3D Ultrasound in Gynecology

- Technique
- Mullerian anomalies
- Fibroid mapping
- HyCoSy
- Adnexal lesion
- Pelvic Floor

DR REZA MARDANI

In 3D(volume ultrasonography)a volume(rather than a slice) of ultrasonographic data is acquired and stored.

*Preparing the volume acquisition

Preparing the volume acquisition Five important steps should be considered during the preparation of a 3D volume acquisition.

These steps are:

1. Optimization of the 2D image before volume acquisition

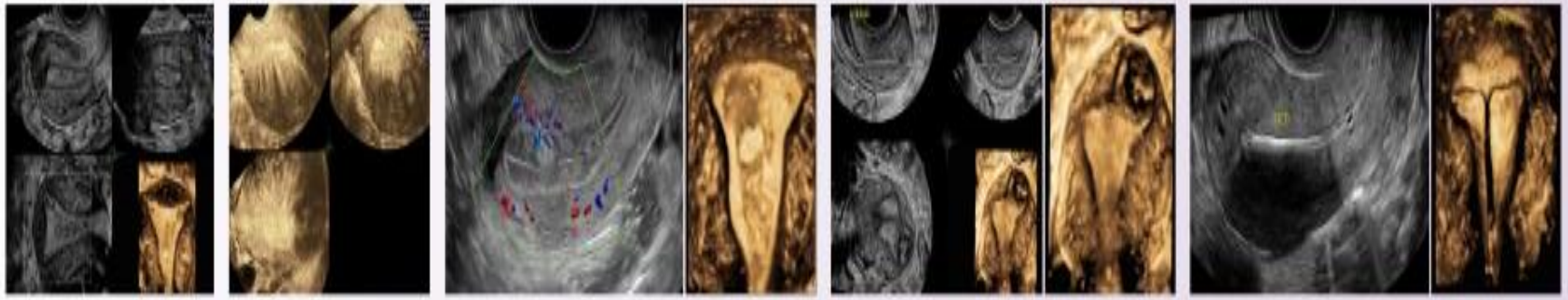
2. Choice of the best reference or starting plane with anticipation of the result expected

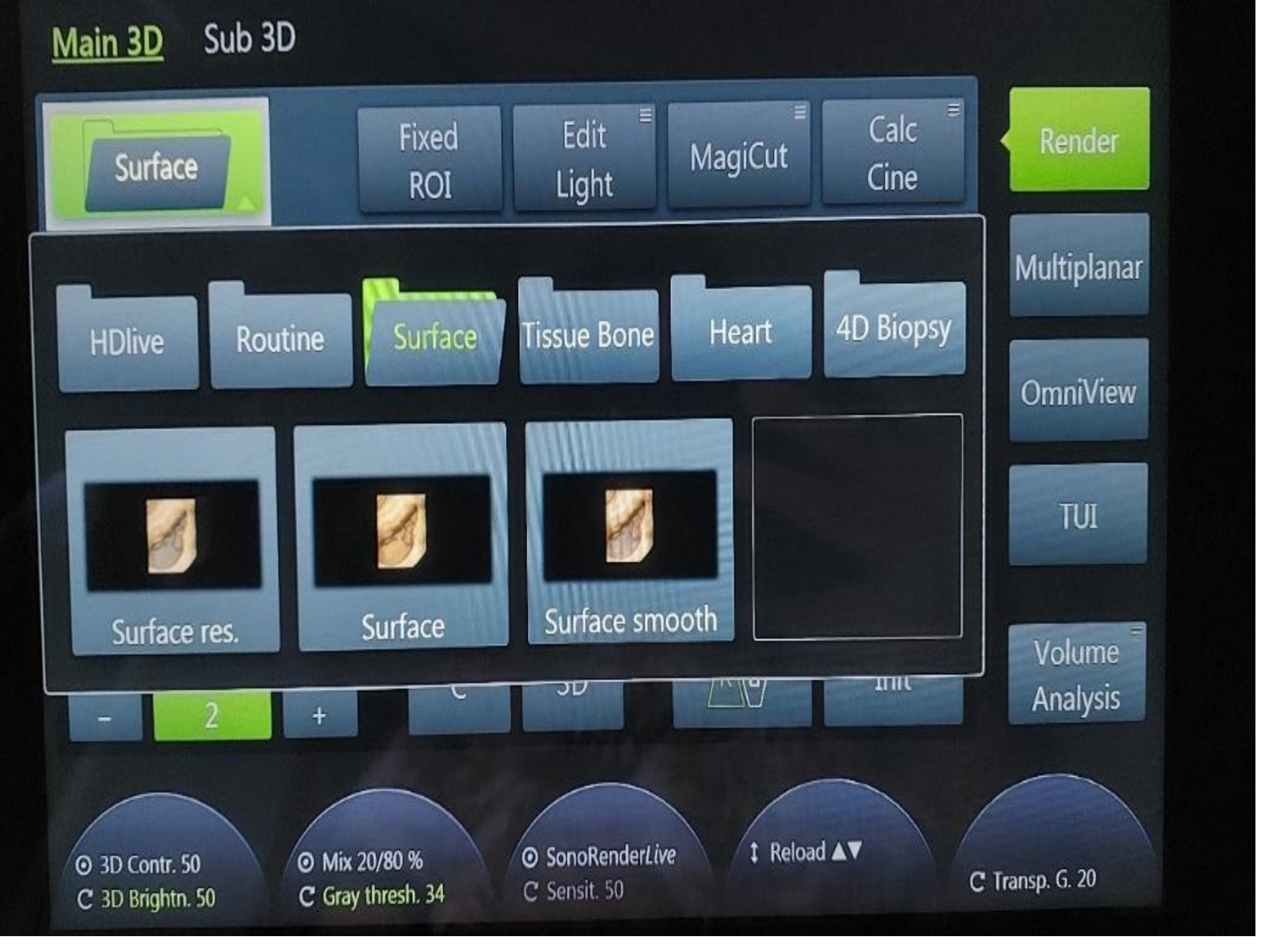
3. The box of acquisition or volume box

4. Acquisition volume angle

5. Volume quality and resolution

* Incorporating 3D ultrasound provides access to the coronal plane and so a more comprehensive and anatomically true view of the endometrial cavity shape.
* congenital malformations and associated pathologies can be visualized and their location within the cavity clearly demonstrated. The improved spatial awareness allows more diagnostic confidence in the detection of endometrial pathology including polyps, submucosal fibroids, and intrauterine adhesions.

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Sub 3D
Surface
Fixed ROI
Edit Light
MagiCut
Calc Cine
Render
Multiplanar
OmniView
TUI
Volume Analysis
HDlive
Routine
Surface
Tissue Bone
Heart
4D Biopsy
Surface res.
Surface
Surface smooth
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3D Contr. 50
3D Brightn. 50
Mix 20/80 %
Gray thresh. 34
SonoRenderLive
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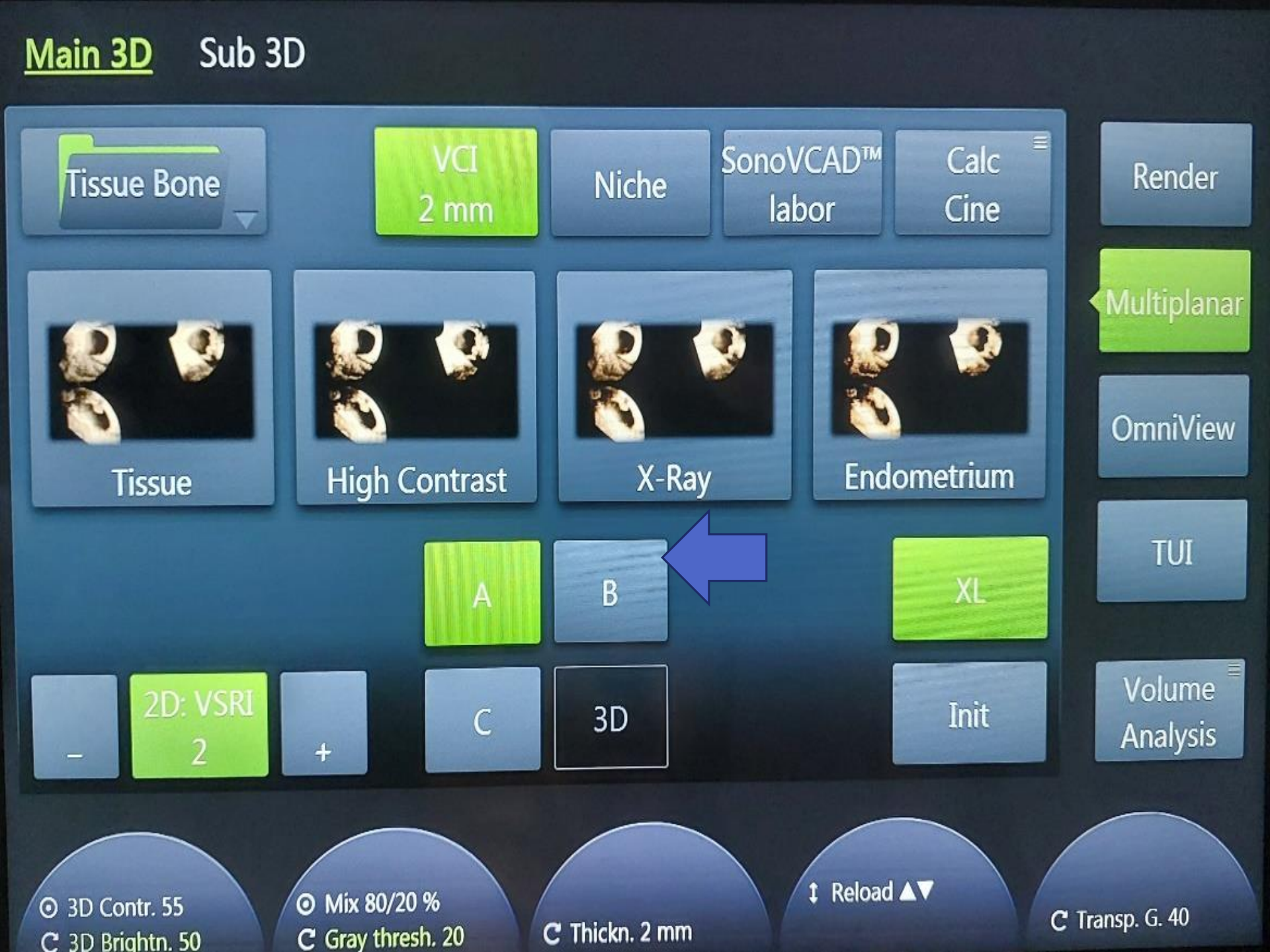
Reload
Transp. G. 20


Main 3D
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3D Brightn. 50
Mix 80/20 %
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Transp. G. 40


Main 3D
Sub 3D
VCI
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Render
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OmniView
TUI
Volume
Analysis
Line
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Trace
Polyline
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XL
Init
2D: VSRI
2
OmniV. rot


Main 3D
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VCI
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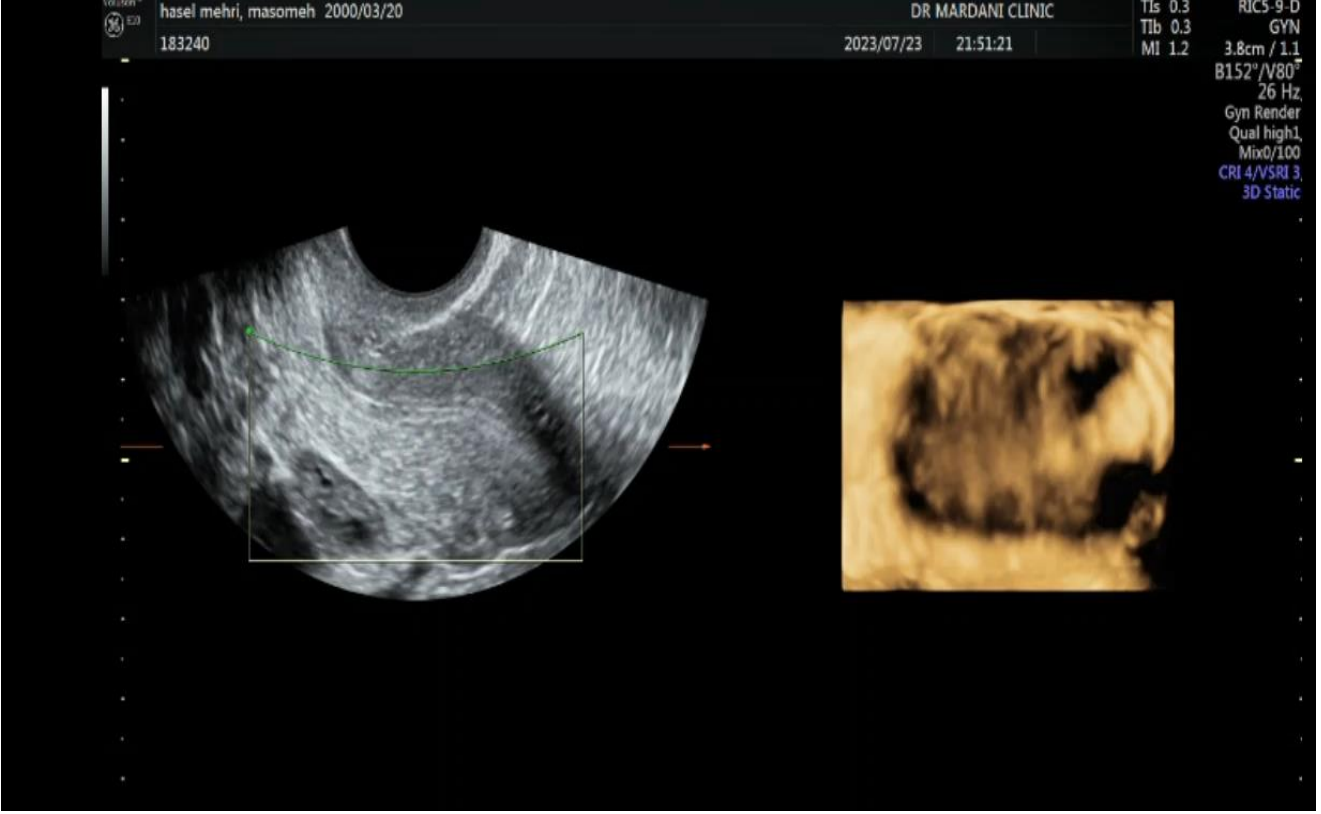
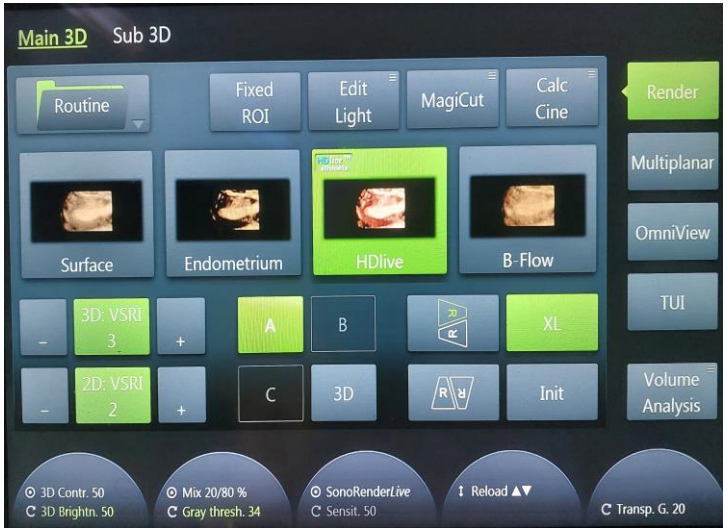


HD*live*™ render mode

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TIb 0.3
MI 1.2
RIC5-9-D
GYN
3.8cm / 1.1
B152°/V80°
26 Hz
Gyn Render
Qual high1
Mix80/20
55mm
CRI 4
3D Static

OmniView


Main 3D
Sub 3D
VCI
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Calc
Cine
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mullerian anomalies

Three-dimensional transvaginal ultrasound (3D-TVS) is a reliable method for classifying uterine malformations.

The acquisition should be performed in the periovulatory or luteal phase of the menstrual cycle, assessing the midcoronal plane of the uterus using the 3D Uterine Trace feature or Advanced VCI (Volume Contrast Imaging) with OmniView and HD*live*™ render mode.

Specific reference points and measurements should be used: the intercornual line, internal fundal indentation depth, mean of left and right lateral indentation angle, depth, and T-angle.

Checklist

* *1)Presence of uterus*
  Is there a uterus or is there a hemi-uterus U4 or uterus aplasia U5.
* *2)Fundal external contour*
  Is there an external indentation of more than 50% of the uterine wall thickness (UWT) as in bicorporeal uterus U3.
* *3)Internal indentation in uterine cavity*
  Is there an internal indentation of more than 50% of the uterine wall thickness as in septate uterus U2.
* *4)Kidneys*
  Are there renal anomalies?
* *5)Cervix and vagina (co-existent classes)*

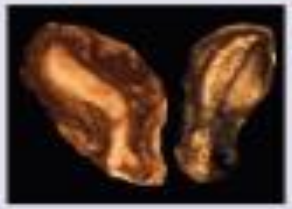
ESHRE/ESGE Classification of Female genital tract anomalies

Uterine anomaly

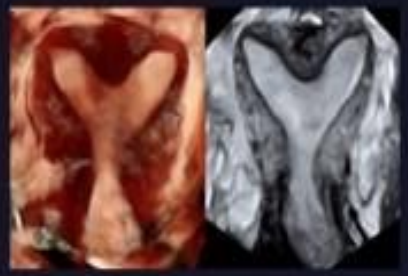
	Main Class	Sub Class
U0	Normal Uterus	
U1	Dysmorphic Uterus	a. T-shaped b. Infantilis c. Others
U2	Septate Uterus	a. Partial b. Complete
U3	Bicorporeal Uterus	a. Partial b. Complete c. Bicorporeal septate
U4	Hemi Uterus	a. with rudimentary cavity (communicating or not horn) b. No rudimentary cavity (horn without cavity / no horn)
U5	Aplastic Uterus	a. with rudimentary cavity (bi- or unilateral horn b. No rudimentary cavity (bi- or unilateral uterine remnants / aplasia
U6	Unclassified malformations	

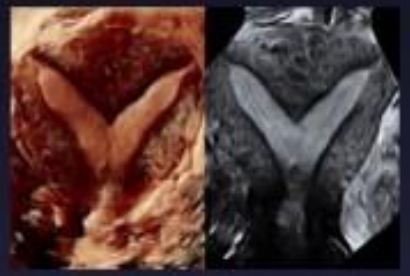
Cervical / vaginal anomaly

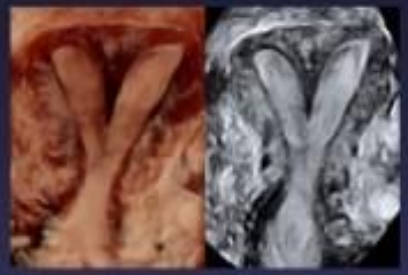
	Co-existent Class
C0	Normal cervix
C1	Septate cervix
C2	Double 'normal' cervix
C3	unilateral cervical aplasia
C4	Cervical aplasia
V0	Normal vagina
V1	Longitudinal non-obstructing vaginal septum
V2	Longitudinal obstructing vaginal septum
V3	Transverse vaginal septum and/or imperforate hymen
V4	Vaginal aplasia

Normal uterus Class U0				In presence of a straight or curved interostial line but with an internal indentation at the fundal midline <50% of the uterine wall thickness
Dysmorphic uterus Class U1				In presence of a normal uterine outline but with an abnormal shape (excluding septa), characterized by a narrow uterine cavity
Septate uterus Class U2 *Partial*				In presence of a normal uterine outline but with an internal indentation at the fundal midline >50% of the uterine wall thickness, dividing partly (U2a) or fully (U2b) the uterine cavity
Septate uterus Class U2 *Complete*				In presence of a normal uterine outline but with an internal indentation at the fundal midline >50% of the uterine wall thickness, dividing partly (U2a) or fully (U2b) the uterine cavity
Bicorporeal uterus Class U3 *Complete*				In presence of a uterus with an abnormal fundal outline with an external indentation at the fundal midline >50% of the uterine wall thickness, dividing partly (U3a) or fully (U3b) the uterine corpus above the level of the cervix
Hemi uterus Class U4				In presence of a unilateral uterine development, with the contralateral part incompletely formed (with or without a communicating functional horn) or absent

SEPTATE UTERUS





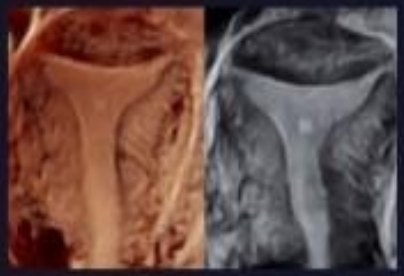


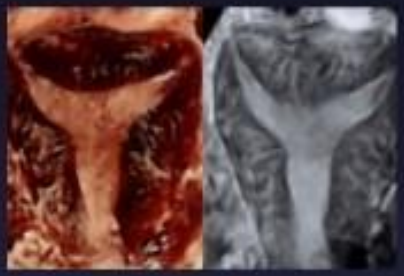
- Internal fundal indentation depth ≥ 10 mm
- Indentation fundal angle < 140°
- Indentation-to-wall thickness ratio > 110%

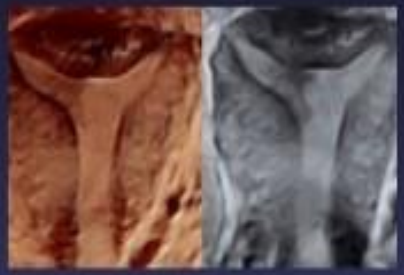
Septate uterus:
Internal indentation depth (main criterion) must be ≥ 10 mm

vs.

NORMAL/ARCUATE UTERUS



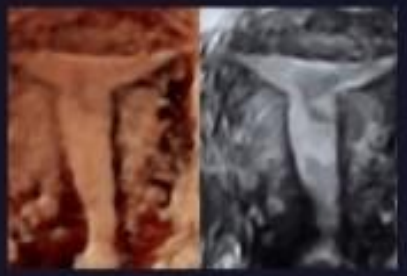


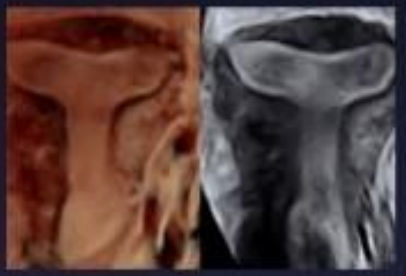


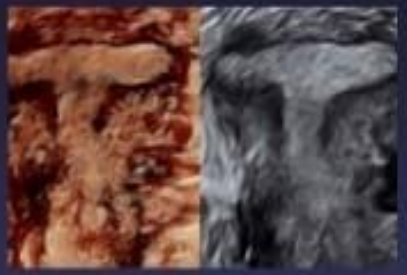
- Internal indentation depth < 10 mm
- Indentation angle > 130°
- Indentation-to-wall thickness ratio < 110%
- None or one of the three criteria for T-shaped uterus

vs.

T-SHAPED UTERUS







- Lateral indentation angle ≤ 130°
- Lateral indention depth ≥ 7 mm
- T-angle ≤ 40°

T-shaped uterus: All three criteria must be present
Borderline T-shaped: Two of the three criteria must be present

ASRM müllerian anomalies classification 2021

MÜLLERIAN AGENESIS

MÜLLERIAN AGENESIS

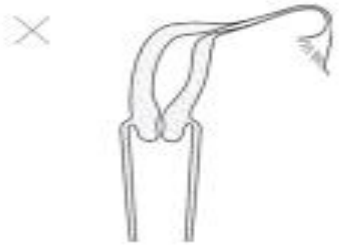
MÜLLERIAN AGENESIS WITH R/L ATROPHIC UTERINE REMNANT WITH FUNCTIONAL ENDOMETRIUM

CERVICAL AGENESIS

CERVICAL AGENESIS

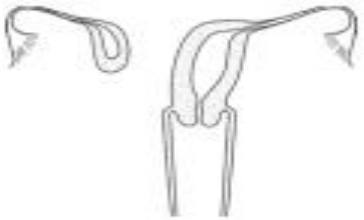
DISTAL CERVICAL AGENESIS

UNICORNUATE UTERUS



R/L UNICORNUATE UTERUS

R/L UNICORNUATE WITH R/L DISTAL ATROPHIC UTERINE REMNANT



R/L UNICORNUATE WITH R/L DISTAL UTERINE REMNANT WITH FUNCTIONAL ENDOMETRIUM

R/L UNICORNUATE WITH R/L ASSOCIATED ATROPHIC UTERINE REMNANT

R/L UNICORNUATE WITH R/L UTERINE HORN COMMUNICATING AT LEVEL OF CERVIX

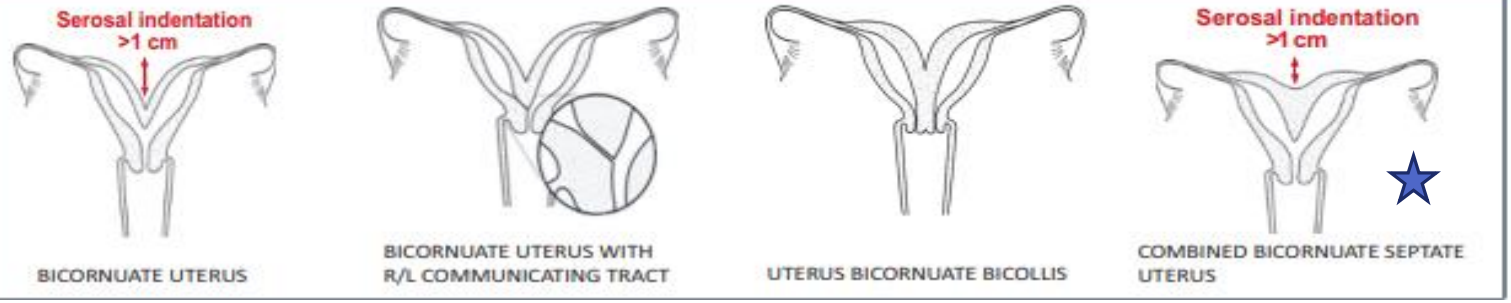
UTERUS DIDELPHYS

UTERUS DIDEPHYS AND LONGITUDINAL SEPTUM

UTERUS DIDELPHYS AND +/- LONGITUDINAL VAGINAL SEPTUM OF VARIABLE LENGTH

UTERUS DIDELPHYS AND OBSTRUCTED R/L HEMIVAGINA

BICORNUATE UTERUS



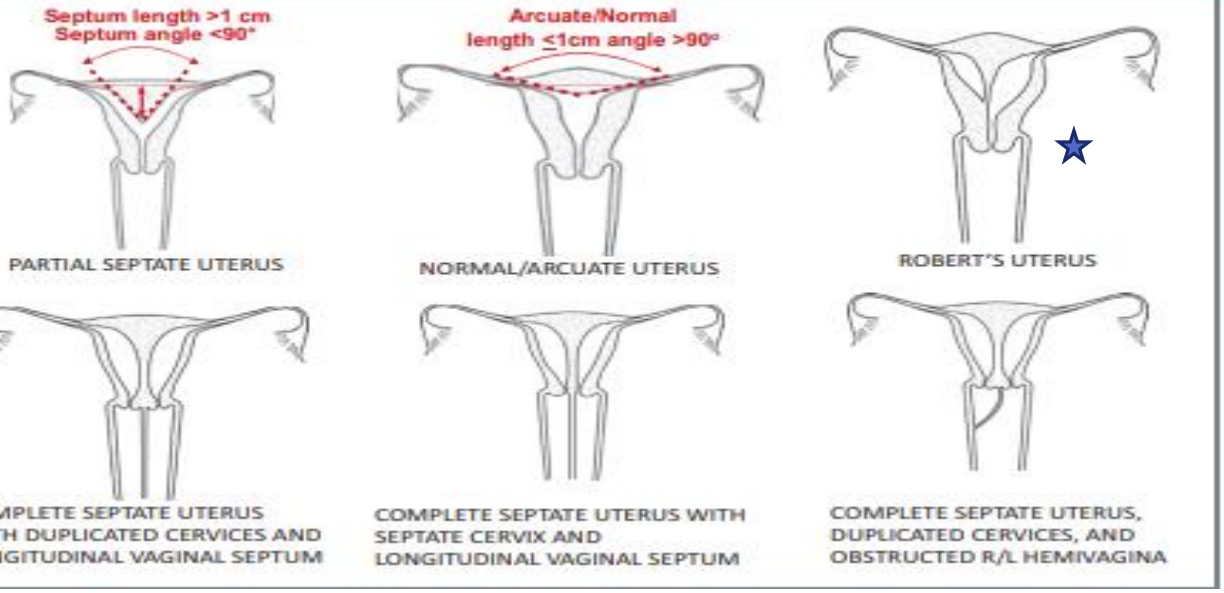
BICORNUATE UTERUS

BICORNUATE UTERUS WITH R/L COMMUNICATING TRACT

UTERUS BICORNUATE BICOLLIS

COMBINED BICORNUATE SEPTATE UTERUS

SEPTATE UTERUS



PARTIAL SEPTATE UTERUS

NORMAL/ARCUATE UTERUS

ROBERT'S UTERUS

COMPLETE SEPTATE UTERUS WITH DUPLICATED CERVICES AND LONGITUDINAL VAGINAL SEPTUM

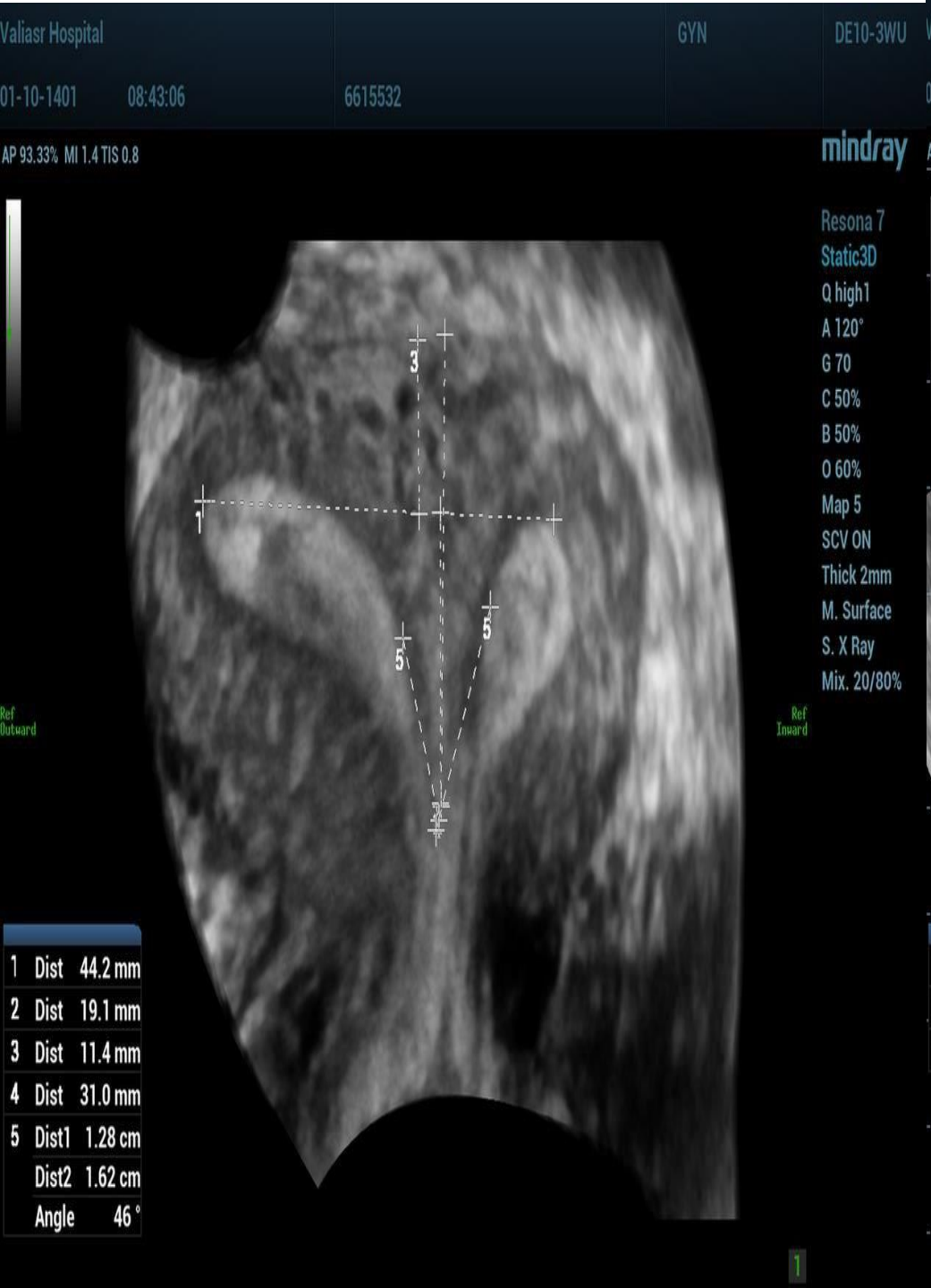
COMPLETE SEPTATE UTERUS WITH SEPTATE CERVIX AND LONGITUDINAL VAGINAL SEPTUM

COMPLETE SEPTATE UTERUS, DUPLICATED CERVICES, AND OBSTRUCTED R/L HEMIVAGINA

TRANSVERSE VAGINAL SEPTUM

MID VAGINAL SEPTUM

DISTAL VAGINAL AGENESIS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AP 93.33% MI 1.4 TIS 0.8
mindray
Resona 7
Static3D
Q high1
A 120°
G 70
C 50%
B 50%
O 60%
Map 5
SCV ON
Thick 2mm
M. Surface
S. X Ray
Mix. 20/80%
Ref
Outward
Ref
Inward
1 Dist 44.2 mm
2 Dist 19.1 mm
3 Dist 11.4 mm
4 Dist 31.0 mm
5 Dist1 1.28 cm
Dist2 1.62 cm
Angle 46 °


Valiasr Hospital
GYN
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G 70
C 50%
B 50%
O 60%
Map 5
SCV ON
Thick 2mm
M. Surface
S. X Ray
Mix. 20/80%
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Outward
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1 Dist 42.4 mm
2 Dist 37.9 mm
3 Dist 11.1 mm


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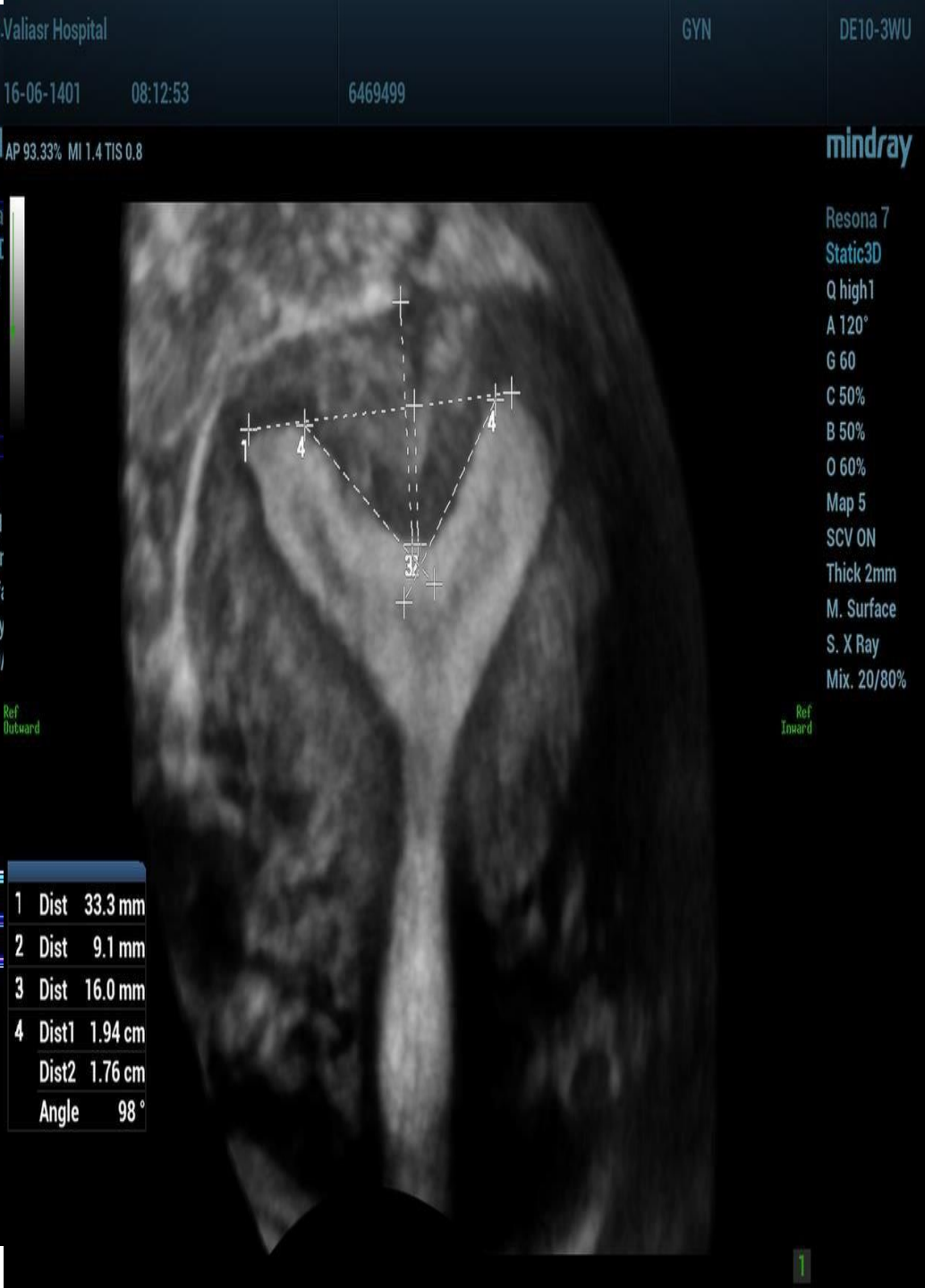
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C 50%
B 50%
O 60%
Map 5
SCV ON
Thick 2mm
M. Surface
S. X Ray
Mix. 20/80%
Ref Outward
Ref Inward
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3 Dist 16.0 mm
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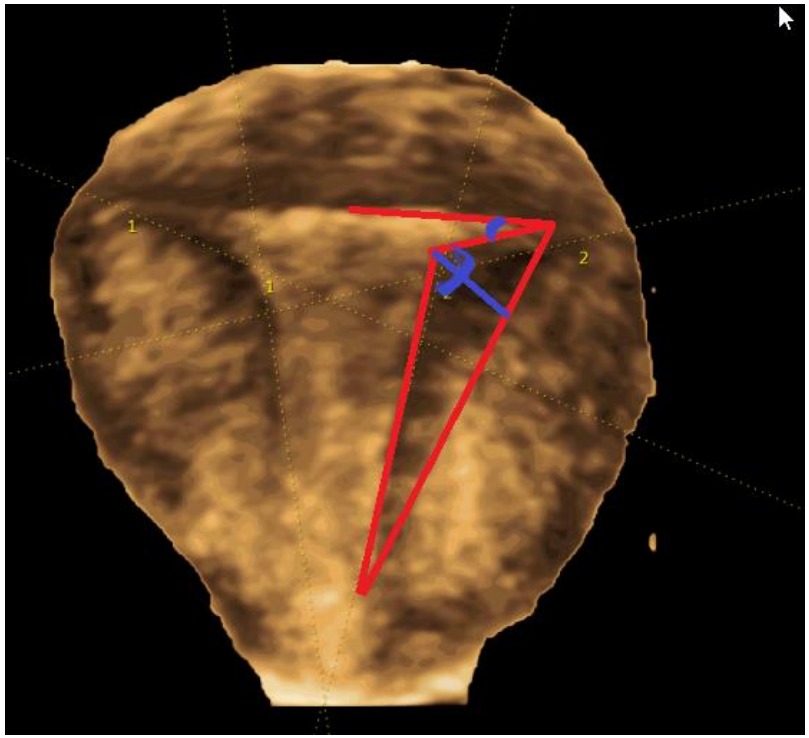
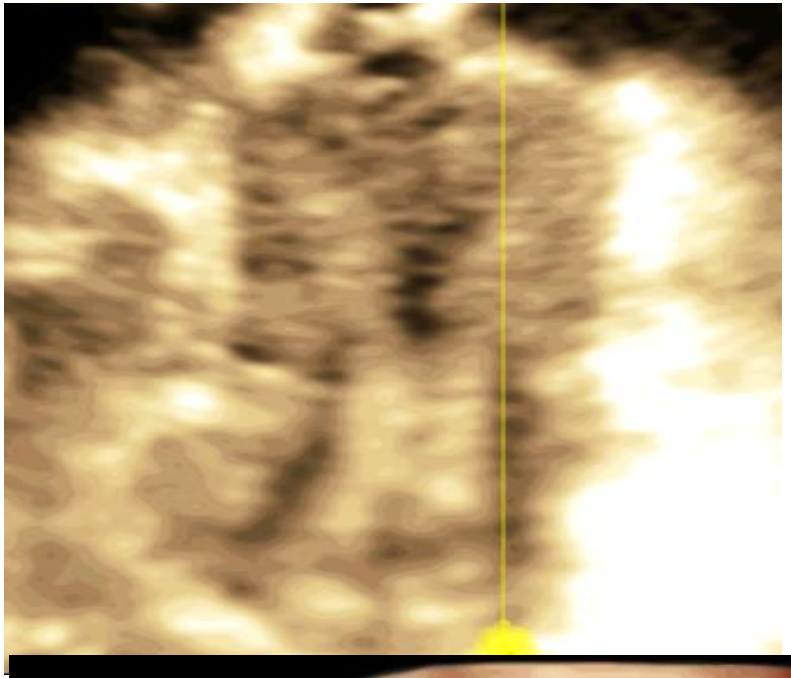
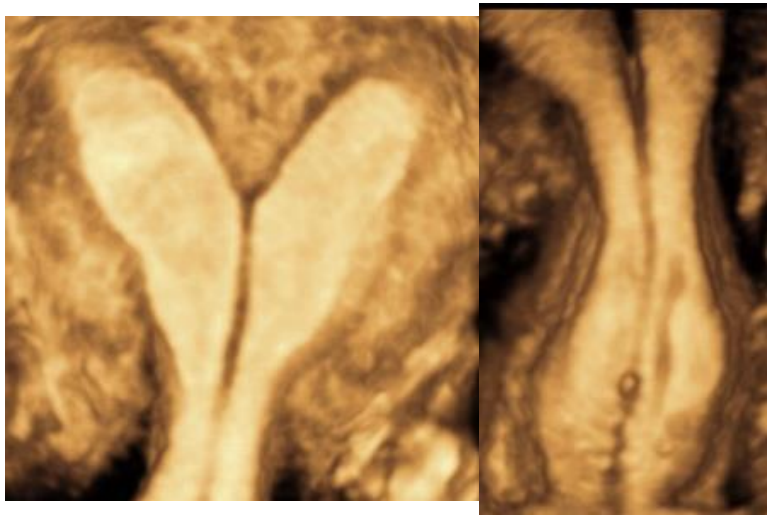
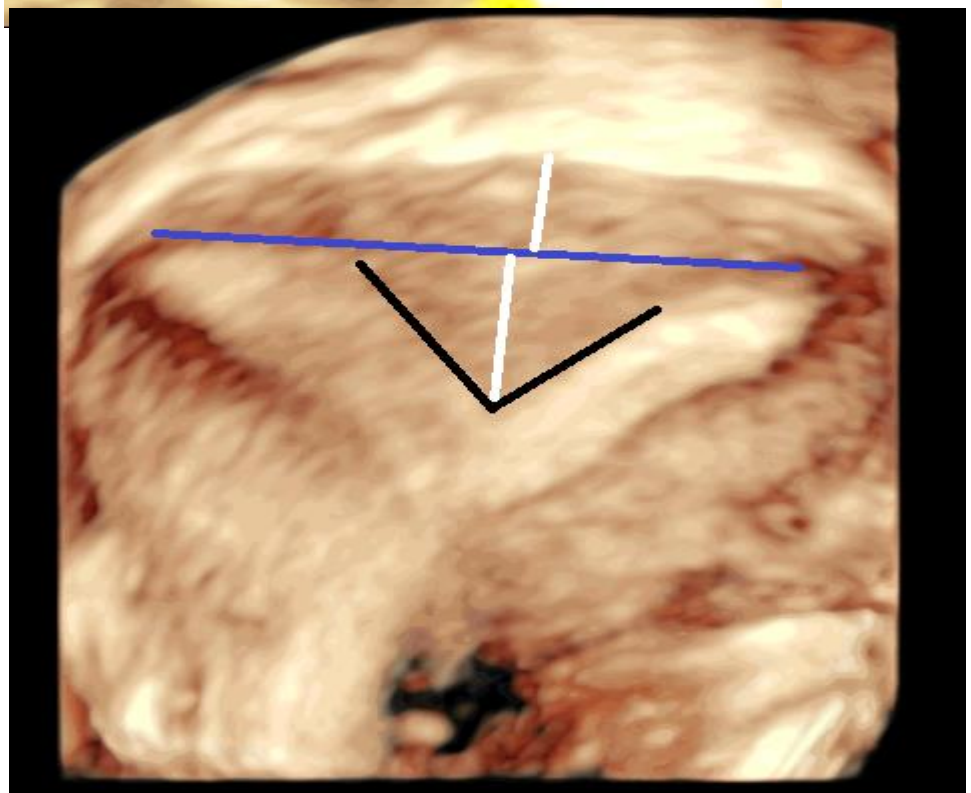
Dist2 1.76 cm
Angle 98 °

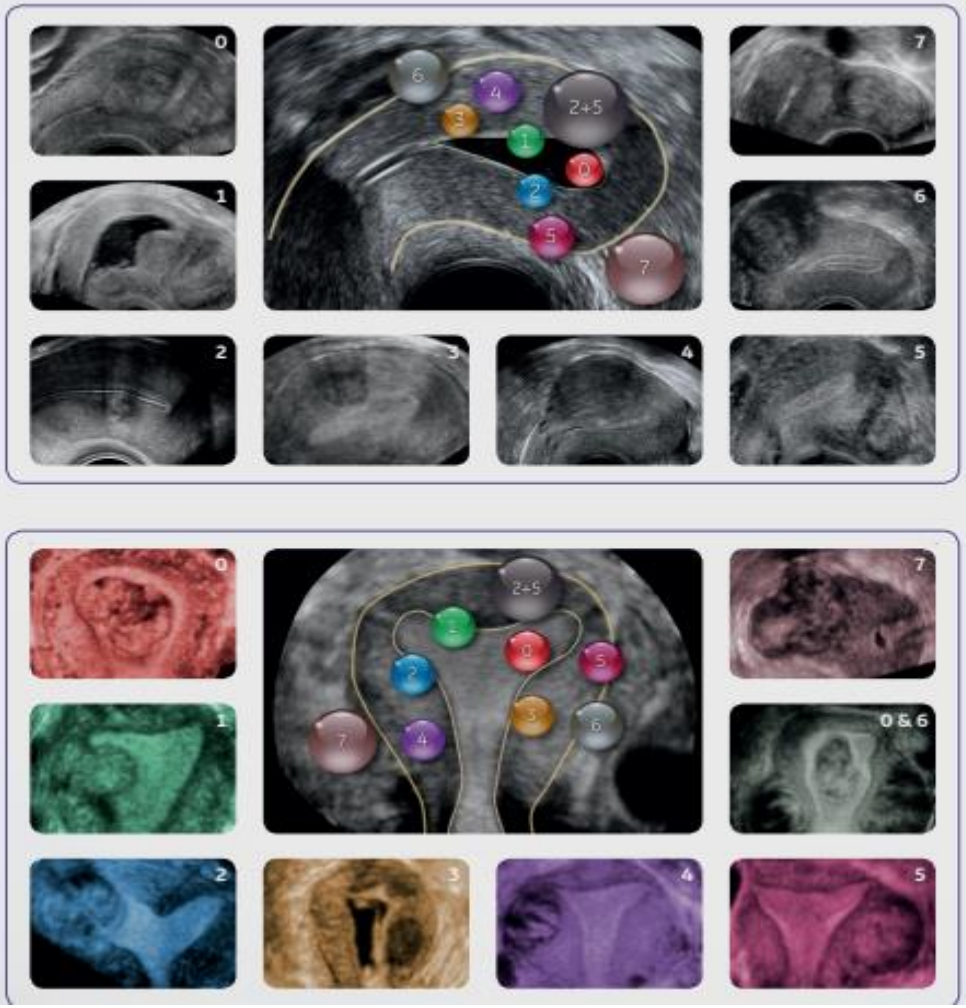

1
1
2







Fibroid mapping



Submucosal

0 Pedunculated intracavitary

1 <50% intra mural

2 ≥50% intra mural

Other

3 Contact endometrium, 100% intra mural

4 Intra mural

5 Subserosal ≥50% intra mural

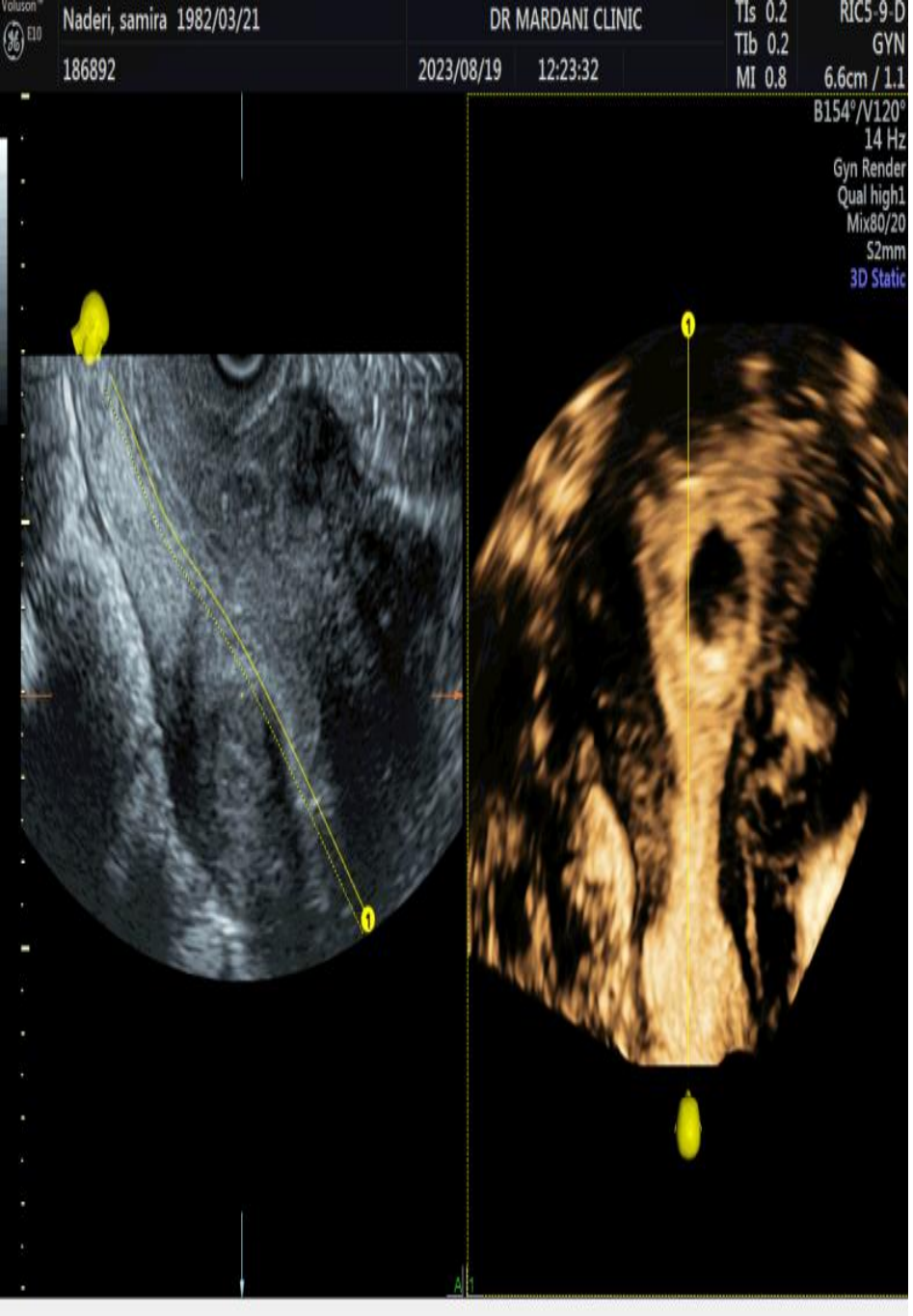
6 Subserosal <50% intra mural

7 Subserosal pedunculated

8 Other (specify e.g. cervical, parasitic)

Hybrid

2-5 Submucosal and subserosal, each with less than half the diameter in the endometrial and peritoneal cavities, respectively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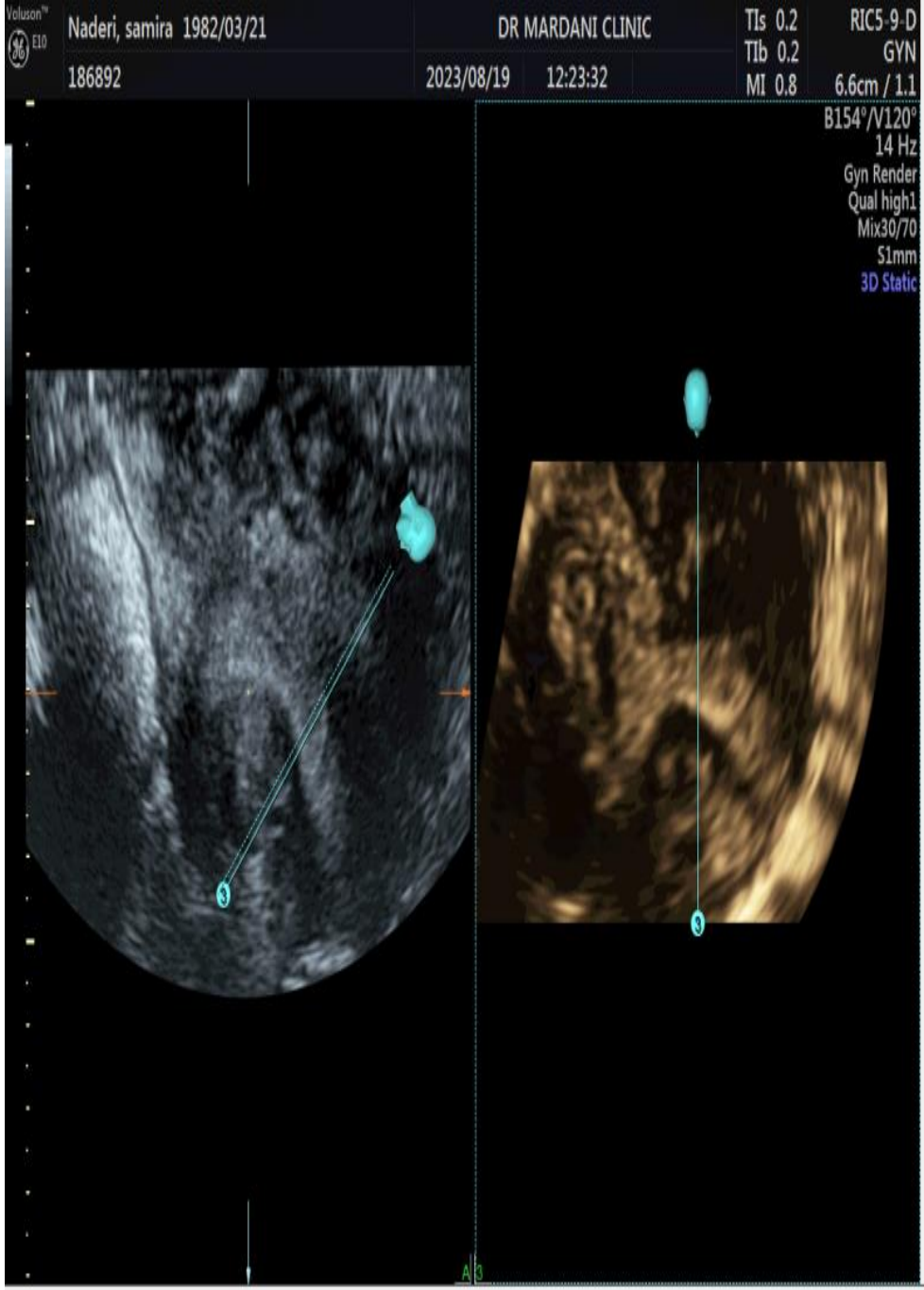
TIb 0.2
MI 0.8
RIC5-9-D
GYN
6.6cm / 1.1
B154°/V120°
14 Hz
Gyn Render
Qual high1
Mix80/20
S2mm
3D Static


Naderi, samira 1982/03/21
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DR MARDANI CLINIC
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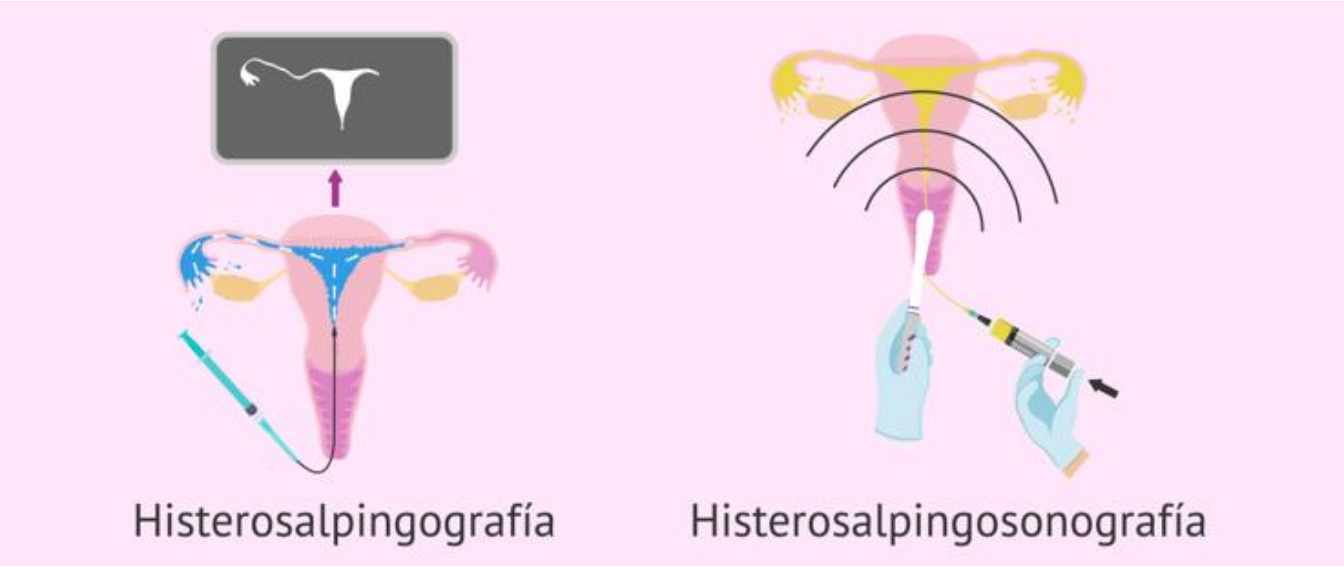
TIb 0.2
MI 0.8
RIC5-9-D
GYN
6.6cm / 1.1
B154°/V120°
14 Hz
Gyn Render
Qual high1
Mix30/70
S1mm
3D Static

HyCoSy (hystero-salpingo contrast sonography)



* 1)The fluid/bubble mix we use is either normal saline mixed with air, or a fluid called ExEm foam gel, which is specifically designed to be used for this test,us contrast
* 2) routine sis teqnique (foley catheter) and normal saline

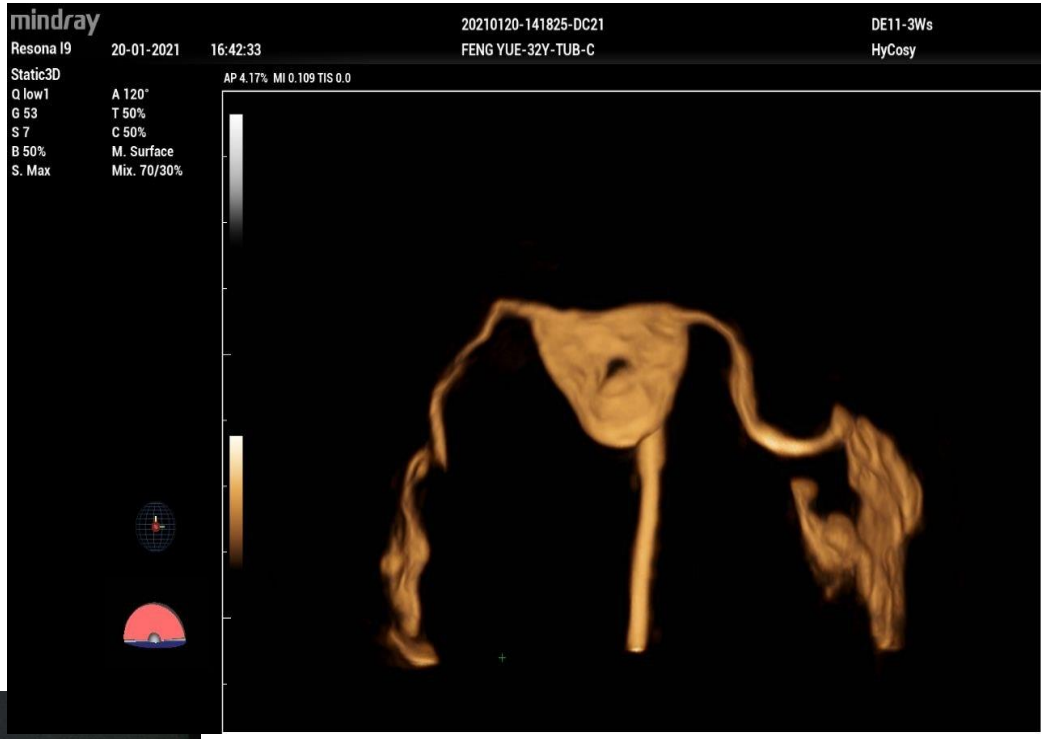
INDICATIONS

* Infertility
* Uterine malformation
* Surgery lower abdomen
* Extrauterine adhesión
* Effects of sterilization

CONTRAINDICATIONS

* Inflammation in genitalia
* Cervical erosion
* Uterine bleeding
* Pelvic tuberculosis
* Contrast allergy


SonoVue
SonoVue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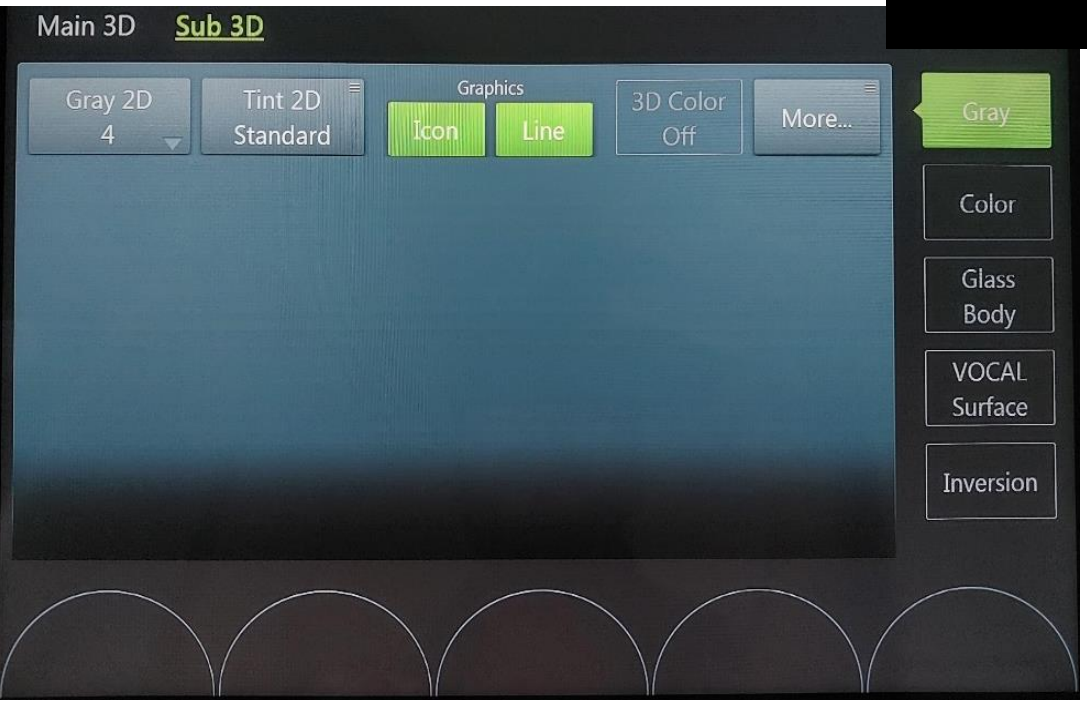
FENG YUE-32Y-TUB-C
DE11-3Ws
HyCosy
Static3D
Q low1
A 120°
G 53
T 50%
S 7
C 50%
B 50%
M. Surface
S. Max
Mix. 70/30%
AP 4.17% MI 0.109 TIS 0.0


Main 3D
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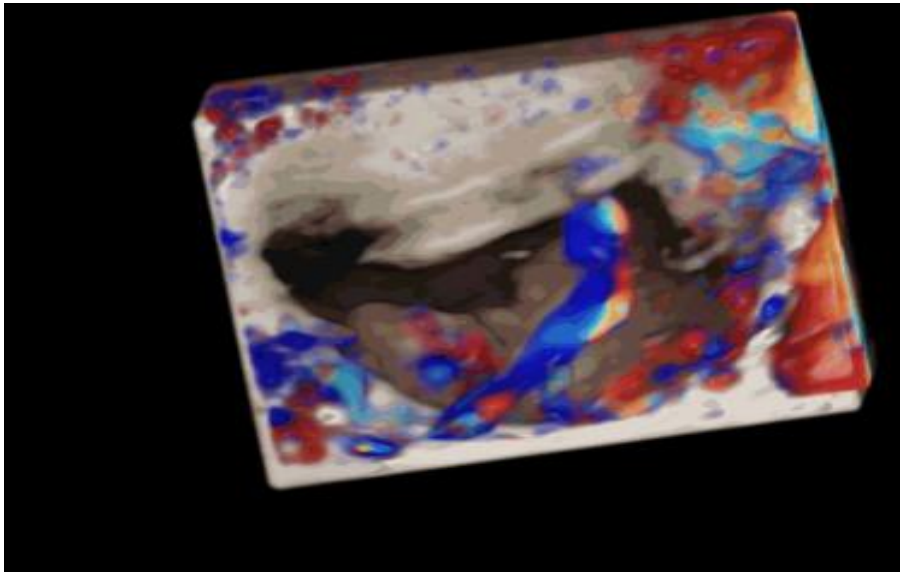
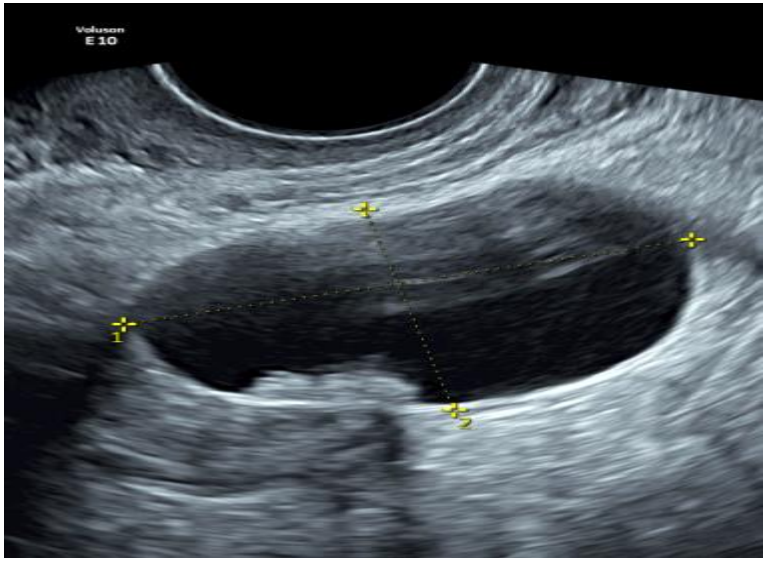
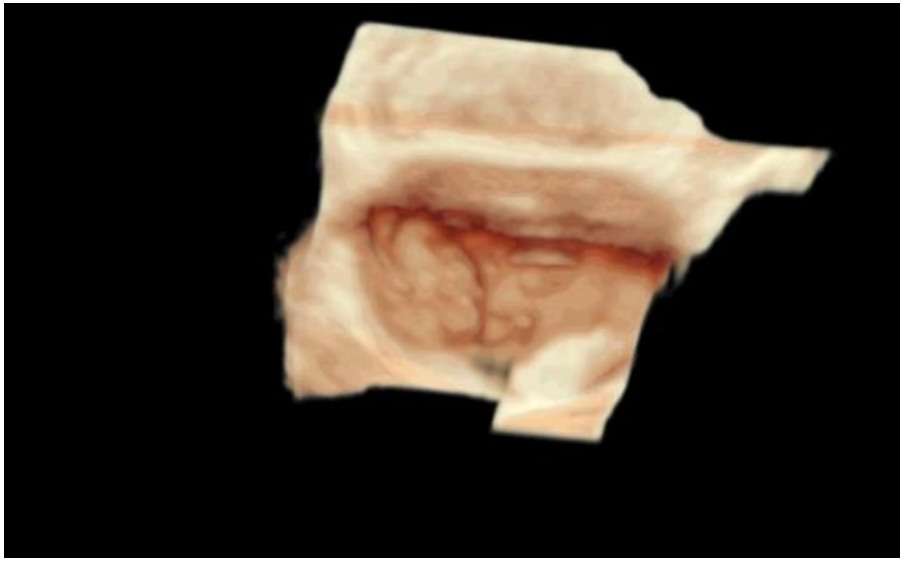
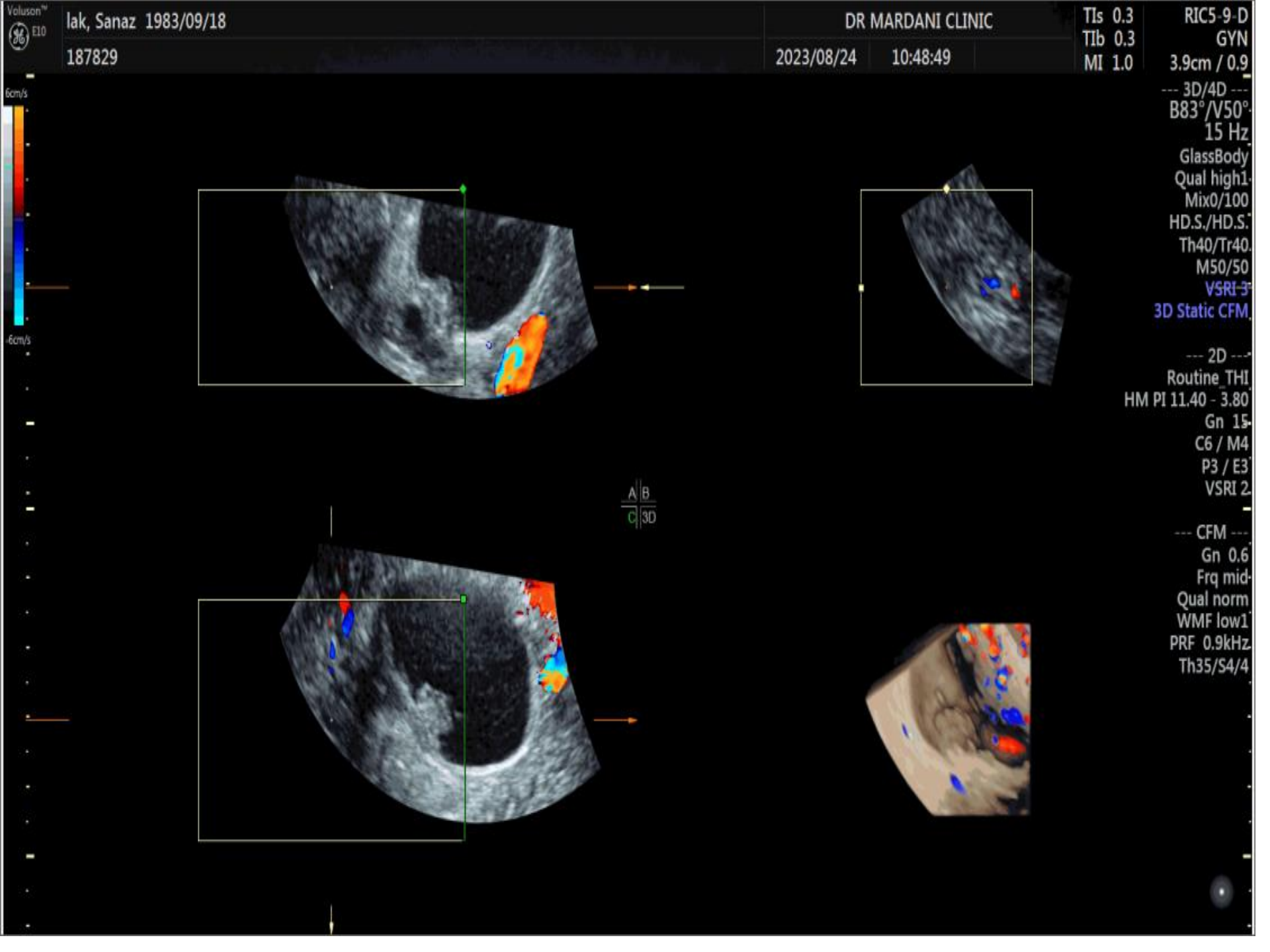
3D Color Off
More...
Gray
Color
Glass Body
VOCAL Surface
Inversion

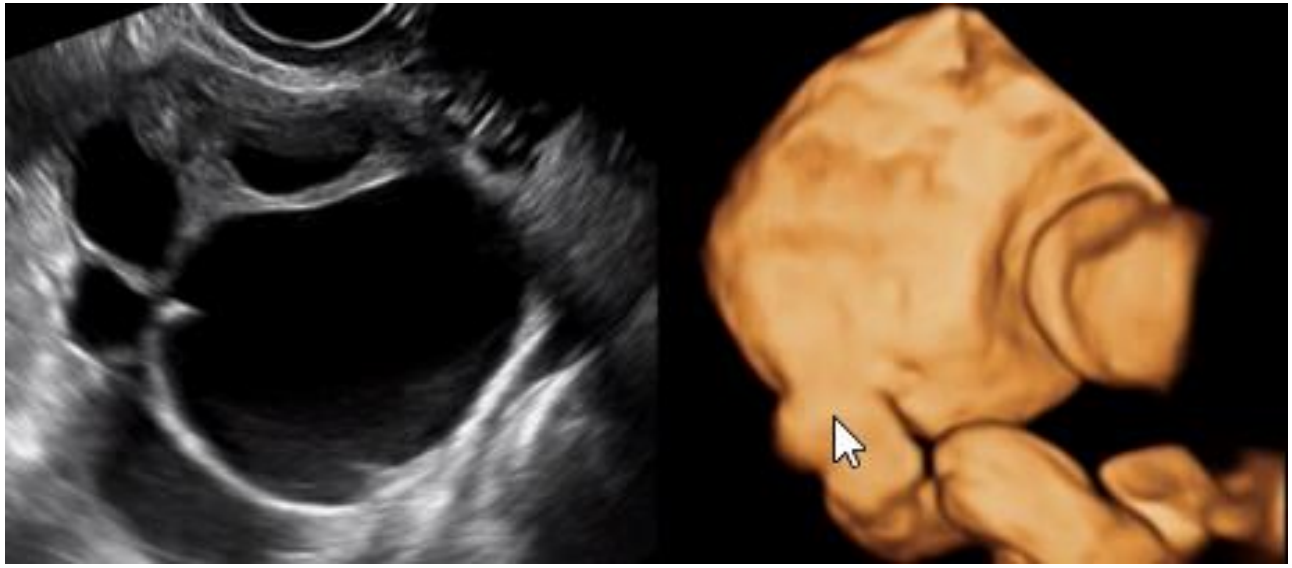
Adnexal lesion



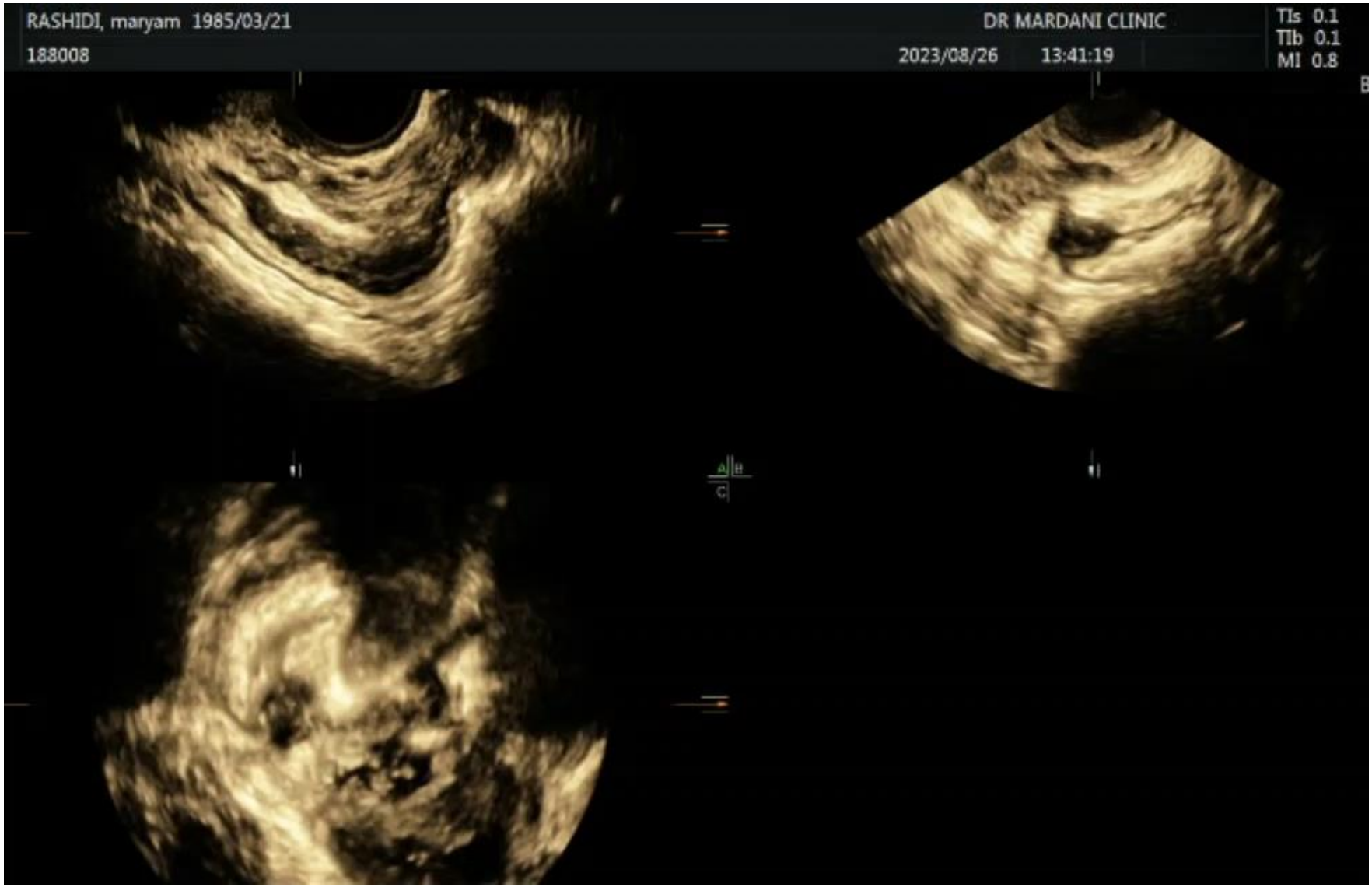


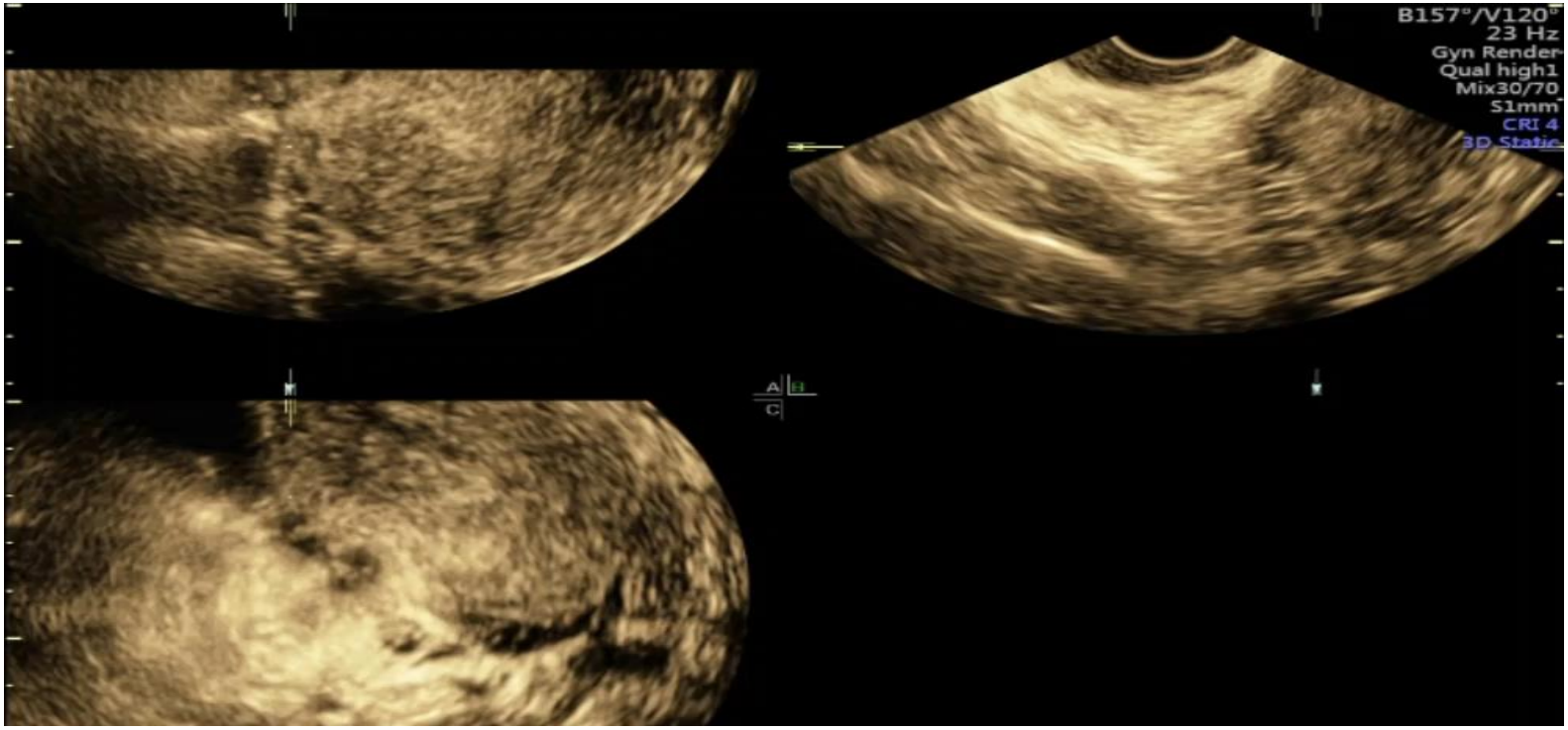



Voluson™ E10
Iak, Sanaz 1983/09/18
187829
DR MARDANI CLINIC
2023/08/24 10:48:49
TIs 0.3
TIb 0.3
MI 1.0
RIC5-9-D
GYN
3.9cm / 0.9
6cm/s
-6cm/s
--- 3D/4D ---
B83°/V50°
15 Hz
GlassBody
Qual high1
Mix0/100
HD.S./HD.S.
Th40/Tr40
M50/50
VSRI 3
3D Static CFM
--- 2D ---
Routine_THI
HM PI 11.40 - 3.80
Gn 15
C6 / M4
P3 / E3
VSRI 2
--- CFM ---
Gn 0.6
Frq mid
Qual norm
WMF low1
PRF 0.9kHz
Th35/S4/4
A B
C 3D



endometriosis




B157°/V120°
23 Hz
Gyn Render
Qual high1
Mix30/70
S1mm
CRI 4
3D Static

#Enzian

(Classification of Endometriosis)

PERITONEUM

P Peritoneum

- Sum of all diameters

P1 Σ < 3 cm

P2 Σ 3-7 cm

P3 Σ > 7 cm

OVARY

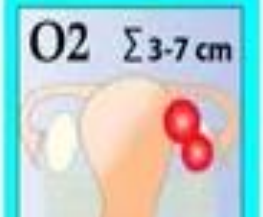
O Ovary

- Sum of all diameters

left right

O1 Σ < 3 cm

O2 Σ 3-7 cm



O3 Σ > 7 cm

TUBE

T Tubal ovarian condition

- Adhesions
- Motility
- Patency test

left right

T1 Pelvic sidewall

T2 Pelvic sidewall Uterus

T3 Pelvic sidewall Uterus Bowel, USL

DEEP ENDOMETRIOSIS

A Rectovaginal space Vagina Retrocervical area

- Largest diameter

B Sacrouterine ligg. Cardinal ligaments Pelvic sidewall

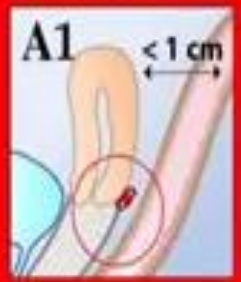
- Largest diameter

left right

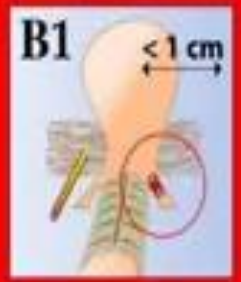
C Rectum

- Largest diameter

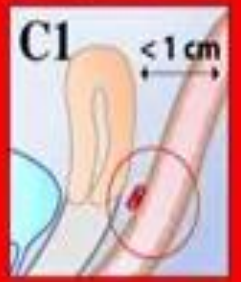
A1 < 1 cm



B1 < 1 cm



C1 < 1 cm

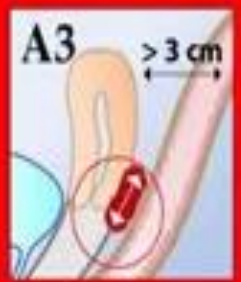


A2 1-3 cm

B2 1-3 cm

C2 1-3 cm

A3 > 3 cm



B3 > 3 cm

C3 > 3 cm

F A adenomyosis

F B bladder

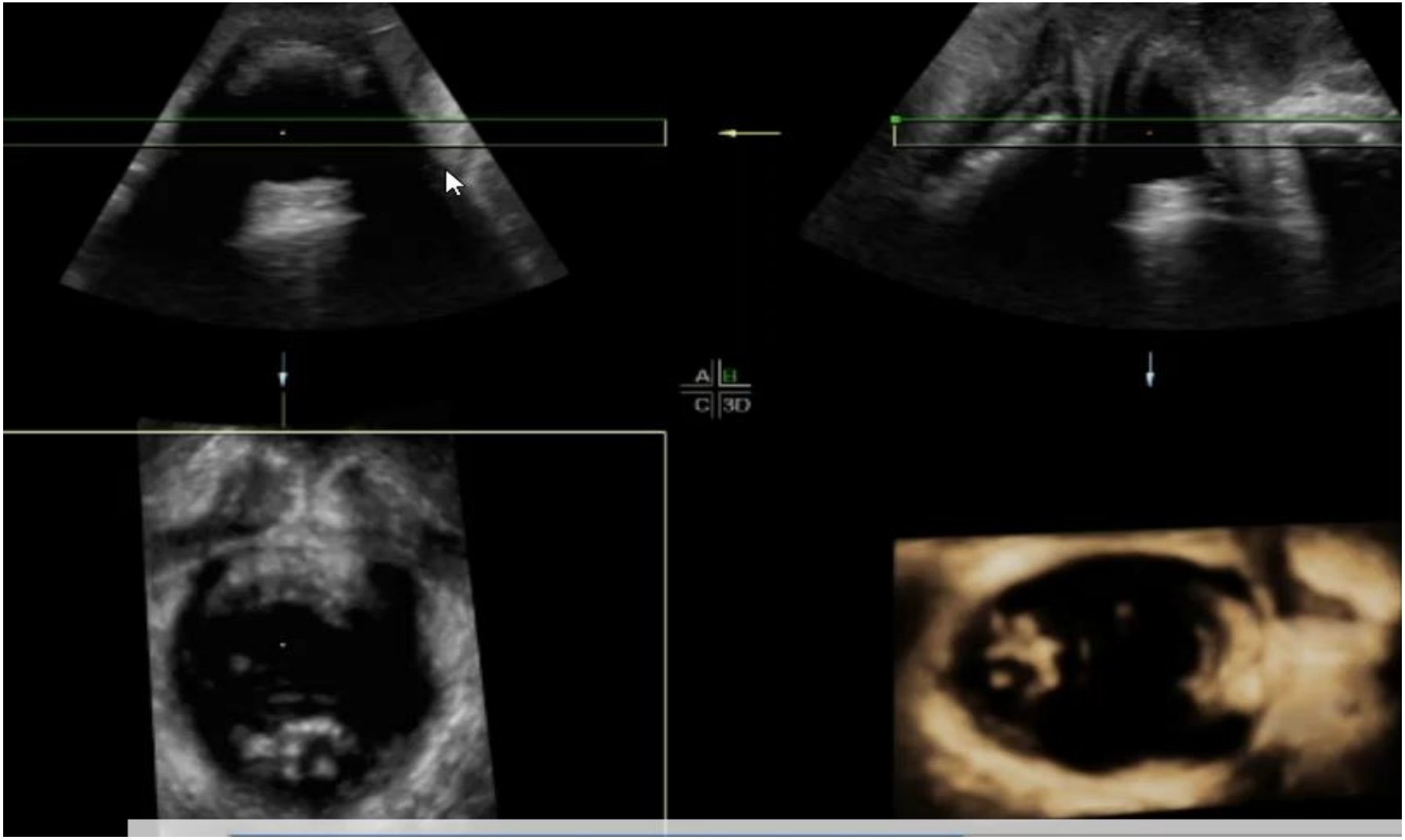
F I intestinum

F U ureter

F (.....) Location

- Diaphragm
- Lung
- Nerve
- .....

Pelvic floor assessment

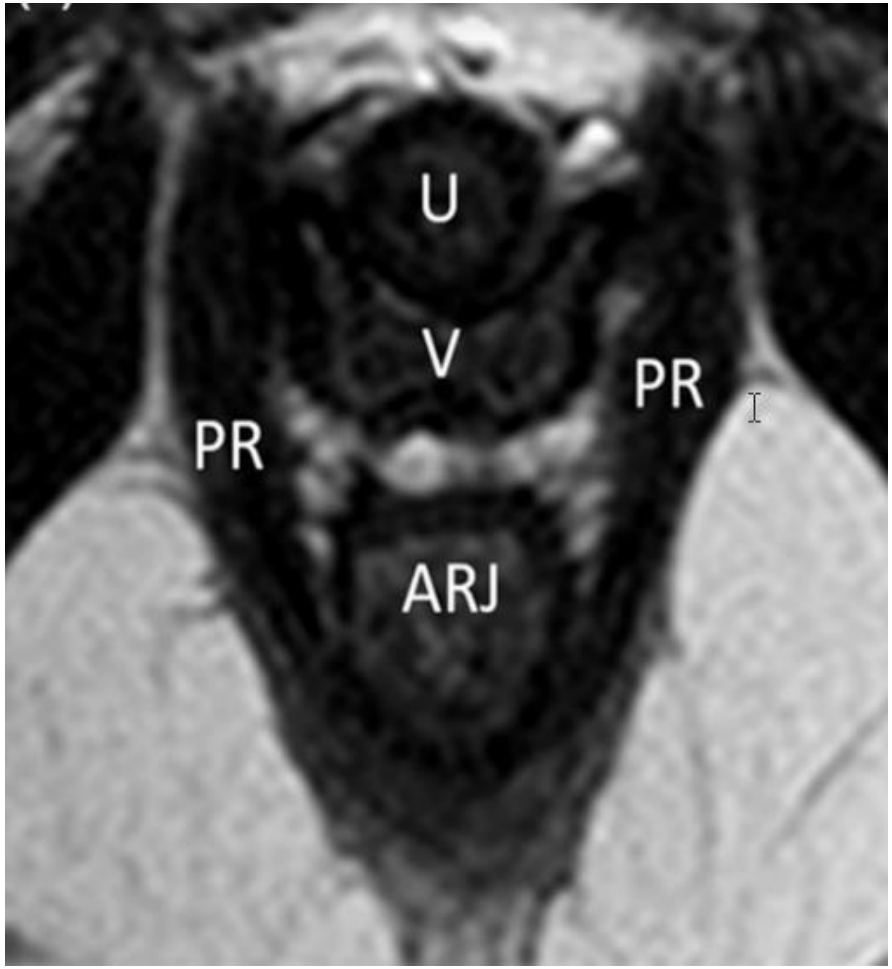


*Checklist:

- *Bladder wall thickness
- *Bladder neck hypermobility
- *Retrovesical angle
- *Levator hiatus area and feature
- *Uretrovaginal prolapse
- *Recto vaginal defect or prolapse
- *Proximal urethra funneling
- *Levator activity
- *Discontinuing internal and external sphincter


A
B
C

* Levator hiatus(area) whith Valsalva manure:
* Normal <25mm
* Mild ballooning : 25-30mm
* moderate ballooning : 30-35mm
* Marked ballooning :35- 40mm
* Sever >40mm


U
V
PR
PR
ARJ


khaje vand, zeynab 1997/03/21
188345
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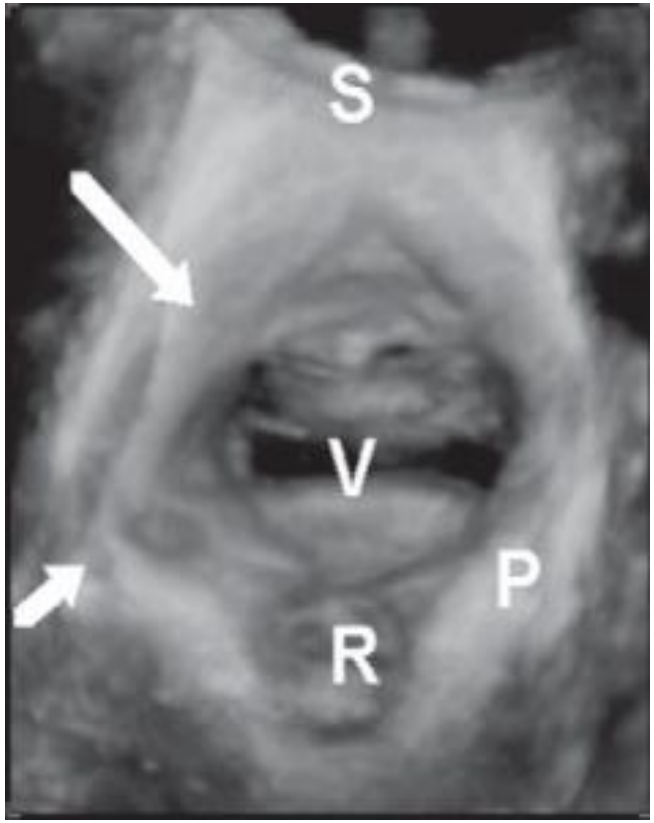
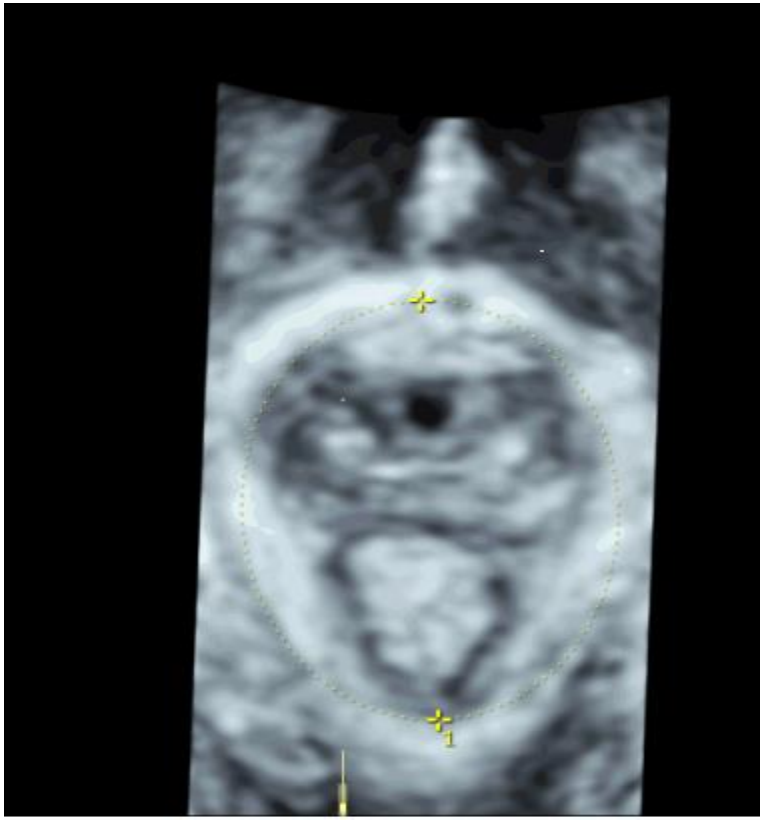
2023/08/27 21:26:04
TIs 0.2
TIb 0.2
MI 0.8
RIC5-9-D
GYN
4.4cm / 1.1
B162°/V120°
47 Hz
Gyn Render
Qual high1
Mix30/70
55mm
CRI 3
3D Static
1 D1 55.77mm
D2 34.33mm
A 1503.95mm
C 143.55mm


S
V
P
R



AFC

indications:

* Age≥35years attempting pregnancy more than 6months
* High risk diminished ovarian reserve
* Cancer treated gonadotoxic drugs or pelvic radiation
* Ovarian surgery for endometrioma
* Prediction risk of fetal aneuploidy
* Predict age at menopause
* Predict risk of ovarian stimulation response

Name FALAHATDOST Parvaneh Pat. ID 187141

SonoAVC™ (Semi-) Automatic

Left Ovary Total#: 9

Nr.	d(V) mm	dx mm	dy mm	dz mm	mean d mm	V cm^3
1	9.8	16.1	10.9	6.6	11.2	0.50
2	9.3	12.7	9.4	7.6	9.9	0.42
3	7.2	12.3	8.4	4.3	8.3	0.20
4	7.2	13.1	6.7	4.9	8.2	0.20
5	7.2	10.3	6.3	6.3	7.6	0.19
6	5.1	7.0	6.3	3.7	5.7	0.07
7	3.0	6.5	3.4	1.8	3.9	0.01
8	2.9	4.2	3.1	2.5	3.2	0.01
9	2.3	3.9	2.4	1.5	2.6	<0.01

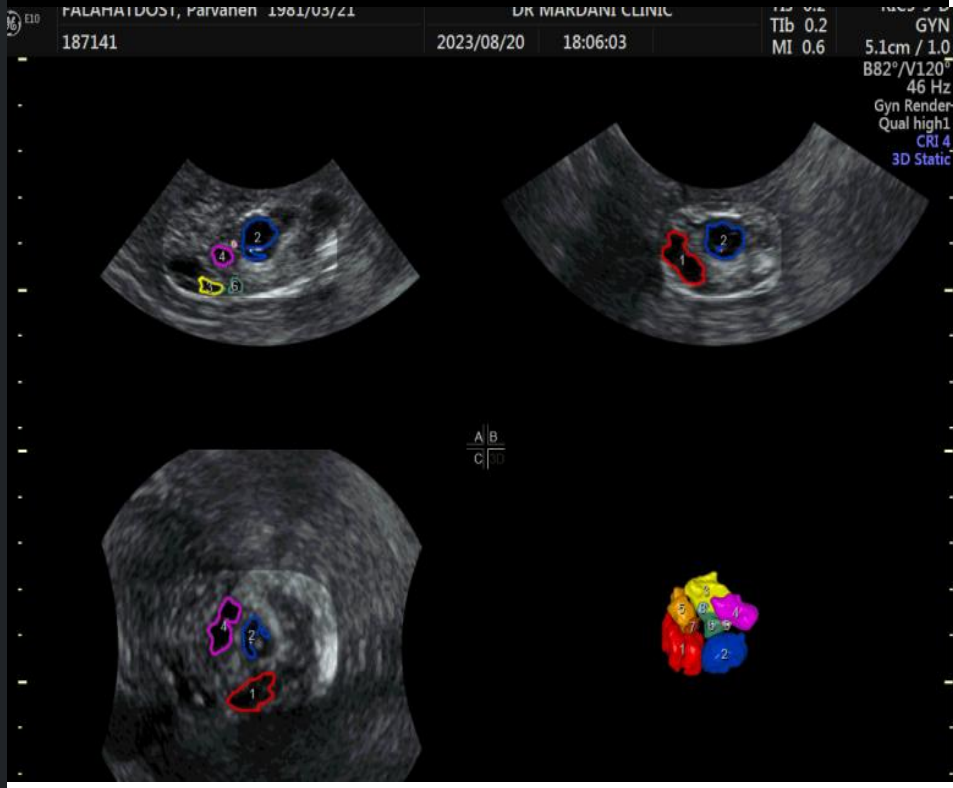
Right Ovary Total#: 6

Nr.	d(V) mm	dx mm	dy mm	dz mm	mean d mm	V cm^3
1	12.6	26.4	11.7	9.6	15.9	1.05
2	10.4	19.7	10.3	6.8	12.3	0.59
3	10.2	16.6	10.6	7.3	11.5	0.55
4	8.9	21.2	8.3	5.8	11.8	0.37
5	5.4	7.8	6.9	3.3	6.0	0.08
6	2.6	4.1	2.9	2.0	3.0	<0.01

Pelvic Floor

funneling ☐ yes ☐ no

urethral kinking ☐ yes ☐ no



* Antral follicle count (early menstrual cycle days 2-6)
* 25-35 years:15-30
* 35-40 years: 10-20
* 40-46 years: below 10

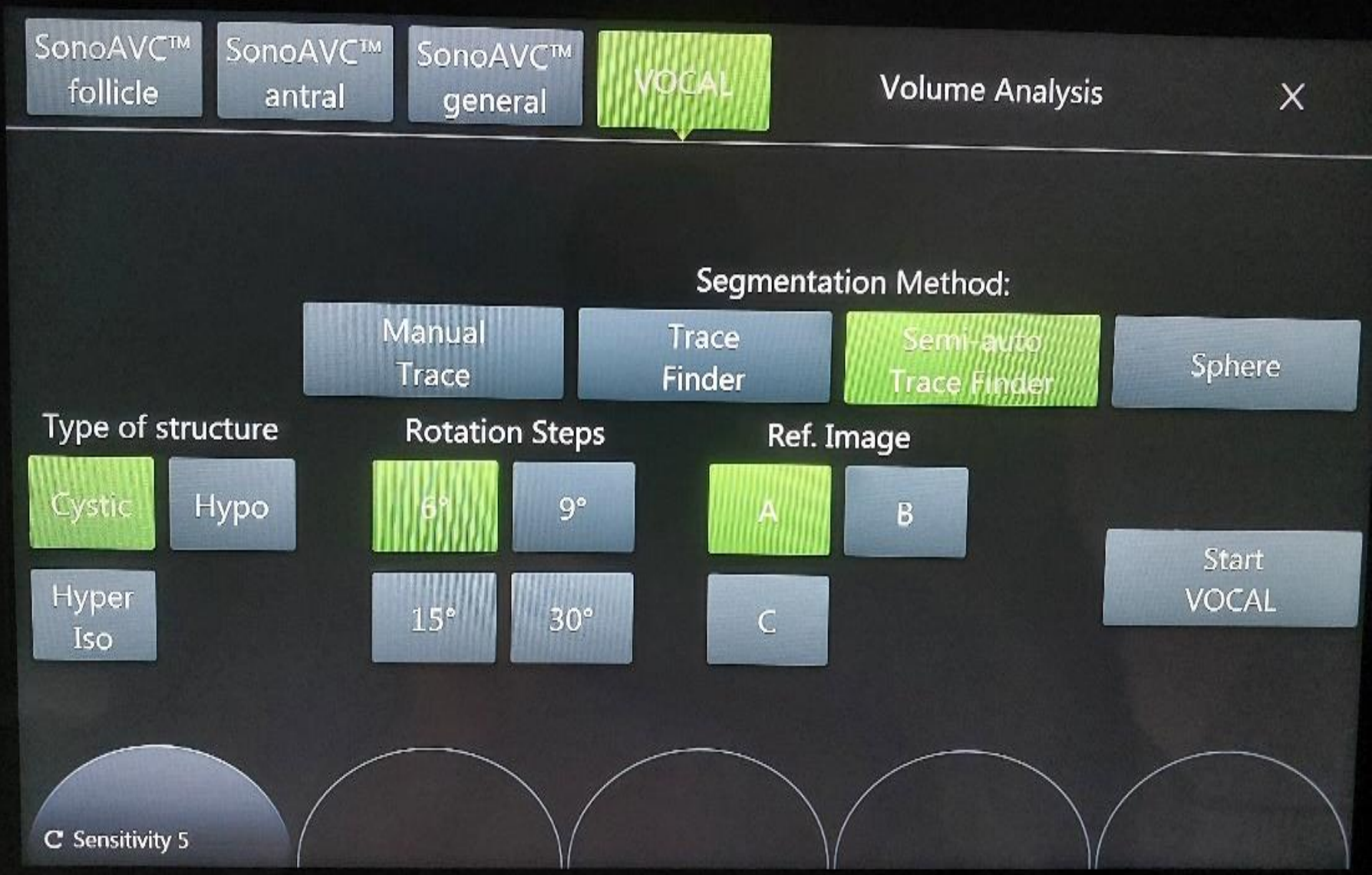
Nomenclature	*FNPO*	*Interpretation in clinical practice*
Oligofollicular or low follicle count	1–3	Low ovarian reserve and increased risk of menopause in next 7 years*
Normofollicular or normal follicular count	4–24	Normal follicle count for women of reproductive age
Multifollicular or high follicle count	≥ 25	High risk of hyperandrogenism
Nomenclature	*Total AFC*	*Interpretation for ovarian stimulation*
Very low functional ovarian reserve or very small number of recruitable follicles	0–4	Very high risk of poor response to ovarian stimulation and reduced chance of pregnancy
Low functional ovarian reserve or small number of recruitable follicles	5–8	High risk of poor response to ovarian stimulation
Normal functional ovarian reserve or normal number of recruitable follicles	9–19	Expected normal response to ovarian stimulation
High functional ovarian reserve or large number of recruitable follicles	≥ 20	High risk of excessive ovarian response and OHSS

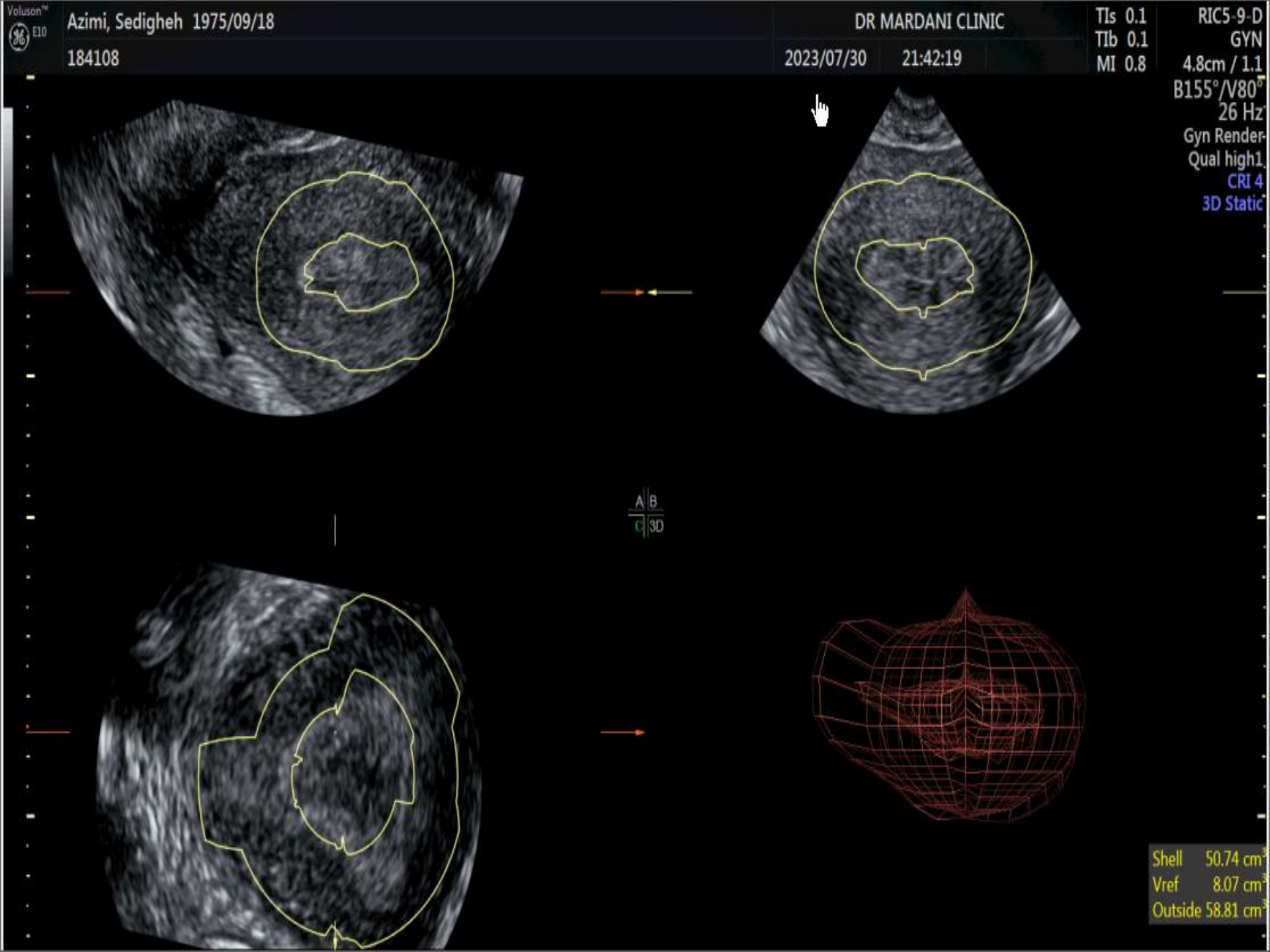
*35% *vs* 13%[7]. AFC, antral follicle count (number of follicles in both ovaries); FNPO, follicle number per ovary (number of follicles in ovary with more follicles); OHSS, ovarian hyperstimulation syndrome. Adapted from Martins *et al.*[5].

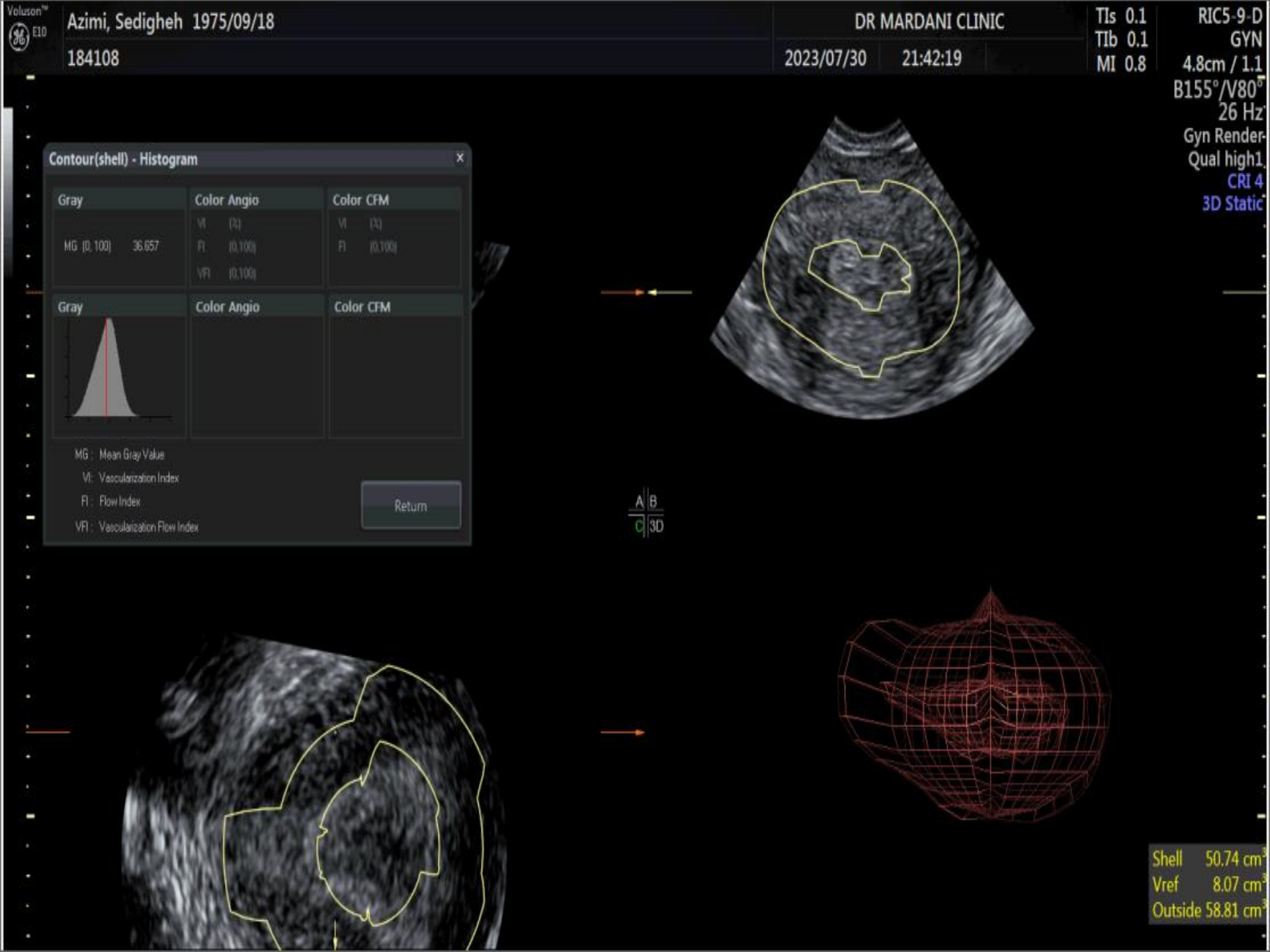
endometrial receptivity

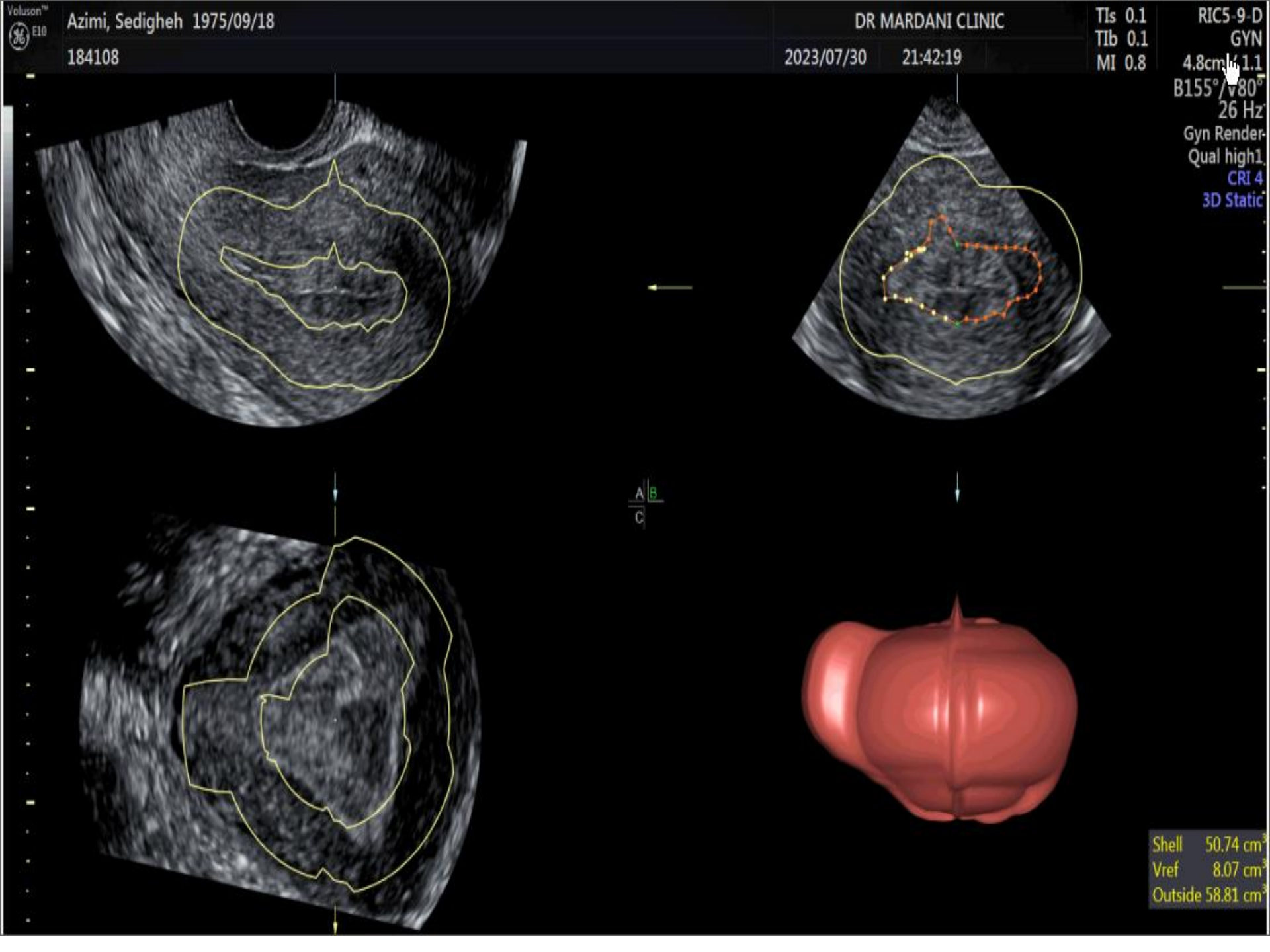
- Optimal condition for implantation:

*endometrium≥7mm
*Endometrium volume >2ml
*Hypoechoic endometrium(3 layer)
*Uterine PI≤3
*Presence of sub endometrial vascularity


SonoAVC™ follicle
SonoAVC™ antral
SonoAVC™ general
VOCAL
Volume Analysis
X
Segmentation Method:
Manual Trace
Trace Finder
Semi-auto Trace Finder
Sphere
Type of structure
Cystic
Hypo
Hyper Iso
Rotation Steps
6°
9°
15°
30°
Ref. Image
A
B
C
Start VOCAL
Sensitivity 5


Voluson™ E10
Azimi, Sedigheh 1975/09/18
184108
DR MARDANI CLINIC
2023/07/30 21:42:19
TIs 0.1
TIb 0.1
MI 0.8
RIC5-9-D
GYN
4.8cm / 1.1
B155°/V80°
26 Hz
Gyn Render-
Qual high1
CRI 4
3D Static
A B
C 3D
Shell 50.74 cm³
Vref 8.07 cm³
Outside 58.81 cm³


Voluson™ E10
Azimi, Sedigheh 1975/09/18
184108
DR MARDANI CLINIC
2023/07/30 21:42:19
TIs 0.1
TIb 0.1
MI 0.8
RIC5-9-D
GYN
4.8cm / 1.1
B155°/V80°
26 Hz
Gyn Render-Qual high1
CRI 4
3D Static
Contour(shell) - Histogram
Gray
Color Angio
Color CFM
MG (0, 100) 36.657
VI (%)
FI (0,100)
VFI (0,100)
MG : Mean Gray Value
VI : Vascularization Index
FI : Flow Index
VFI : Vascularization Flow Index
Return
A B C 3D
Shell 50.74 cm³
Vref 8.07 cm³
Outside 58.81 cm³


Voluson™ E10
Azimi, Sedigheh 1975/09/18
184108
DR MARDANI CLINIC
2023/07/30 21:42:19
TIs 0.1
TIb 0.1
MI 0.8
RIC5-9-D
GYN
4.8cm 1.1
B155°/v80°
26 Hz
Gyn Render-
Qual high1
CRI 4
3D Static
A
B
C
Shell 50.74 cm³
Vref 8.07 cm³
Outside 58.81 cm³