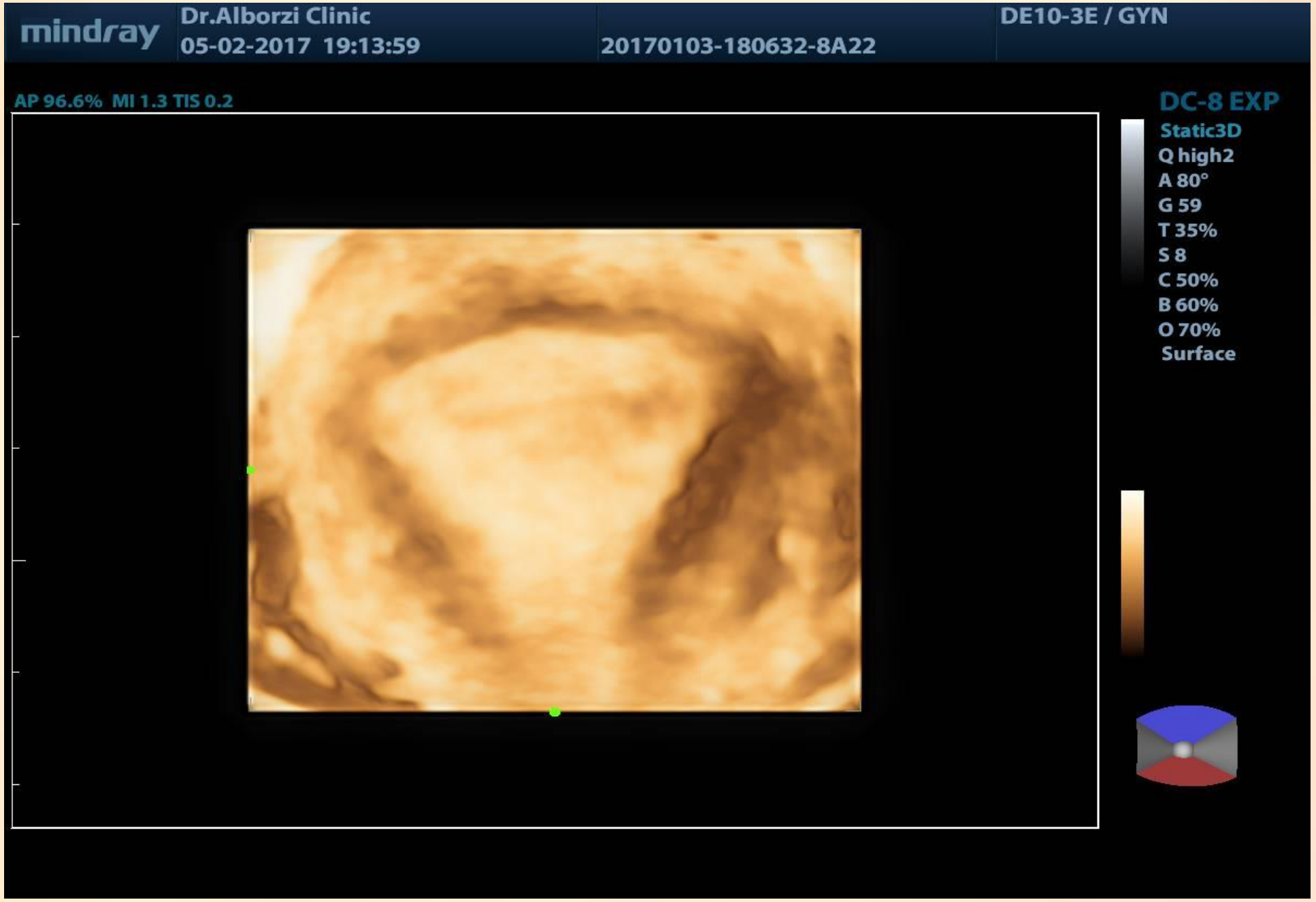
C 50%
B 60%
O 70%
Surface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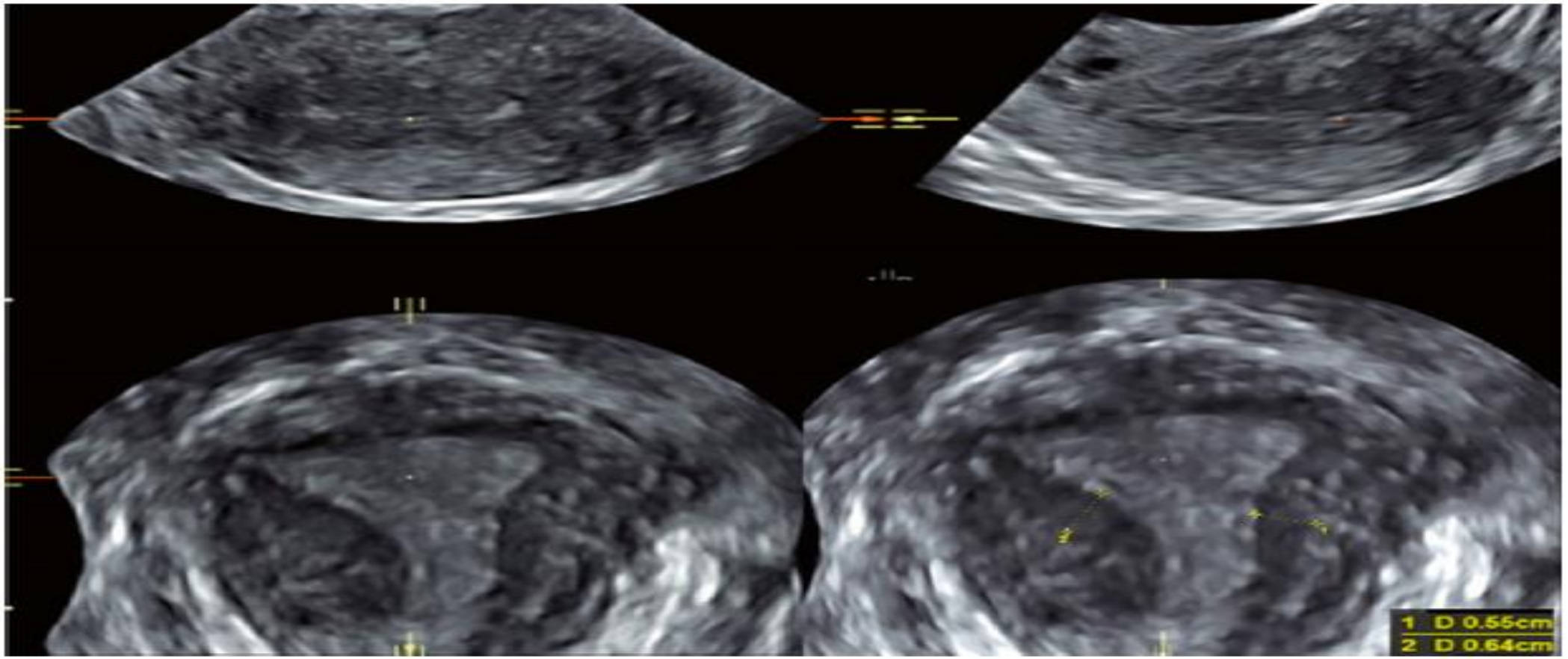
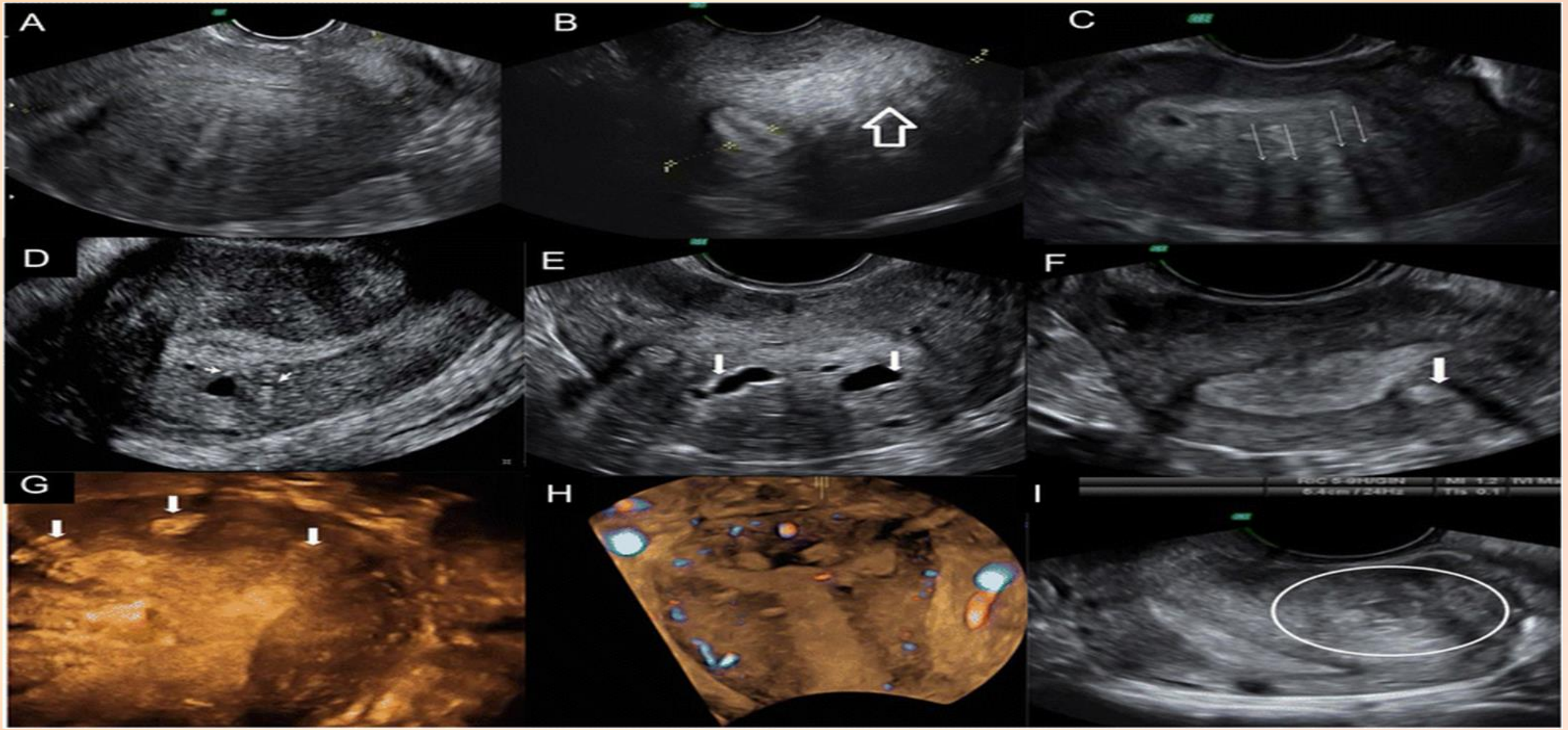
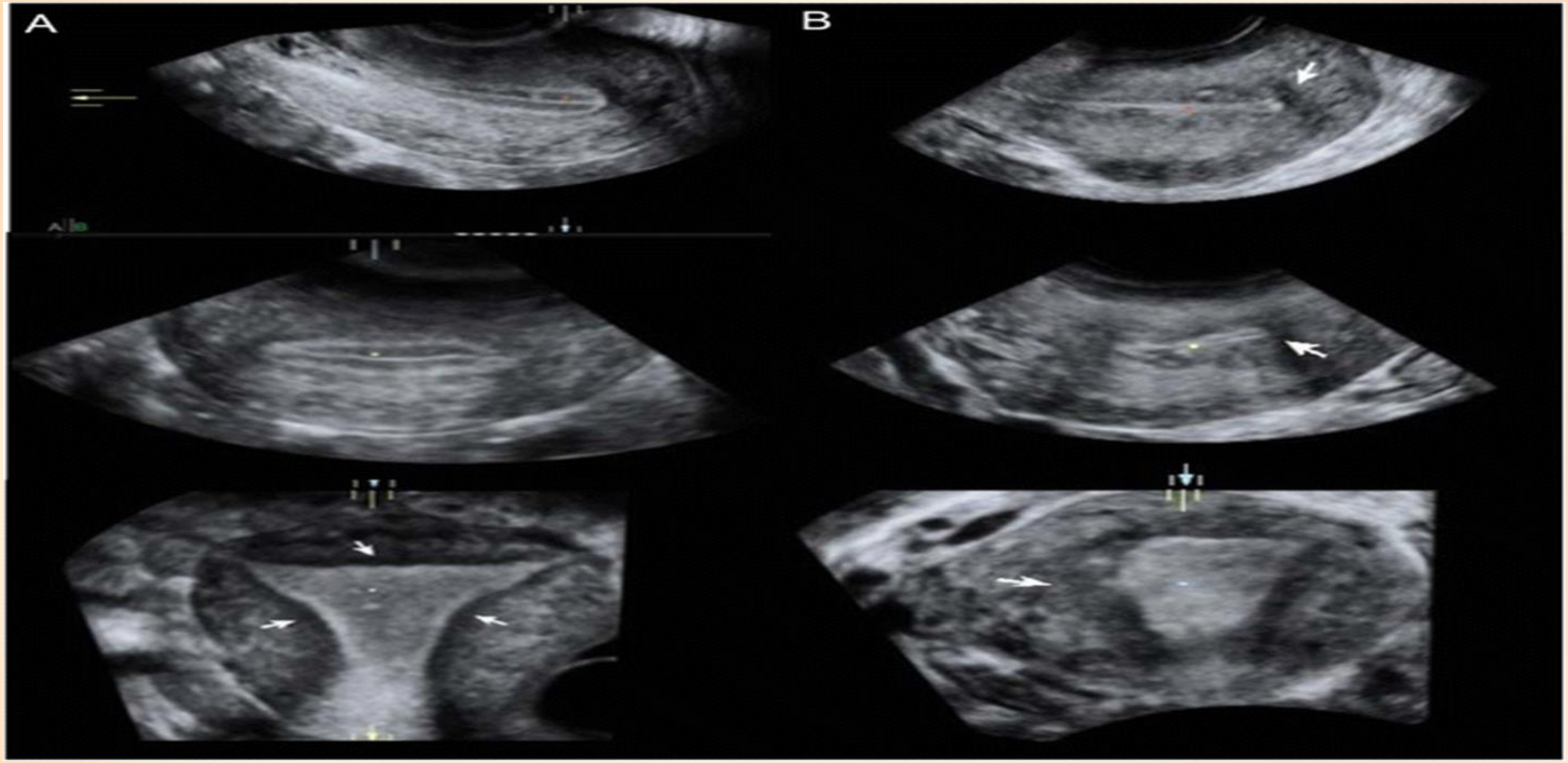


Fig. 9.11 Ultrasound image of the uterus obtained using three-dimensional ultrasound and volume contrast imaging (VCI) with 4 mm slices. A multiplanar view is shown: transverse and coronal sections of the uterus are shown on the *left side* of the image, a longitudinal section is shown on the *right side* of the image. The thickened junctional zone appears as a hypoechoic zone surrounding the endometrium. 2D ultrasound features of adenomyosis are not clearly seen in the longitudinal and transverse sections. However, in the coronal section, a slightly thickened distorted junctional zone is seen on the left

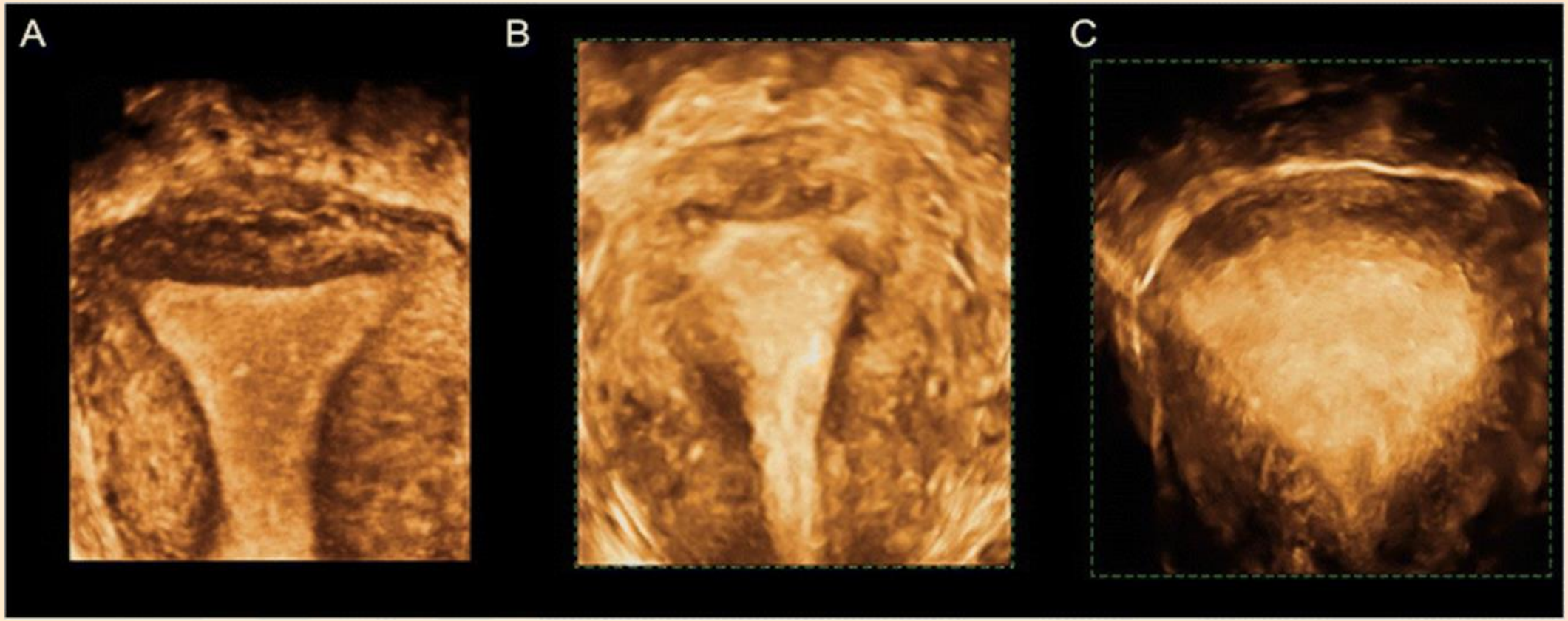
Ultrasonographic diagnostic criteria for adnomyosis. **a** Globulous aspect of the uterus. **b** Uterine asymmetry. Longitudinal section of a retroverted uterus, where the posterior uterine wall is clearly thicker than the anterior wall. **c** Heterogeneous myometrial texture. Transversal section of the uterus at the fundus level, where hypoechoic areas with radial pattern can be seen (*arrows*). **d** Linear striations. In this sagital section of an anteverted uterus thin hyperecogenic lines cross the myometrial thickness, visible from the endometrial-myometrial interphase. **e** Intramyometrial cysts. Transversal section of the uterus at the fundus level with sonoluscent images distributed in posterior wall of the myometrium. **f** and **g**, **h** Hyperechogenic nodules. Transversal (**f**) and coronal (**g**, **h**) sections of the uterus at the fundus level where hyperechogenic Intramyometrial areas can be observed (*arrows*). **i** Adenomyoma. Longitudinal section of a retroverted uterus with heterogeneous nodular mass lacking well-defined margins in the posterior wall



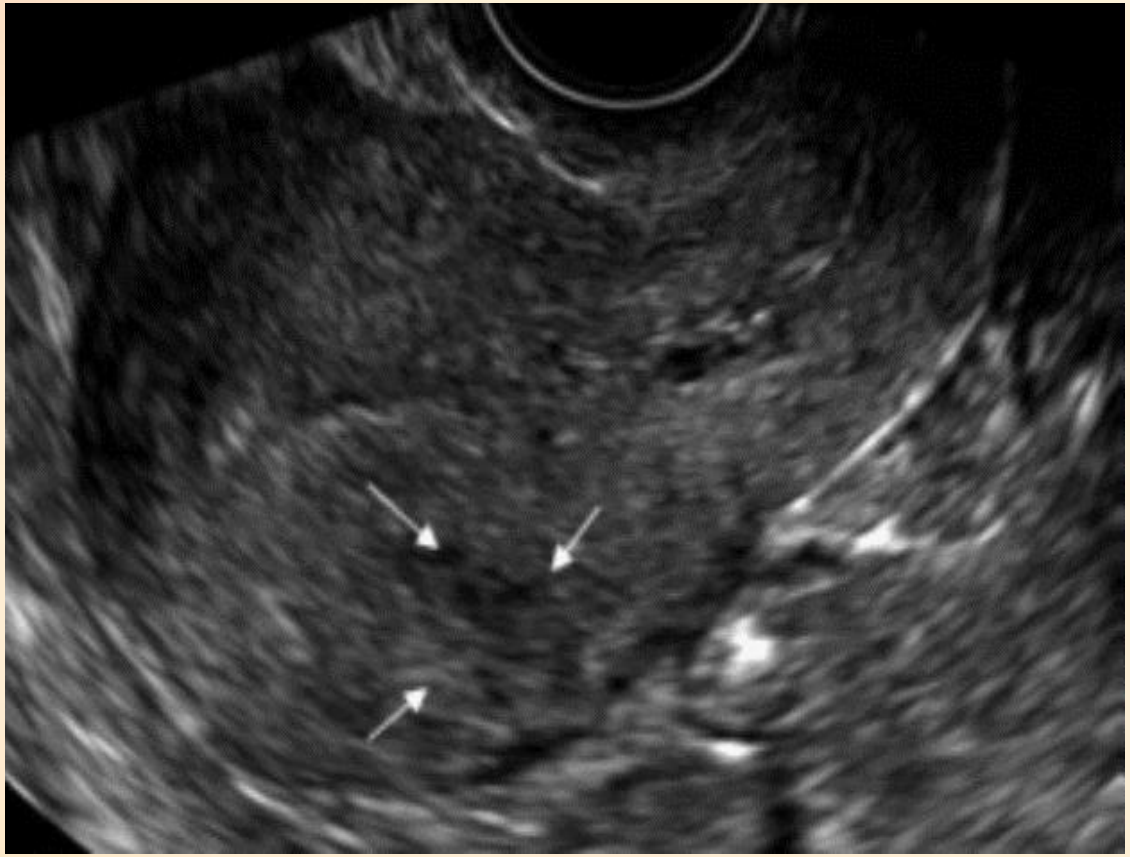
Evaluation of the junction zone (JZ). Multiplanar view in volume contrast image (VCI) mode attaining images with ٢ mm slice thickness. Sagital, transversal and coronal views of a retroverted uterus **a** Normal JZ, observed as hypoechogenic area surrounding all endometrial thickness (*arrows*). **b** Thickened, irregular JZ

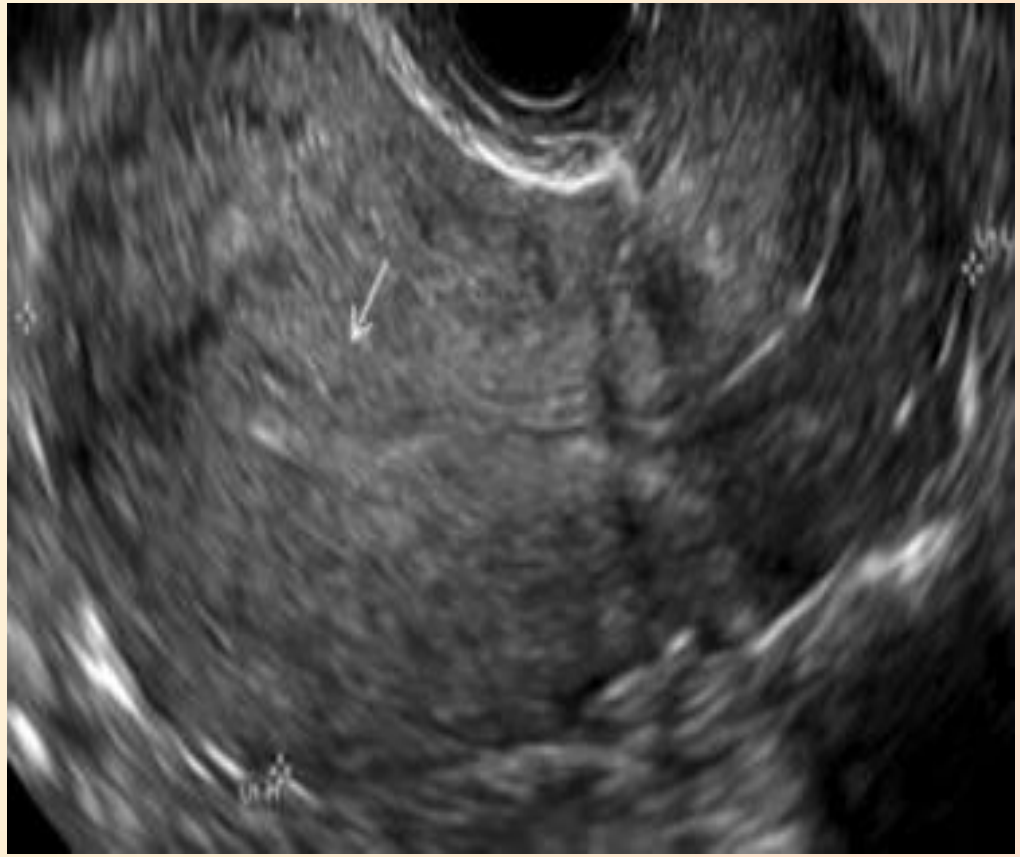


Evaluation of the JZ using ٣D surface reconstruction mode. **a** Normal JZ. **b** and **c** thickenned, irregular JZ, where it is not possible to adequatly differentiate the endometrial-myometrial transition

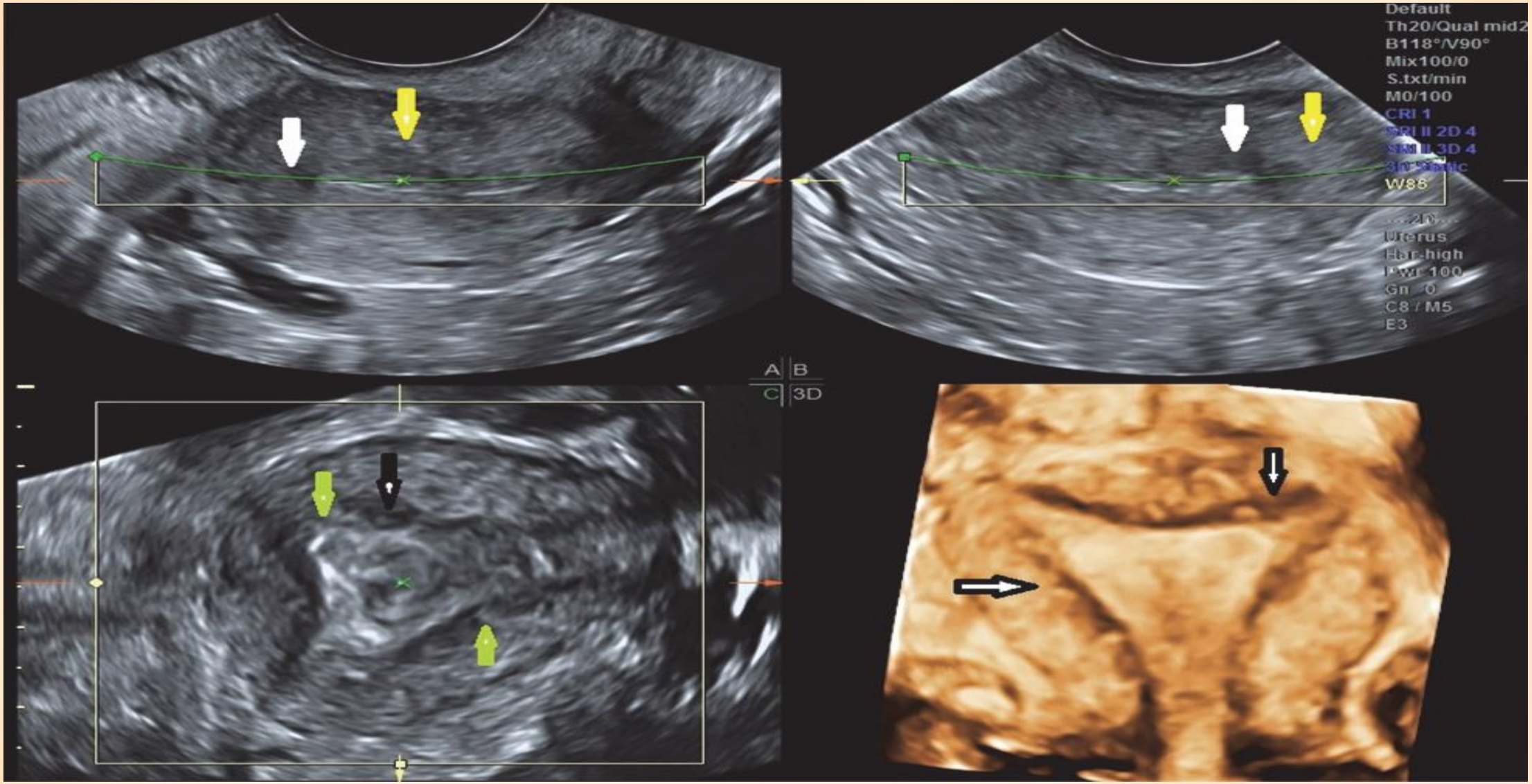


Focal adenomyoma (Rt figure)
Globular uterine enlargement with an obscure endomyometrial border (arrow).





Severe adenomyosis with multiple sonographic signs: multiplanar and ٣D rendering of an anteverted uterus with multiple sonographic signs: myometrial cysts (white arrow), hyperechoic islands (yellowarrow), linear striations (green arrow), and irregularEMJ (black arrow).



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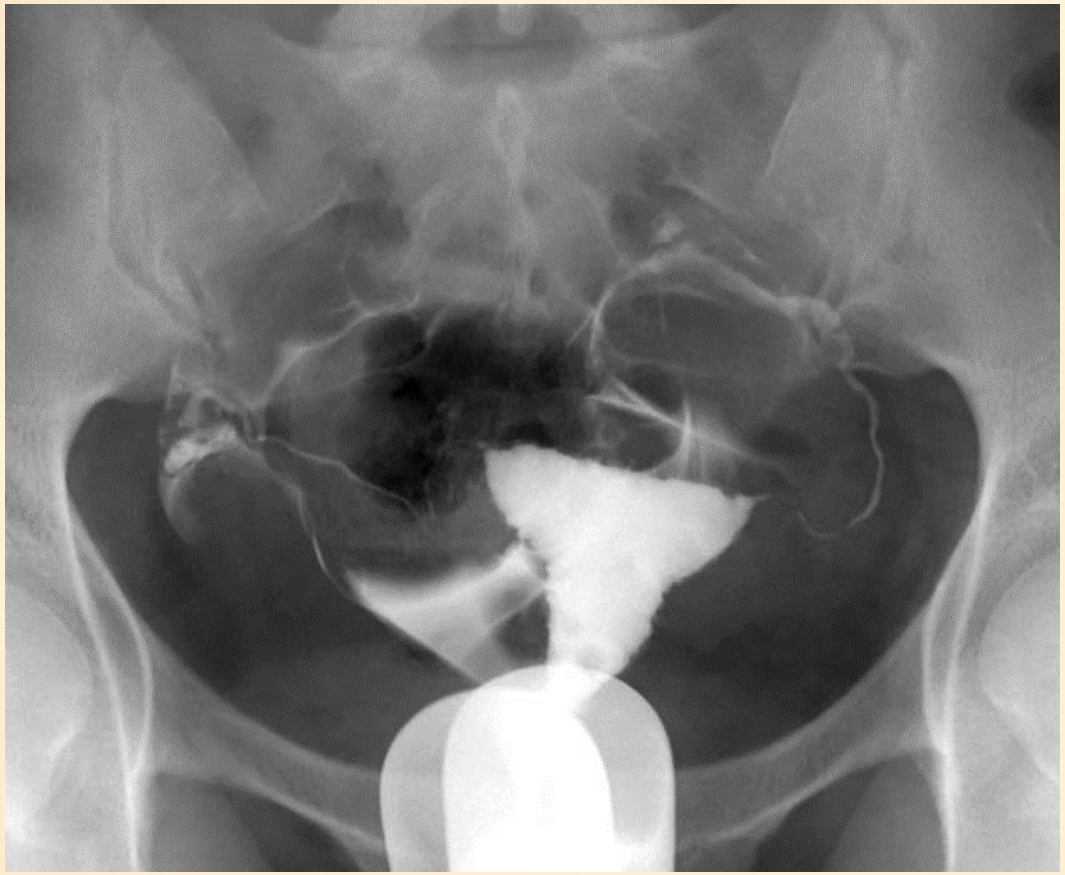
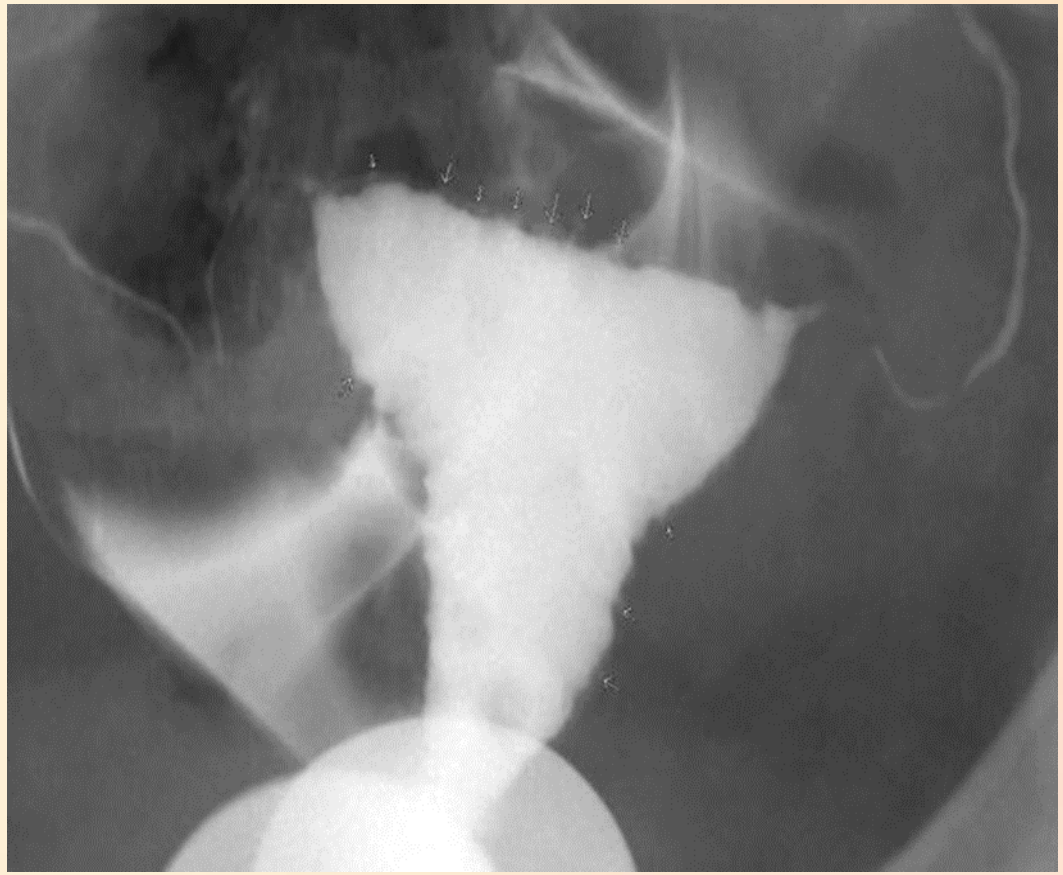
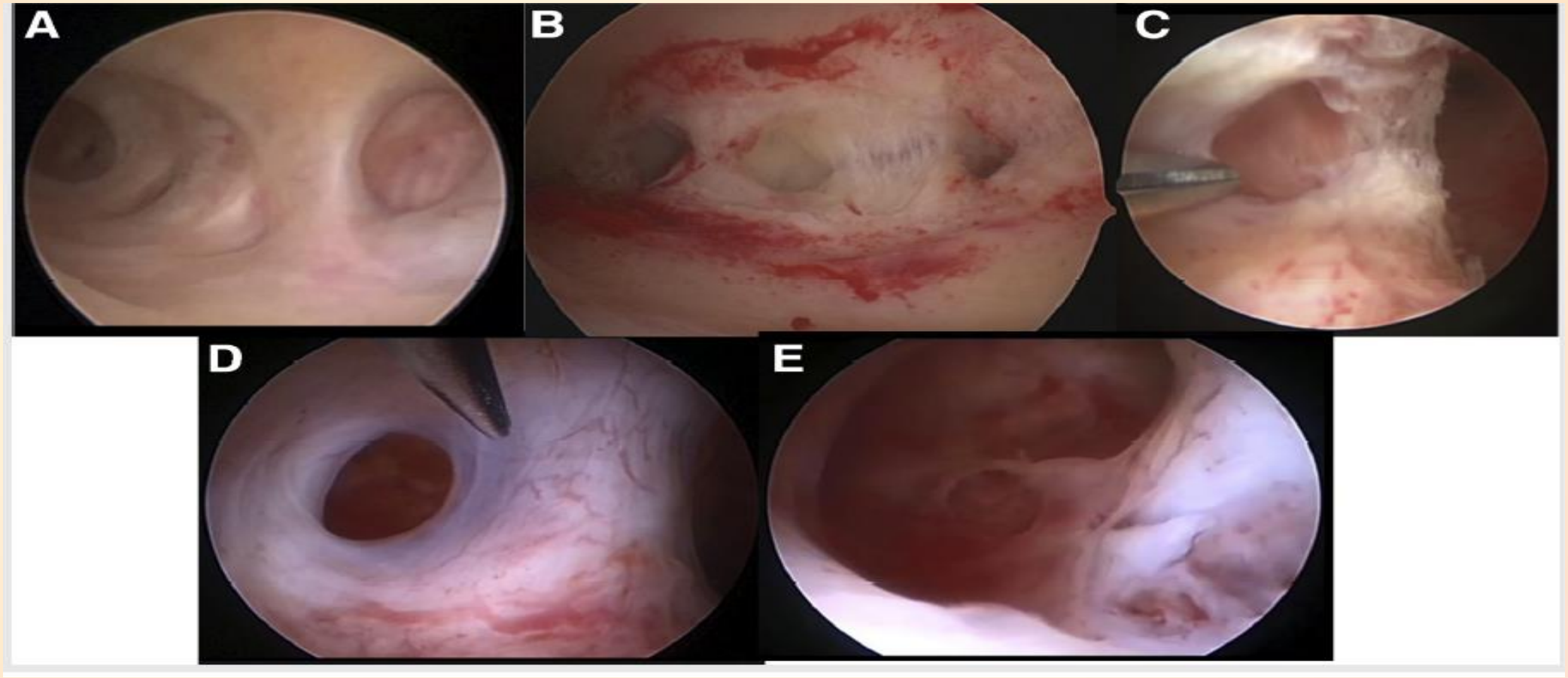




Adenomyotic hysteroscopic images become pathognomic after sub-endometrial exploration: (A) visible endometrial defects on uterine septum; (B)
after incision different cystic structures become visible; (C) incision of lateral wall of T-uterus reveals the presence of adenomyotic cyst; (D) formation
of cyst, still small opening is present; and (E) opening of this defect shows the inner sight of the cyst.

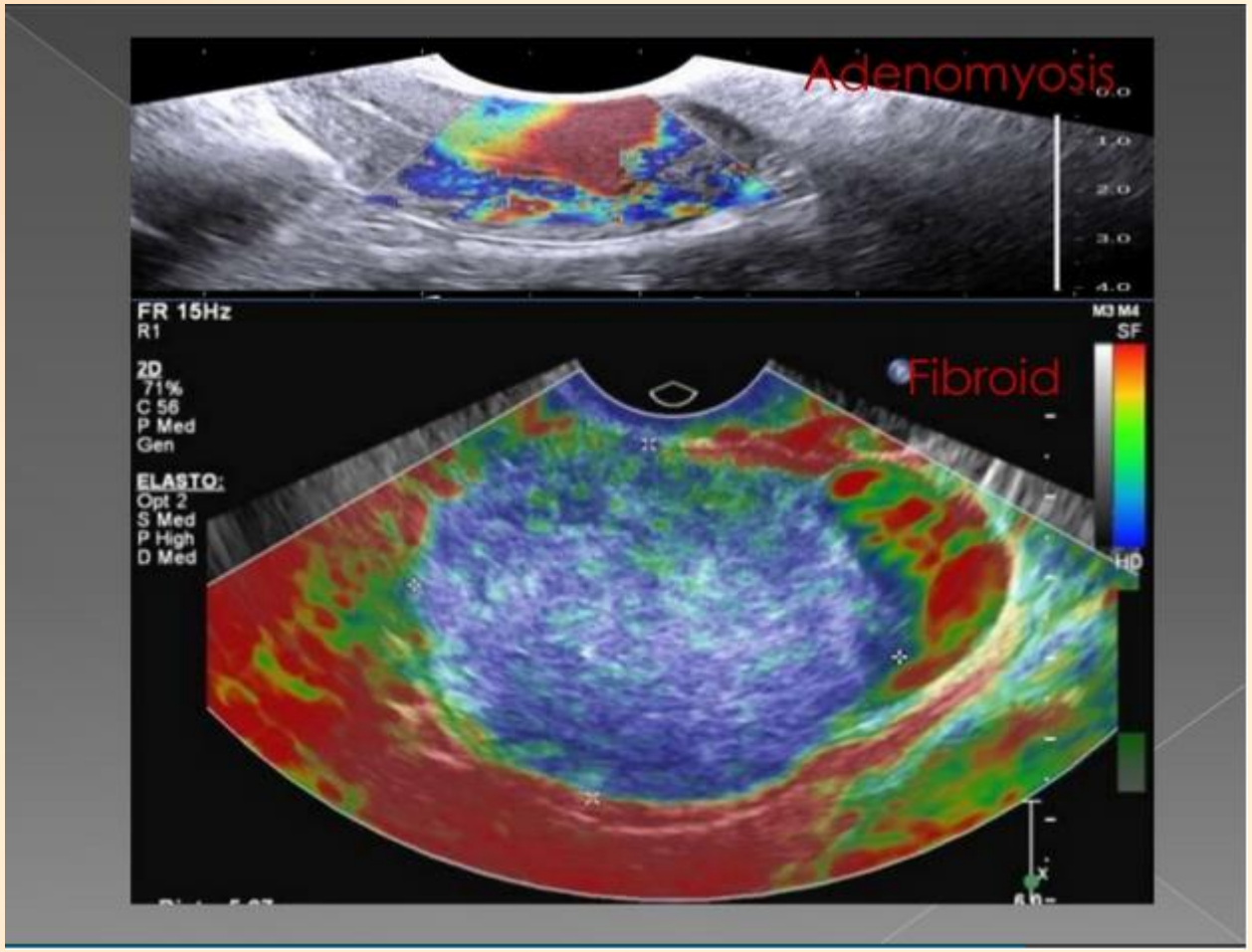


Tissue Distortion

- The main Principle behind Sonoelastography is creating a distortion in a certain ROI and comparing the elasticity of its different parts.
- To image the mechanical properties of tissue, we need to see how it behaves when deformed. There are three main ways:
- 1-Pushing or vibrating the surface of the body with a mechanical device or the practitioner's arm
- 2-Using ultrasound to create a 'push' or a high or low frequency mechanical wave inside the tissue
- 3-Observing distortions created by normal physiological processes, like the pulse or heartbeat

- Accurately Delineating the extent and site of the lesion and malignancy likehood by Strain Ratio .
- The Strain Ratio is one way of semi-quantifying the stiffness of a tissue
- A SR-measurement compares the strain in two manually selected regions of interest (ROIs) on the elastograms. One ROI is placed in the focal lesion, and the reference ROI is placed in the surrounding normal tissue, preferably in the same depth as the lesion.
- The SR is automatically calculated by the elastography software and yields the fraction of the average strain in the reference area divided by the average strain in the lesion. The higher the SR, the higher the likelihood of malignancy.
- When the strain ratio of a cervical lesion was higher than 4.53, it is confidential to be diagnosed as malignant

- Real-time Sonoelastography images of the two fibroids. The strain ratio is evaluated by comparing the mean strain in a region of interest centered on the myoma, with the mean strain in a region of interest in the surrounding myometrium close to the probe. The ratio shows a mean strain about 10 times greater for normal myometrium compared with the fibroids.


Adenomyosis
FR 15Hz
R1
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71%
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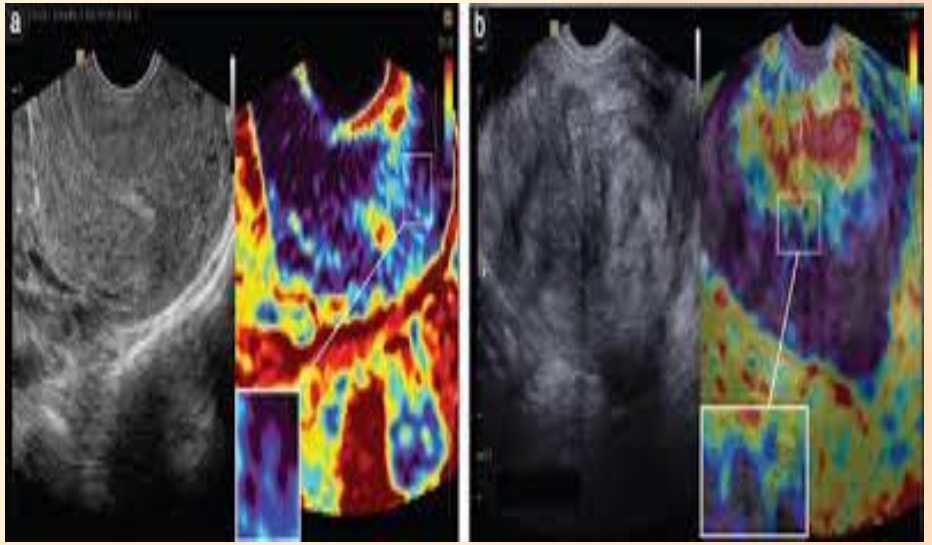
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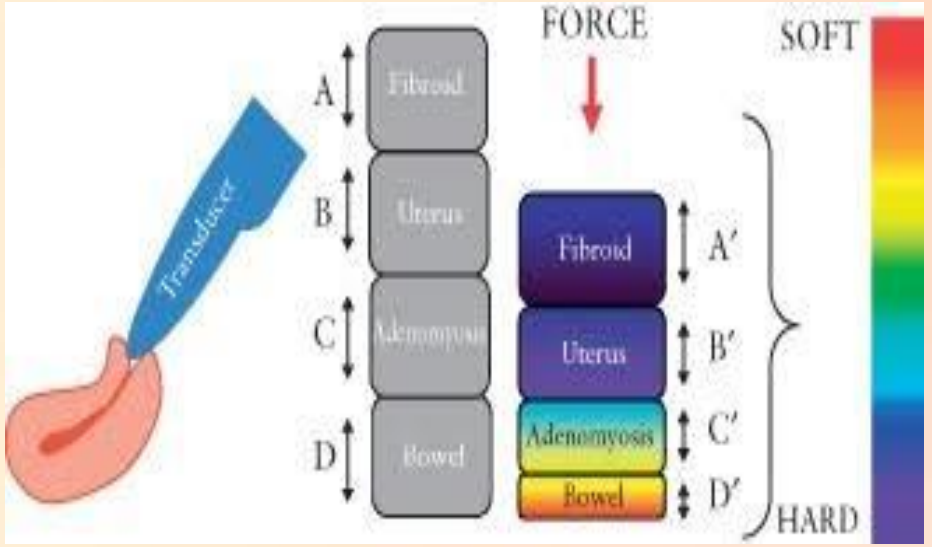
FORCE
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A′
B′
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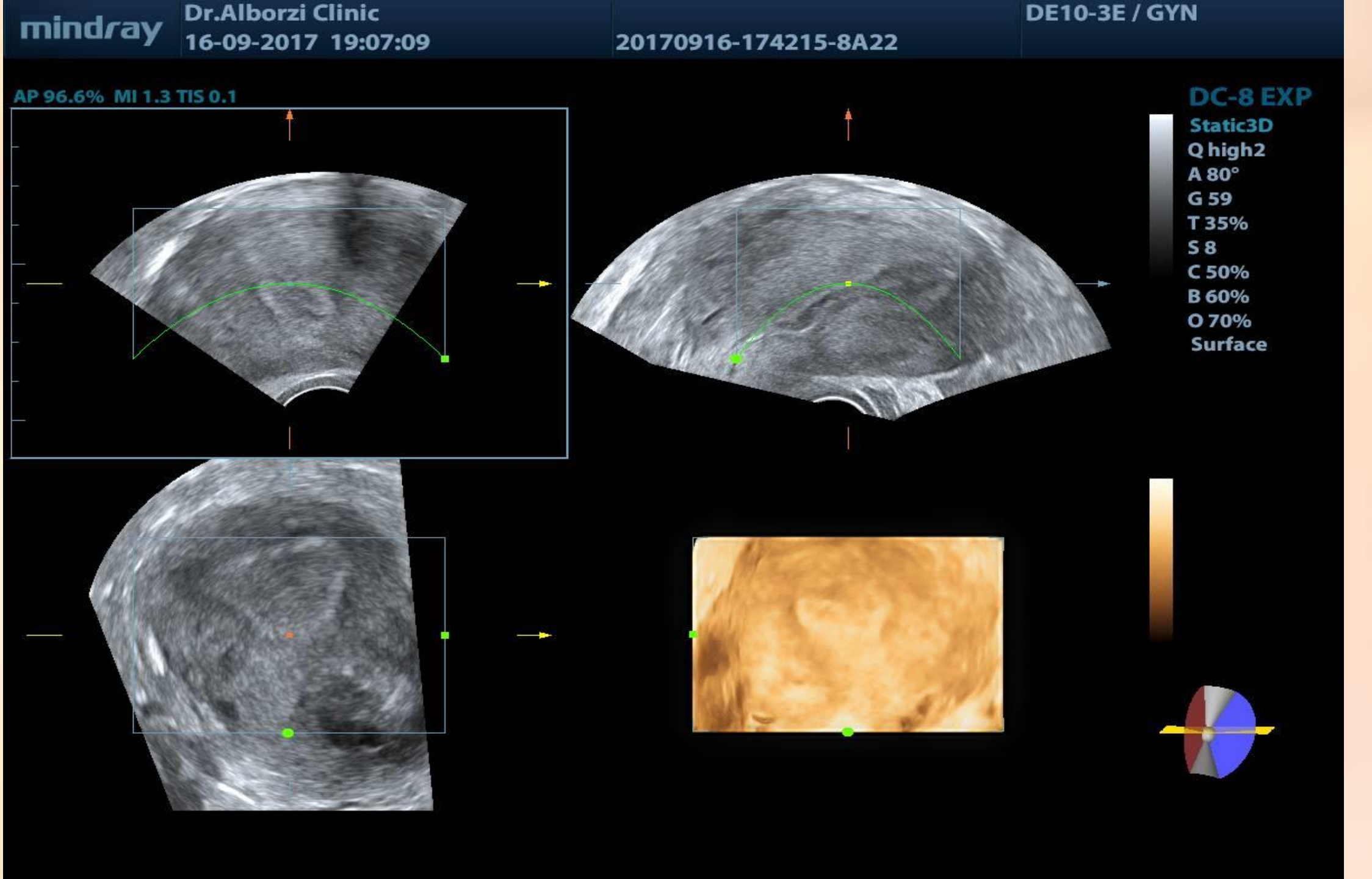
Transvaginal Sonography and External Adenomyosis:

- In a preliminary study including six women with suspected bladder endometriosis, TVS revealed an infiltration of the entire thickness of the bladder wall that was continuous with a nodule of adenomyosis of the anterior uterine wall in three of them
- To the best of our knowledge, no publications describe the role of TVS in the detection of posterior external adenomyosis. Sonographers should bear in mind that this subtype is particularly difficult to detect and that diagnosis should always be considered, especially in the presence of posterior deep endometriosis .
- In our experience, the outer posterior myometrial border appears heterogeneous on power Doppler analysis and can be seen to contain myometrial cysts and radial vessels .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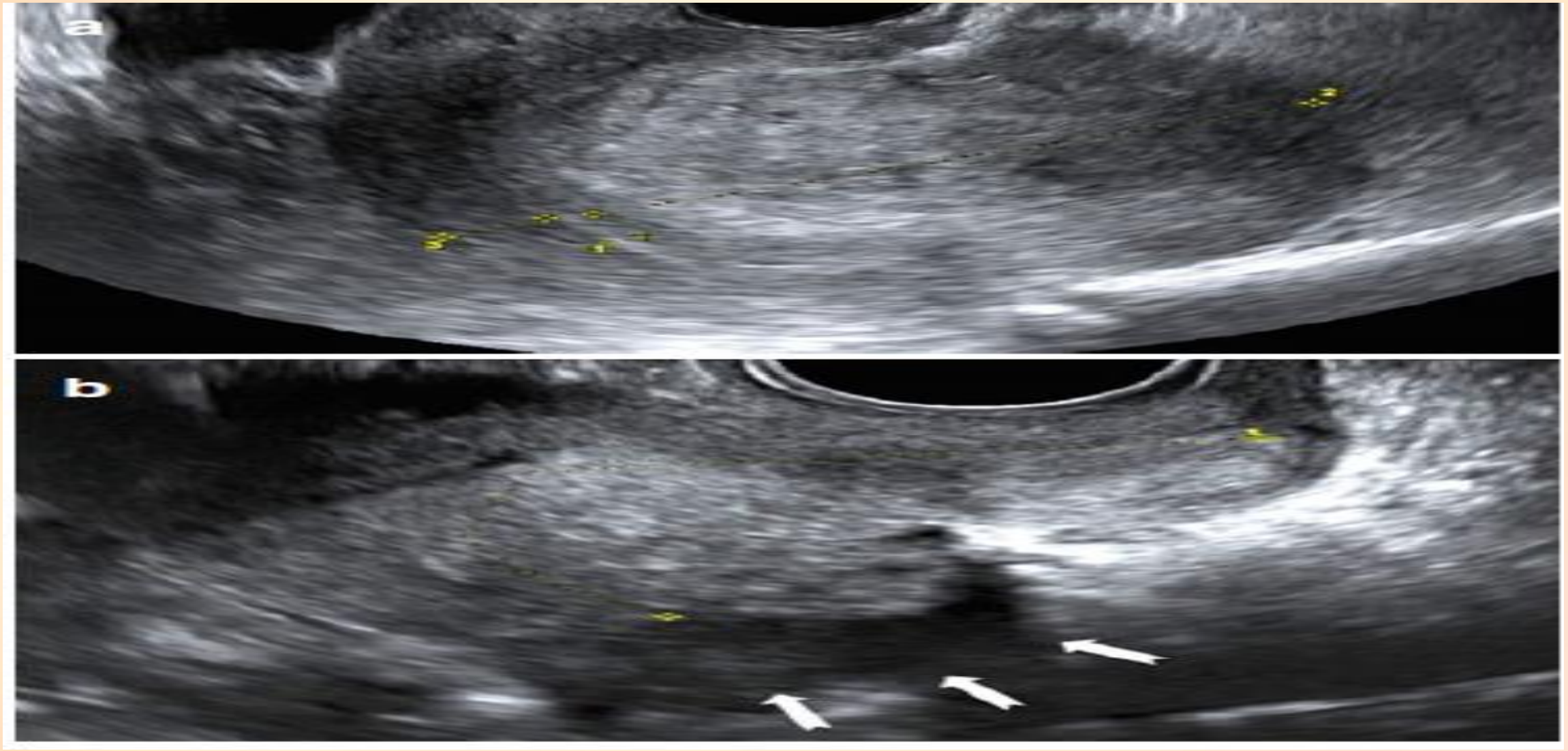
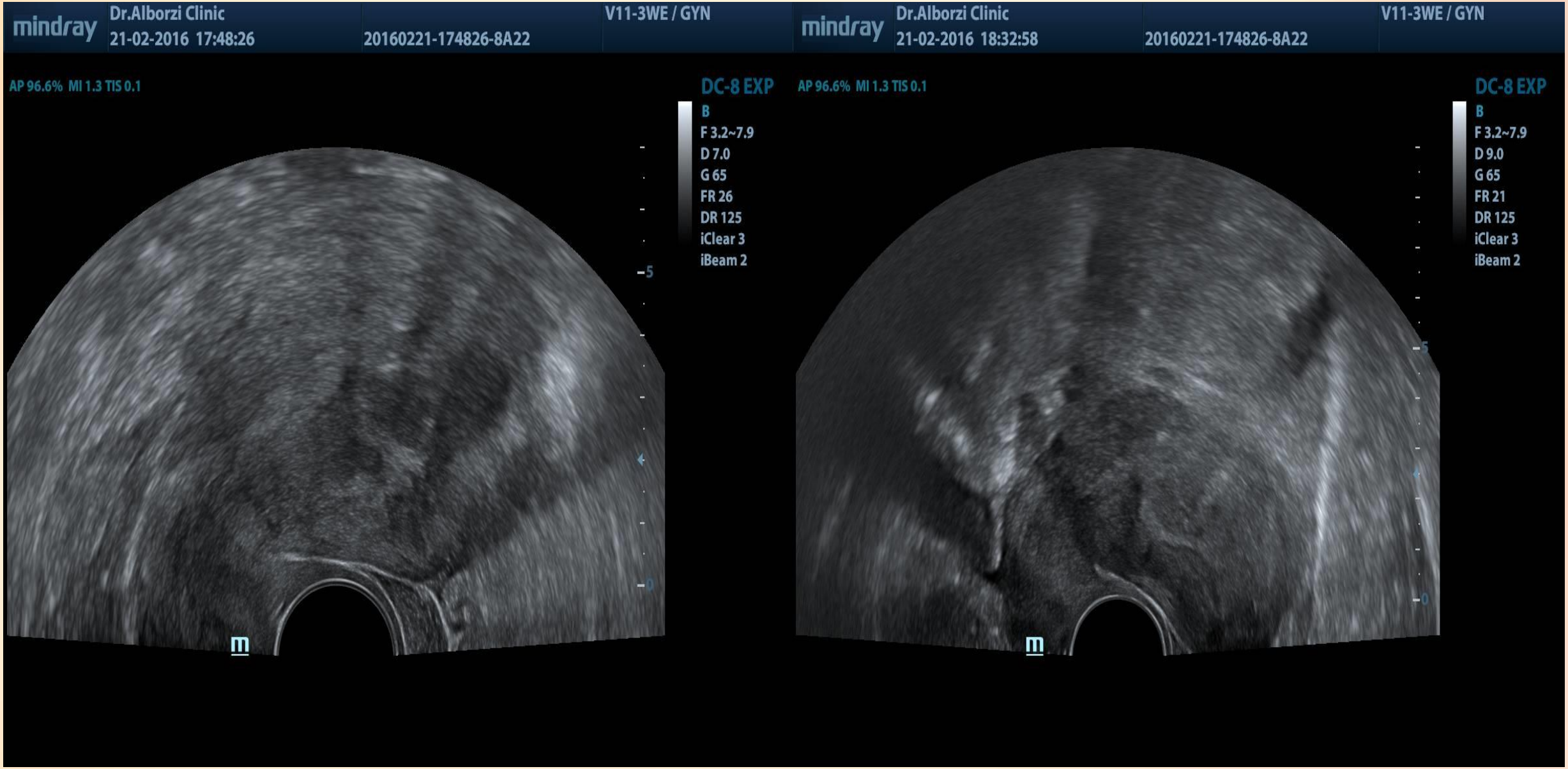
Q high2
A 80°
G 59
T 35%
S 8
C 50%
B 60%
O 70%
Surface

Ultrasound images of a retroverted uterus with adenomyosis with the typical ‘question sign’. (**a**)
Grayscale image showing asymmetrically thickened posterioruterine wall (٢) with abnormal echogenicity,
(١ endometrila thickness, ٣ thicknes of the anterior uterine wall).
(**b**) Posterior deep infiltrating lesions (*white arrows*) involving the adenomyotic myometrium and infiltrating the rectal wall posteriorly



Transvaginal Sonography and Adenomyomas:

- An adenomyoma appears on TVS as an ill-defined heterogeneous myometrial lesion containing hypoechoic spaces larger than ٥ mm
- Occasionally, TVS suggests a submucosal adenomyoma in the presence of an ill-defined endometrial mass containing cystic lesions protruding into the endometrial cavity.
- Whatever its location, the differential diagnostic criteria with a leiomyoma are ill-defined margins and a cystic component . The absence of vascularization, or peripheral vascularization, on color Doppler sonography reinforces the diagnosis.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F 3.2~7.9
D 7.0
G 65
FR 26
DR 125
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Dr.Alborzi Clinic
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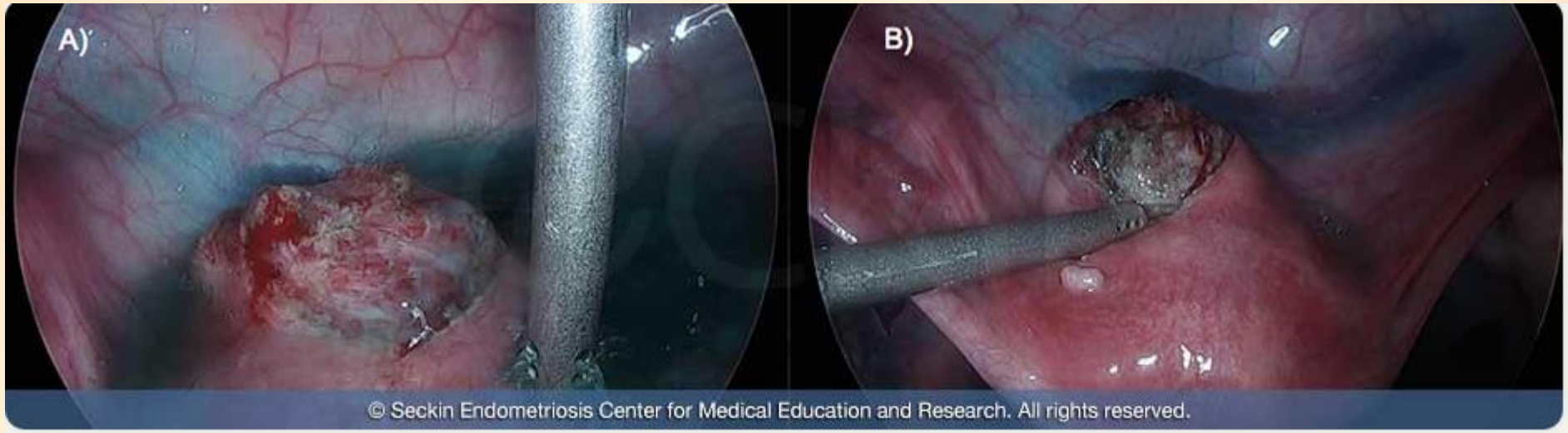
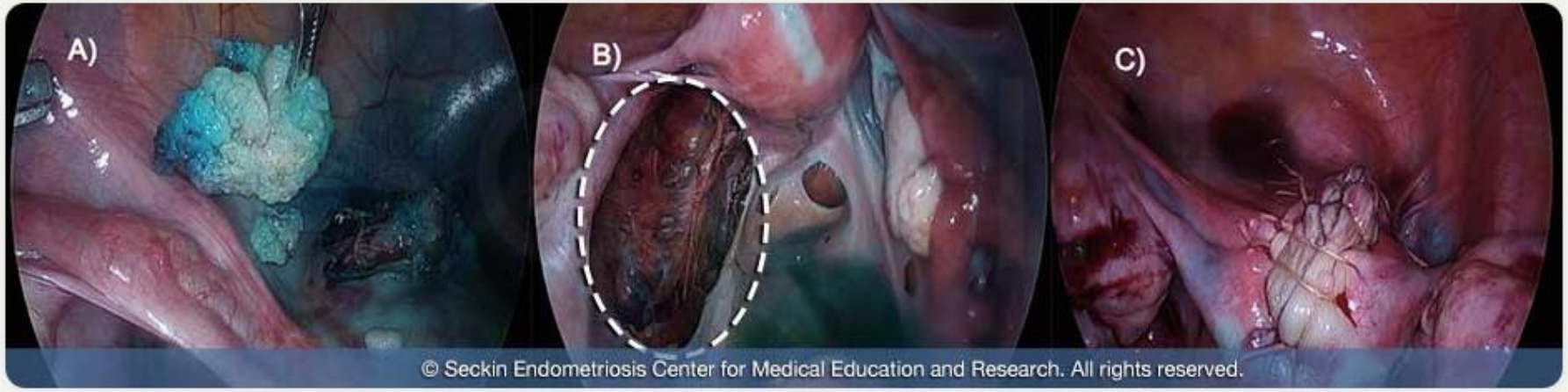


A) A visible Adenomyoma within the uterine tissue. B) Uterine tissue cut in order to reveal opened site containing Adenomyoma



A) An adenomyoma that is being removed from the uterus. B) The bed of tissue where the adenomyoma was once implanted within C) The uterus is sutured and repaired in order to restore uterine function