Clitoral Ultrasound:
Overview and Applications

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ISSWSH WEBINAR

Disclosures

- Research & Development Consultant for getcere.com, a physician-developed sexual wellness brand

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Outline

1. Clitoral Anatomy and Terminology
2. Clitoral Ultrasound: State of the Science
3. First Clitoral Ultrasound Protocol (Clitogram™)
4. Clinical Applications
5. Creative Research Applications
6. Challenges and Need for Advocacy

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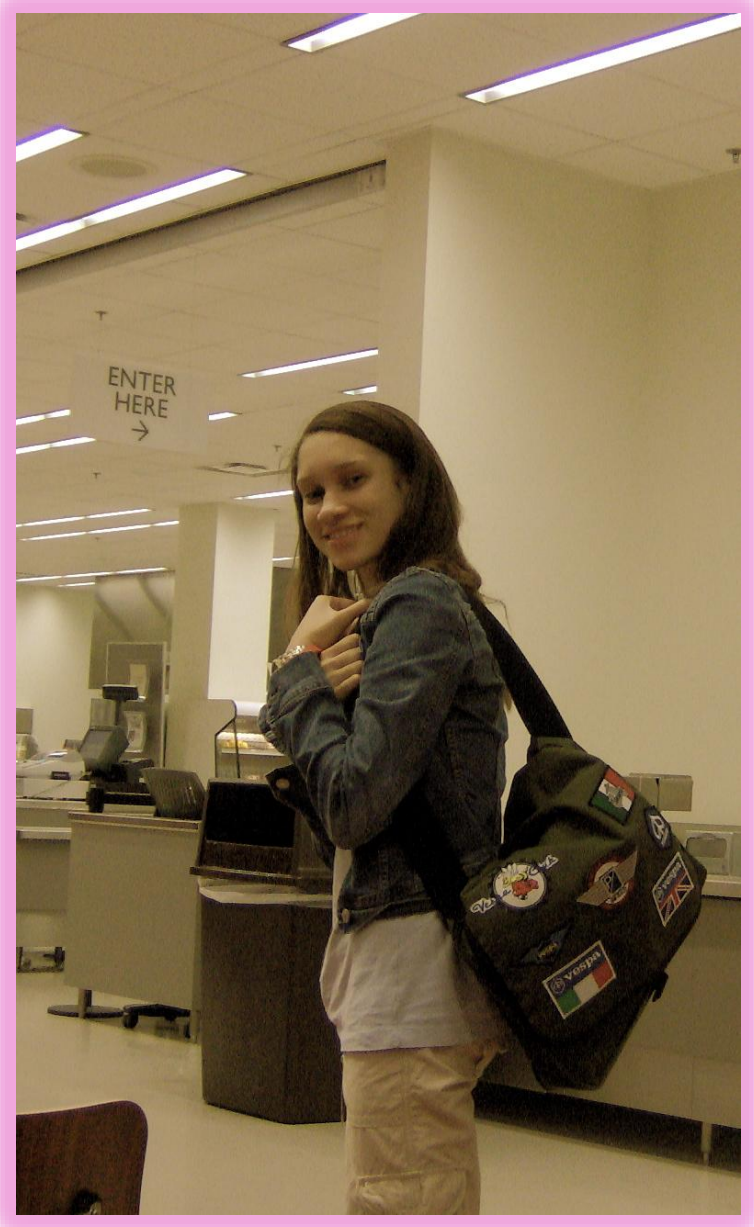

First Job
(NIH 2005, age 16)

First Ultrasound Scanning
(Yale Med 2013, age 24)

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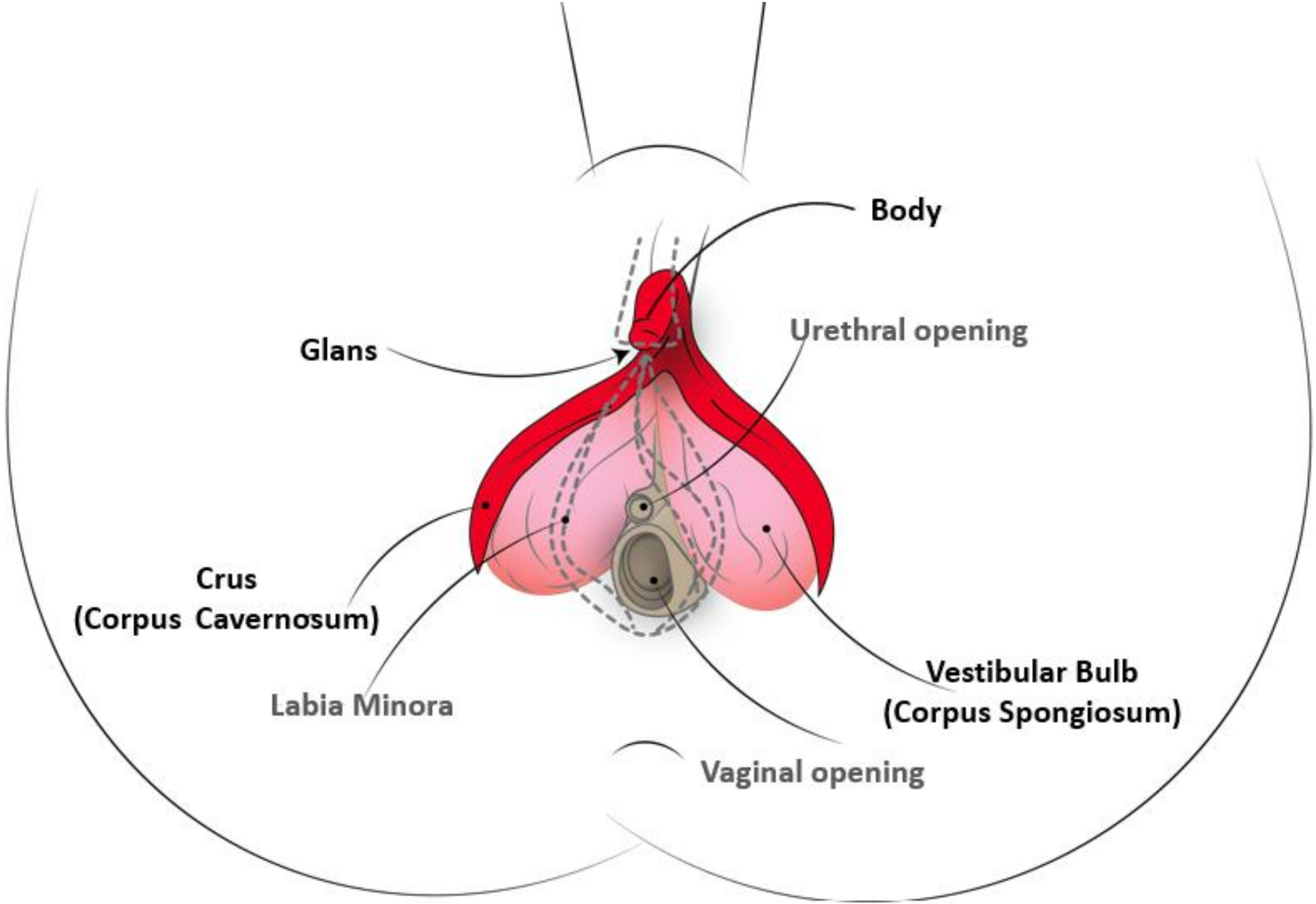
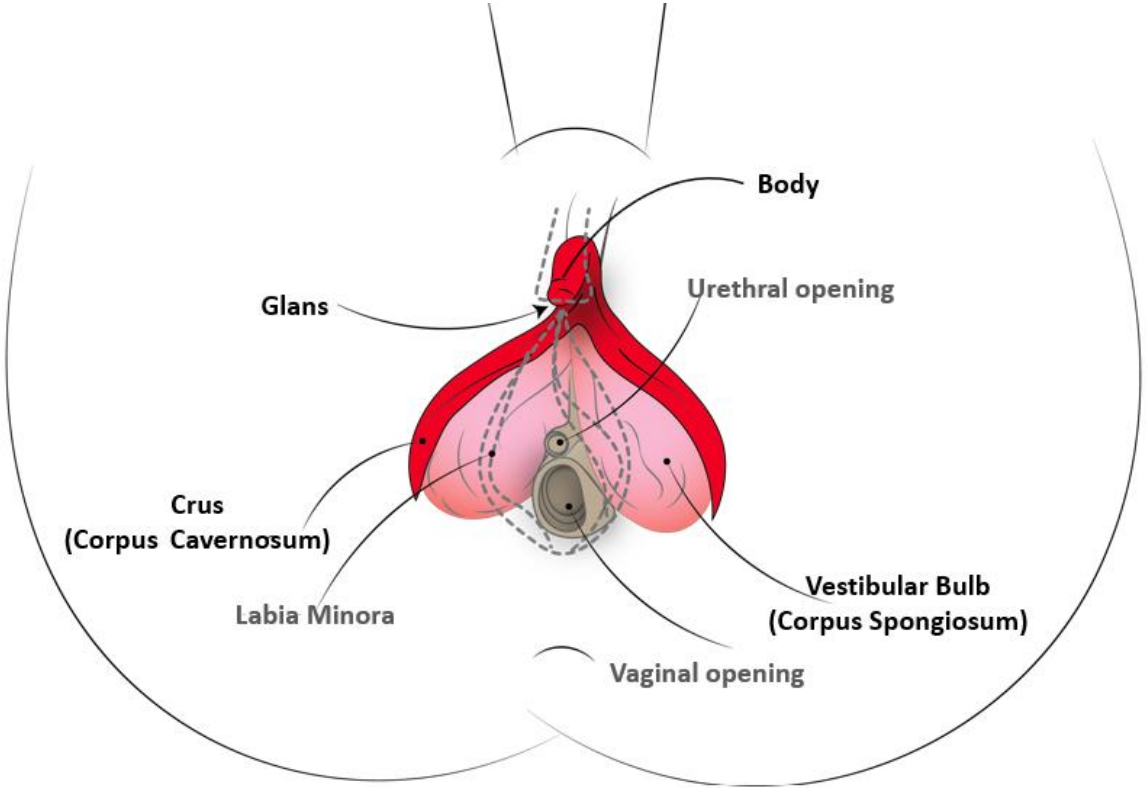
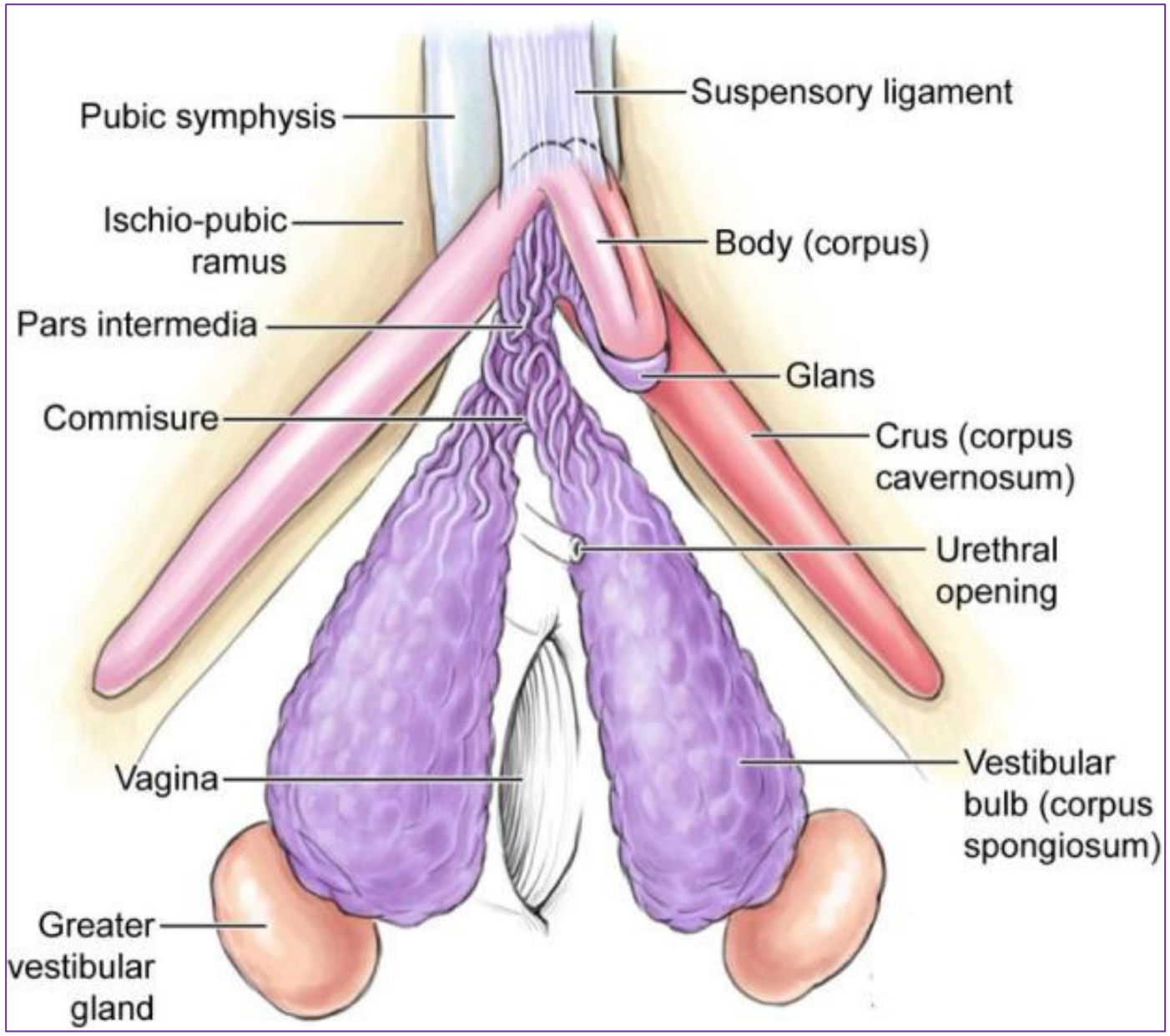
1. Clitoral Anatomy and Terminology


Body
Glans
Urethral opening
Crus
(Corpus Cavernosum)
Labia Minora
Vestibular Bulb
(Corpus Spongiosum)
Vaginal opening

What's in a Name?

- Glans
- Body = Corpus = Shaft
- Vestibular Bulb = Corpus Spongiosum
  - *Plural: Vestibular Bulbs = Corpora Spongiosa*
- Crus = Corpus Cavernosum
  - *Plural: Crura = Corpora Cavernosa*



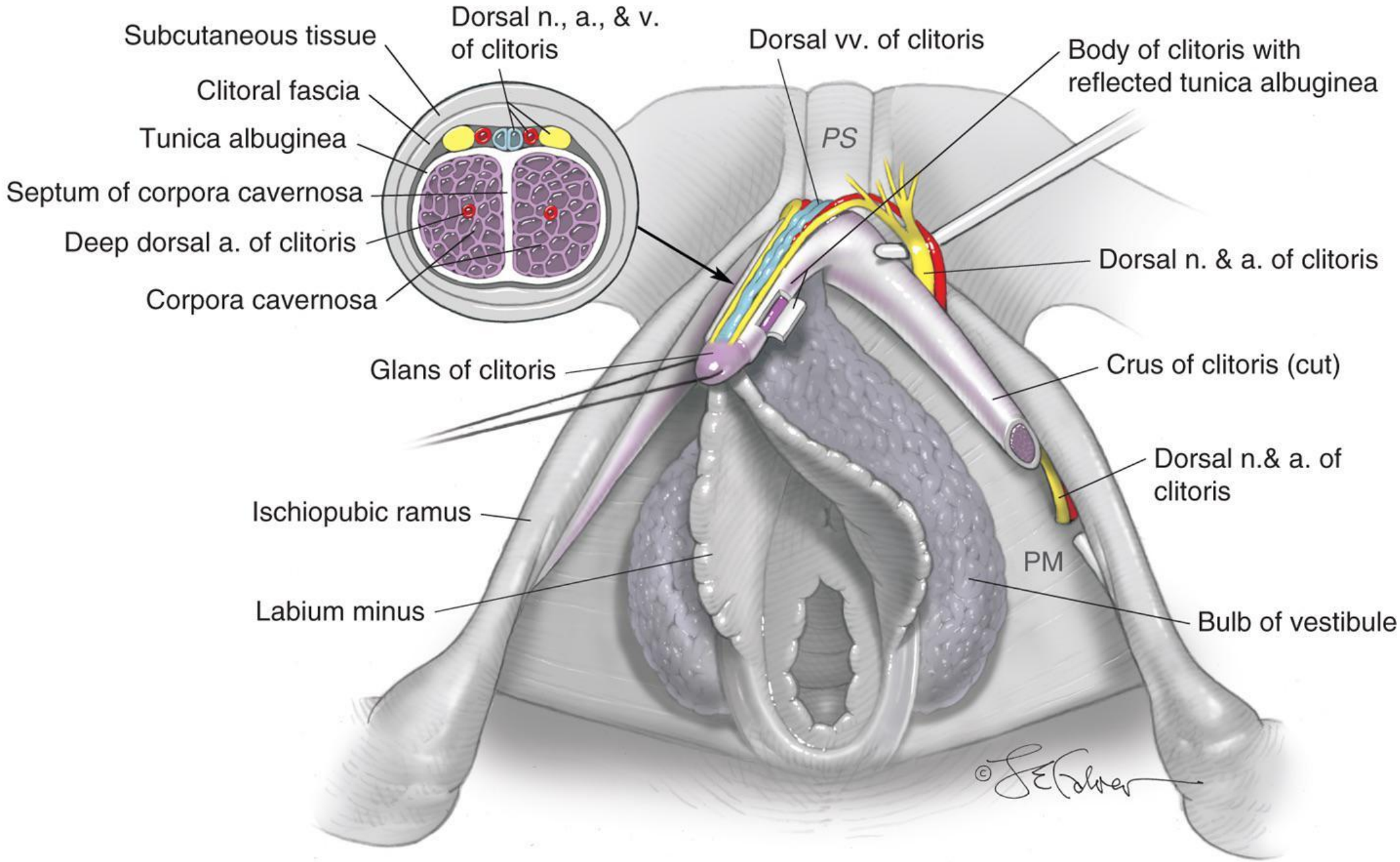


Historically, the vestibular bulbs and clitoris were thought of as separate erectile organs. But the pars intermedia (venous plexus of Kobelt) of the vestibular bulbs closely apposes the inferomedial aspect of the body and both contribute to the glans.

"Bulboclitoris" is accepted as the unified term for the entire erectile organ and consists of:

- Glans
- Body
- Crura (corpora cavernosa)
- Vestibular bulbs (corpora spongiosa)

Marshall DC, Ghiassi-Nejad Z, Powers A, Reidenberg JS, Argiriadi P, Ru M, et al. A first radiotherapy application of functional bulboclitoris anatomy, a novel female sexual organ-at-risk, and organ-sparing feasibility study. Br J Radiol 2021; 94: 20201139.



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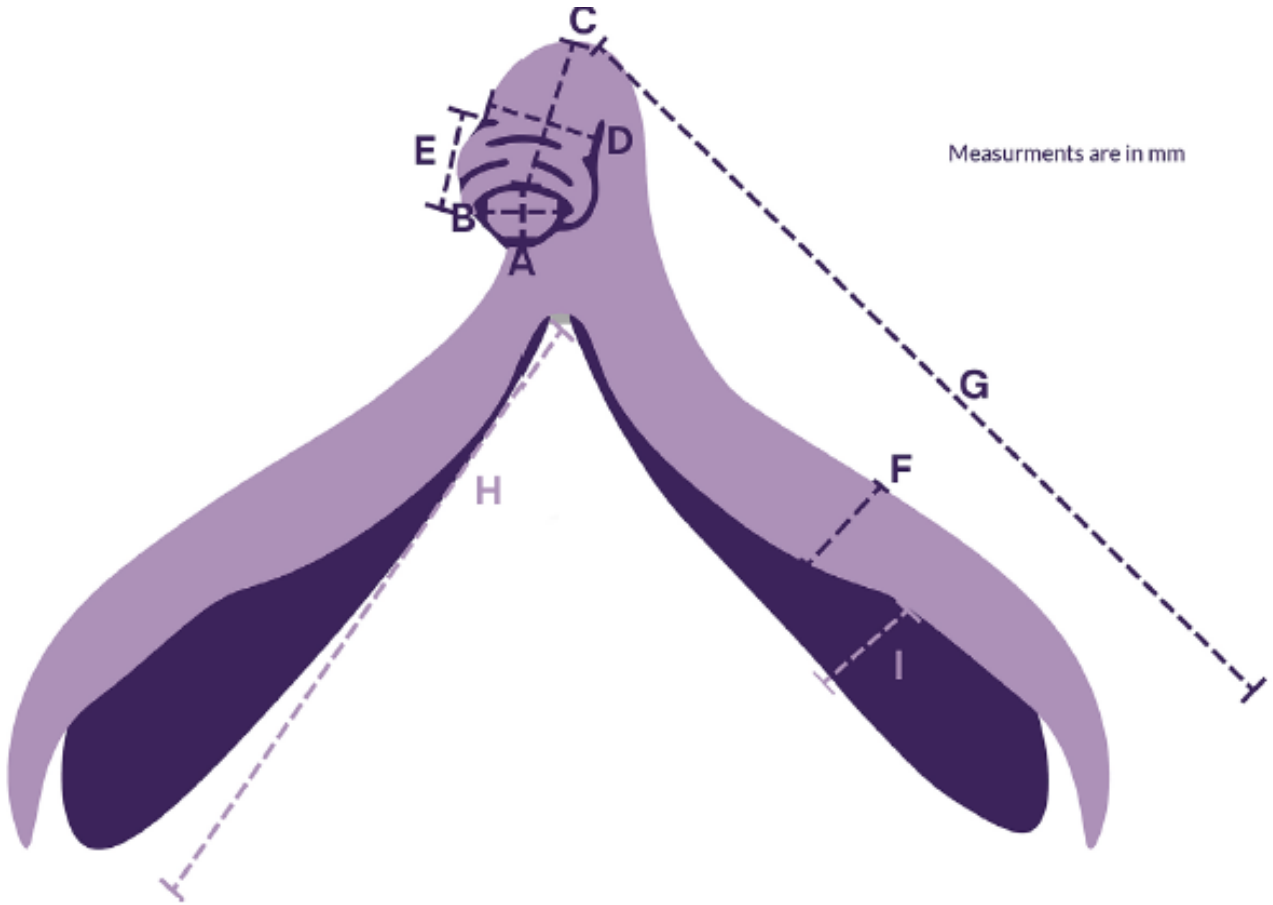
2. Clitoral Ultrasound: State of the Science

Meta-analysis of clitoral measurements (MRI, US, cadaveric, living people)



Measurments are in mm

A Length of the glans	1.00	6.40	21.00
B Width of the glans	2.00	5.14	32.00
C Length of the body	5.00	25.46	59.00
D Width of the body	5.00	9.00	20.00
E Length of prepuce	5.00	23.19	40.00
F Width of the crura	2.00	8.71	13.00
G Length of the crura	23.00	52.41	90.00
H Length of the bulb of the vestibule	13.00	52.00	70.00
I Width of the bulb of the vestibule	3.00	10.33	29.00

Longhurst, G. J., Beni, R., Jeong, S. R., Pianta, M., Soper, A. L., Leitch, P., De Witte, G., & Fisher, L. (2024). Beyond the tip of the iceberg: A meta-analysis of the anatomy of the clitoris. Clinical Anatomy, 37(2), 233–252. https://doi.org/10.1002/ca.24113

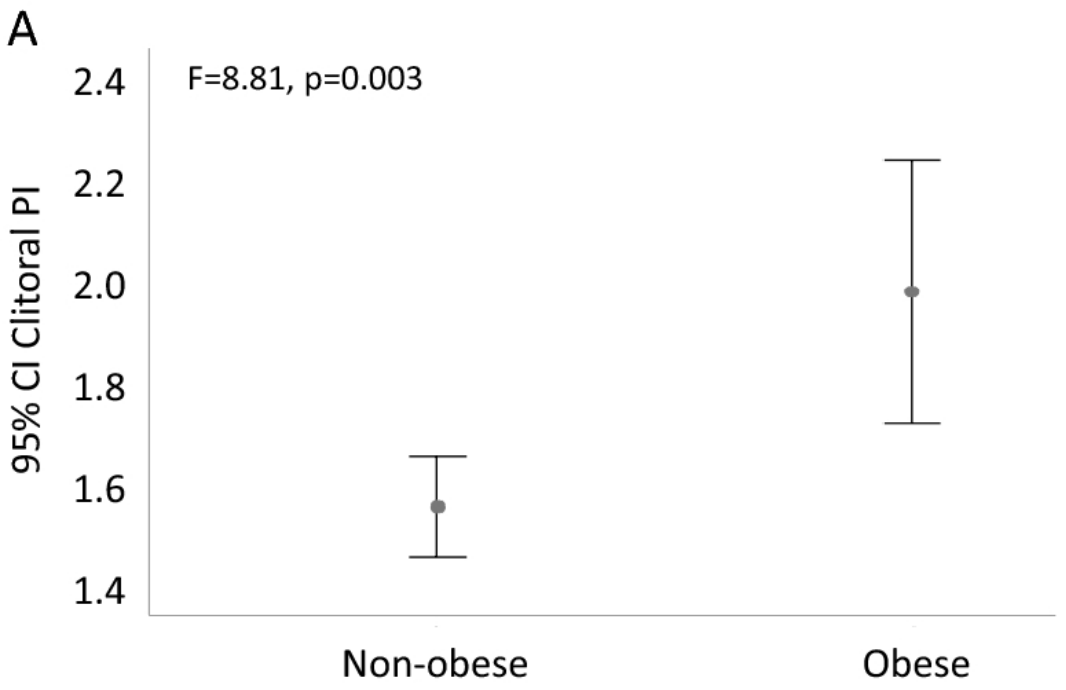
Cardiometabolic risk is unraveled by color Doppler ultrasound of the clitoral and uterine arteries in women consulting for sexual symptoms

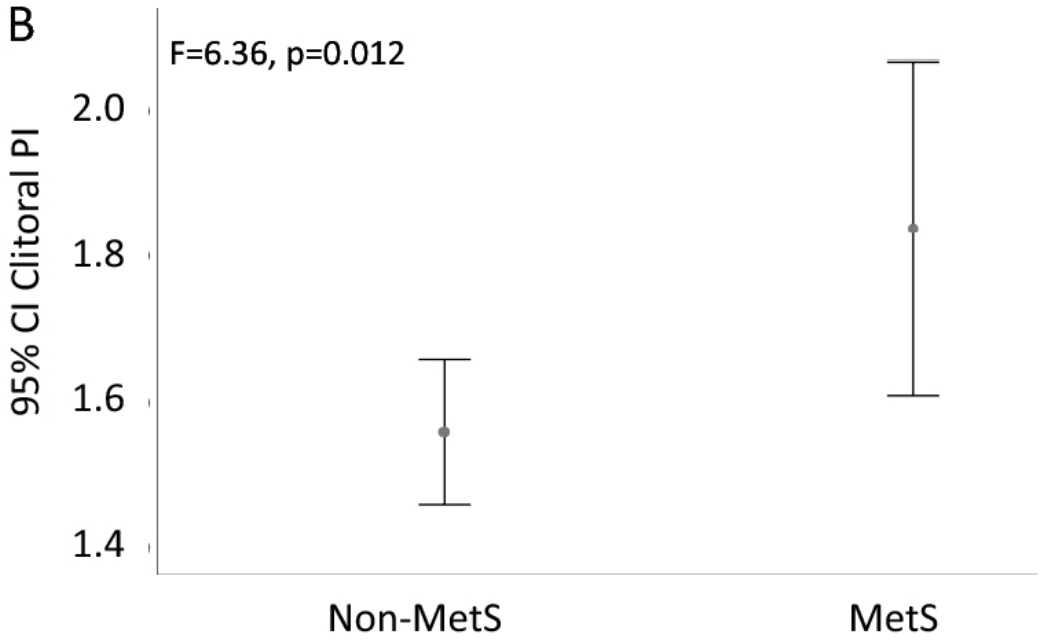
Pulsatility Index (PI) is a measure of how much the blood speeds up and slows down in a vessel during the cardiac cycle.

$PI = (v_{max} - v_{min}) / (v_{mean})$

PI = (peak systolic velocity - minimal diastolic velocity) / (mean velocity)

A high PI means the flow is very pulsatile (big differences between high and low flow speeds), which happens when there's higher resistance in the blood vessel downstream (like trying to pump water through a narrow hose)





Scavello I, Maseroli E, Cipriani S et al. Cardiometabolic Risk is Unraveled by Color Doppler Ultrasound of the Clitoral and Uterine Arteries in Women Consulting for Sexual Symptoms. Sci Rep. 2021;11(1):18899. doi:10.1038/s41598-021-98336-7 - Pubmed

Effect of hormone replacement therapy on clitoral artery blood flow in healthy postmenopausal women

Table 1 Comparison of the basal demographic data between the study groups

	HRT group (N = 25)	Control group (N = 35)	*P* value
Age (years)			
Mean ± SD	51.3 ± 4.5	50.0 ± 4.2	0.265
Range	43–60	43–63	
Postmenopausal duration (years)			
Mean ± SD	5.2 ± 2.8	3.7 ± 2.5	0.258
Range	1–20	1–18	
BMI (kg/m^2)			
Mean ± SD	28.5 ± 8.9	27.8 ± 9.4	0.287
Range	18.8–43.6	17.6–42.7	
Parity			
Mean ± SD	3.1 ± 1.6	2.9 ± 1.4	0.124
Range	0–6	0–5	
Duration of HRT use (years)			
Mean ± SD	2.0 ± 1.1	NA	NA
Range	1–5		

HRT = hormone replacement therapy; BMI = body mass index; SD = standard deviation; NA = not applicable.

Table 2 Comparison of Doppler sonographic findings between groups

Study parameter	HRT group (N = 25)	Control group (N = 35)	*P* value
PSV (cm/second) of CA	15.0 ± 5.4	11.8 ± 5.2	0.025
RI of CA	0.79 ± 0.10	0.81 ± 0.11	0.787
PI of CA	2.23 ± 1.13	2.22 ± 0.89	0.949

Data are presented as mean ± standard deviation.
HRT = hormone replacement therapy; CA = clitoral artery; PI = pulsatililty index; PSV = peak systolic velocity; RI = resistance index.

"…basal clitoral blood flow was determined higher in postmenopausal patients who have HRT in comparison with women who had no hormonal therapy. Because the indices of impedance (PI and RI) are not significantly altered, our results imply that HRT improves clitoral blood flow without changing vascular resistance."

Alatas E, Yagci B, Oztekin O, Sabir N. Effect of hormone replacement therapy on clitoral artery blood flow in healthy postmenopausal women. *J Sex Med.* 2008;5(10):2367-2373. doi:10.1111/j.1743-6109.2008.00887.x

Cigarette smoking decreases the genital vascularization in young healthy, eumenorrheic women

Introduction. Cigarette smoking is a major health hazard and may impair the normal sexual response.

Aim. To evaluate (in the early follicular phase, and independently from sexual stimulation) in young, eumenorrheic, healthy, lean women the general and genital vascular effects of the smoking habit.

Methods. One hundred thirty-seven patients undertook, in the early follicular phase of the menstrual cycle (day 3–5): the administration of the two-factor Italian McCoy Female Sexuality Questionnaire (MFSQ); two-dimensional (2-D) color Doppler evaluation of the ophthalmic, carotid, uterine, clitoral, and labia minora arteries; three-dimensional (3-D) analysis of clitoral and labia minora vascularization; and blood pressure evaluation. Fasting blood samples were drawn to test plasma estradiol, androstenedione, and testosterone circulating levels.

Main Outcome Measures. The two-factor Italian MFSQ; the pulsatility index (PI) of internal carotid, ophthalmic, uterine, clitoral, and labia minora arteries; the vascularization index (VI), the flow index (FI), and the vascularization flow index (VFI) of clitoral body and labia minora, blood pressure measurement, and hormonal assay.

Results. The subjects were divided in: nonsmokers (Group I; N = 72); current (>2 years) light smokers—1 to 10 cigarettes/day—(Group II; N = 35); and current heavy smokers—> 10 cigarettes/day—(Group III; N = 30). The 2-D Doppler analysis of the ophthalmic and internal carotid arteries showed significant increased resistance in Group III compared with Group II and Group I. The genital vessels (uterine, clitoral, and labium minus arteries) showed the lowest PIs in the nonsmokers. The 3-D power Doppler histogram analysis of clitoral and labium minus blood flow showed the worst vascular indices (VI, FI, VFI) in the heavy smokers.

Conclusions. Cigarette smoking may favor a reduced central and peripheral tissue perfusion with consequent increased risk of cerebrovascular and cardiovascular diseases and with genital vessels stiffness and impaired sexual performances. **Battaglia C, Battaglia B, Mancini F, Persico N, Nappi RE, Paradisi R, and Venturoli S. Cigarette smoking decreases the genital vascularization in young healthy, eumenorrheic women. J Sex Med 2011;8:1717–1725.**

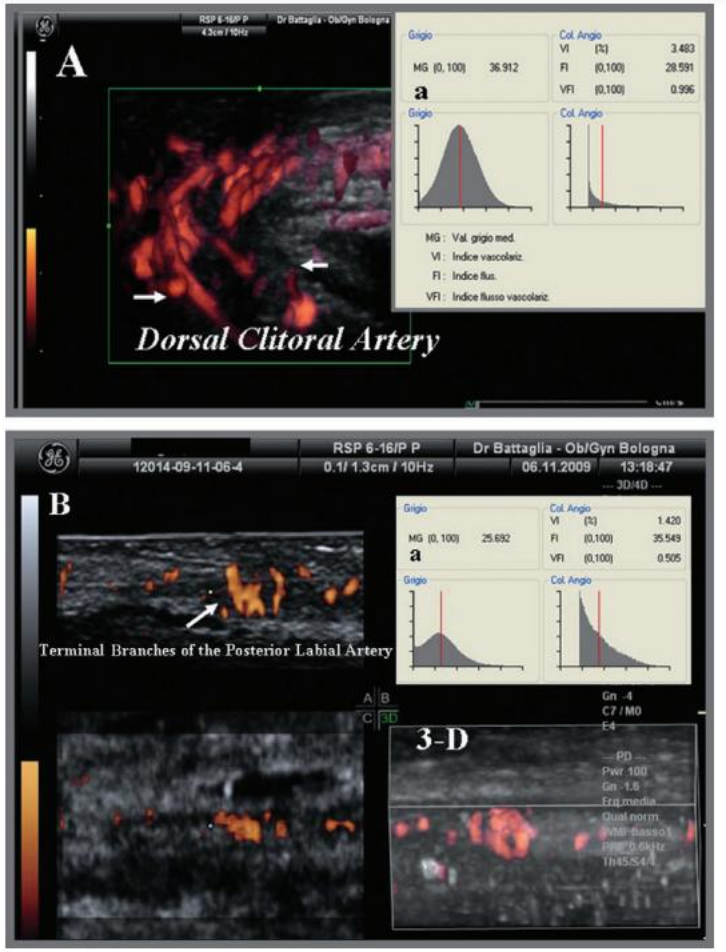


Figure 1 (A) Three-dimensional reconstruction of clitoral body vascularization. It is possible to observe the dorsal clitoral arteries (arrow) and many vessels that branch out. The power Doppler histograms (a) allow the derivation of three different vascular indices (vascularization index [VI], flow index [FI], vascularization flow index [VFI]). (B) Three-dimensional reconstruction of the labium minus vascularization (terminal branches of the posterior labial artery). The small vessels spread out inside the labium. The power Doppler histograms (a) measure the VI, the FI, and the VFI.

Battaglia C, Battaglia B, Mancini F, Persico N, Nappi RE, Paradisi R, Venturoli S. Cigarette smoking decreases the genital vascularization in young healthy, eumenorrheic women. *J Sex Med.* 2011;8(6):1717-1725. doi:10.1111/j.1743-6109.2011.02257.x

The evaluation of clitoral blood flow and sexual function in elite female athletes

Group I: Elite female athletes who are professional volleyball or handball players (at least 4 hours of exercise/day)

Group II: Healthy sedentary female volunteers (less than 2 hours of exercise/week)

Table 1 Demographic characteristics of both groups

	Group I (N = 25)	Group II (N = 25)	*P* value
Age (years)	28.4 ± 4.4	28.9 ± 4.9	NS
(range)	(22–41)	(21–43)	
BMI (kg/m^2)	20.7 ± 1.9	21.6 ± 1.5	NS
Age of menarche (years)	13 ± 1.3	12.7 ± 0.9	NS
Marriage age (years)	23.7 ± 2.3	23.2 ± 1.6	NS
Number of childbirth	0.68 ± 0.8	1.32 ± 1.2	0.049

Data presented as mean ± SD.
BMI = body mass index; NS = not significant.

Table 2 Clitoral color Doppler ultrasound and FSFI parameters of both groups

		Group I (N = 25)	Group II (N = 25)	*P* value
Color Doppler ultrasonography parameters	PSV (cm/s)	15.3 ± 2.3	11.8 ± 1.7	<0.001
	EDV (cm/s)	5.8 ± 1.2	4.4 ± 1.1	<0.001
	RI	0.64 ± 0.04	0.62 ± 0.06	NS
FSFI domain scores	Desire	3.8 ± 0.6	3.9 ± 0.5	NS
	Arousal	4.4 ± 0.5	3.7 ± 0.6	<0.001
	Lubrication	4.3 ± 0.4	3.8 ± 0.6	0.001
	Orgasm	5.2 ± 0.7	3.9 ± 0.7	<0.001
	Satisfaction	5.2 ± 0.8	3.9 ± 0.8	<0.001
	Pain	5.4 ± 0.6	4.3 ± 0.8	<0.001
Total FSFI score		28.3 ± 2.7	23.4 ± 1.8	<0.001

Data presented as mean ± standard deviation.
PSV = peak systolic velocity; EDV = end-diastolic velocity; RI = resistive index; FSFI = Female Sexual Function Index; NS = not significant.

Karatas O, Baltaci G, Ilerisoy Z et al. The Evaluation of Clitoral Blood Flow and Sexual Function in Elite Female Athletes. J Sex Med. 2010;7(3):1185-9. doi:10.1111/j.1743-6109.2009.01569.x - Pubmed

Ultrasonographic and doppler findings of subclinical clitoral microtraumas in mountain bikers and horseback riders

ABSTRACT

Introduction. Repeated microtraumas in horseback riders and mountain bikers are, in males, associated with perineal and scrotal lesions. No data are reported in the females.

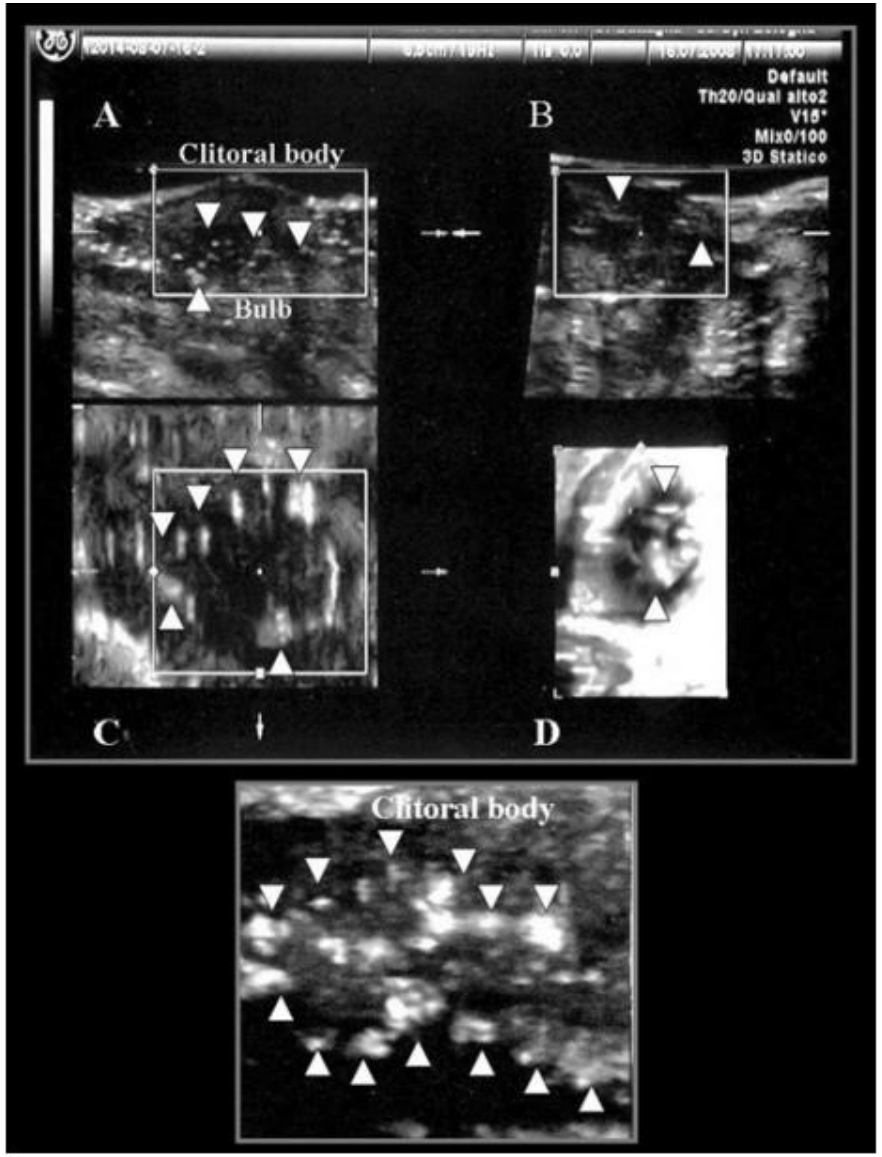
Aim. To report five cases of clitoral microcalcifications, diagnosed by ultrasonography, in six healthy, eumenorrheic athletes, and to verify the clinical and sexual impact of the ultrasonographic findings.

Main Outcome Measures. Translabial ultrasonographic evaluation of the clitoris, Doppler analysis of dorsal clitoral arteries, and the two-factor Italian McCoy Female Sexuality Questionnaire (MFSQ)

Methods. The patients were assessed with a detailed history, and were submitted, in the periovulatory phase of the cycle (day 14), to clitoral ultrasonographic analysis and color Doppler evaluation of the dorsal clitoral arteries. The women were not sexually aroused. On the same day, in a separate room—and prior the ultrasound and Doppler examinations took place—the subjects completed the two-factor Italian MFSQ.

Results. All the patients were completely asymptomatic but reported a past history of intermittent perineal tenderness or discomfort. In five out of the six subjects, the ultrasonographic assessment of the clitoris evidenced a disseminated clitoral microlithiasis. Only the youngest (18 years old) biker showed a normal pattern of the clitoral structures. A normal clitoral body volume (0.68 ± 0.21 mL) and a normal mean dorsal artery pulsatility index (PI) was found (PI = 1.75 ± 0.32) in all the patients. The two-factor Italian MFSQ showed a mean value of 42 ± 4 (range 37–45).

Conclusions. The chronic traumatisms may be responsible, especially in well-trained riders, for microhematomas, inflammation, and/or degenerative processes at level of the clitoral structure. Further studies should be undertaken to determine the clinical significance of the described disseminated clitoral microlithiasis. **Battaglia C, Nappi RE, Mancini F, Cianciosi A, Persico N, and Busacchi P. Ultrasonographic and Doppler findings of subclinical clitoral microtraumatisms in mountain bikers and horseback riders. J Sex Med 2009;6:464–468.**



Battaglia C, Nappi RE, Mancini F, Cianciosi A, Persico N, Busacchi P. Ultrasonographic and Doppler findings of subclinical clitoral microtraumatisms in mountain bikers and horseback riders. *J Sex Med.* 2009;6(2):464-468. doi:10.1111/j.1743-6109.2008.01124.x

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3. First Clitoral Ultrasound Protocol (Clitogram™)

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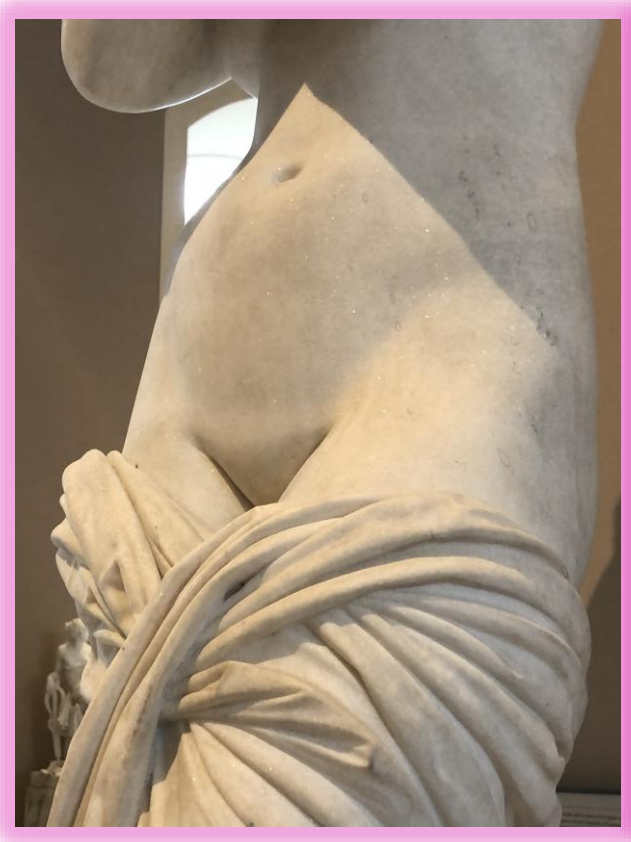
"How do Radiologists evaluate the clitoris?"

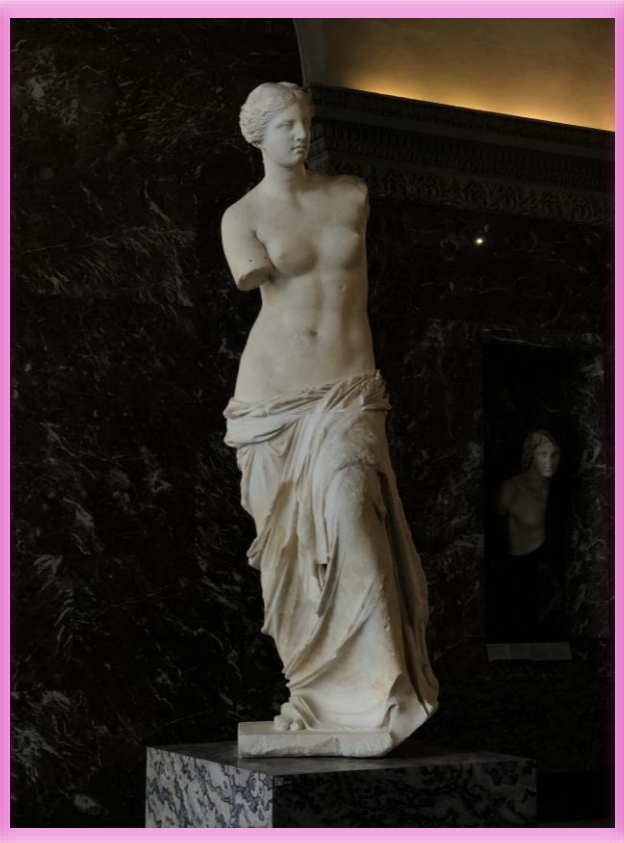
"That's a great question…"

April 2021

WWW.ISSWSH.ORG

Paris 2021





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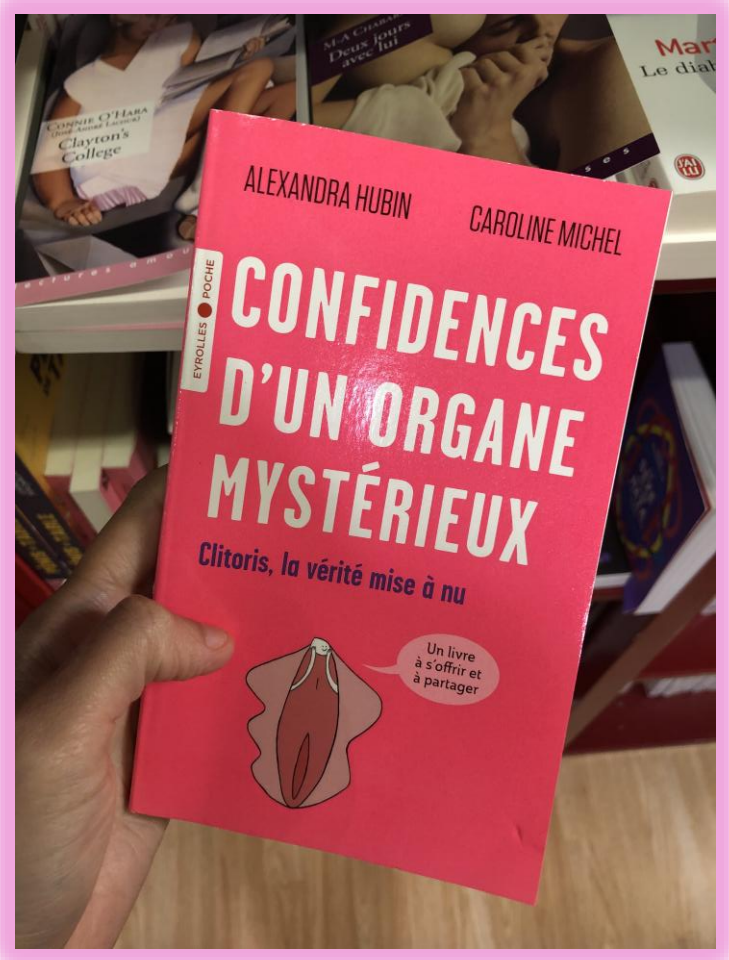

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Defining Clitoral Ultrasound for the Radiology Community

Murdaugh K, Sharma R, Bell D, et al. Clitoral ultrasound. Reference article, Radiopaedia.org. https://doi.org/10.53347/rID-98480

Clitoris

(see: clitoris)

- bulboclitoris consists of the erectile tissues of the clitoris (glans, body, crura (corpora cavernosa) and vestibular bulbs (corpora spongiosa)
- in the transverse plane, the vestibular bulbs are round, hypoechoic structures lateral to the urethra
- the vestibular bulbs join superomedially at the commisure and pars intermedia (adjacent to the body), forming the glans
- during arousal and clitoral erection, blood flow increases to deep artery of the clitoris, supplying the vestibular bulbs ; this can be visualized with color Doppler
- clitoral erection leads to an increase in length of the vestibular bulbs and crura, best measured in the sagittal plane
- the paired crura, which attach to the ischiopubic rami and are surrounded by connective tissue (tunica albuginea) and skeletal muscle (ischiocavernosus), may be difficult to distinguish from the more medial vestibular bulbs on ultrasound

Technique

Clitoral ultrasound involves a transperineal component.

Transperineal exam

A broadband linear array transducer (4-12 MHz) is often used. The transducer can be placed on the clitoral hood and fanned to visualize the rest of the clitoris. Color Doppler can be used qualitatively to assess general blood flow to the clitoris, and/or quantitatively to assess the velocity of blood flow through the deep artery of the clitoris.

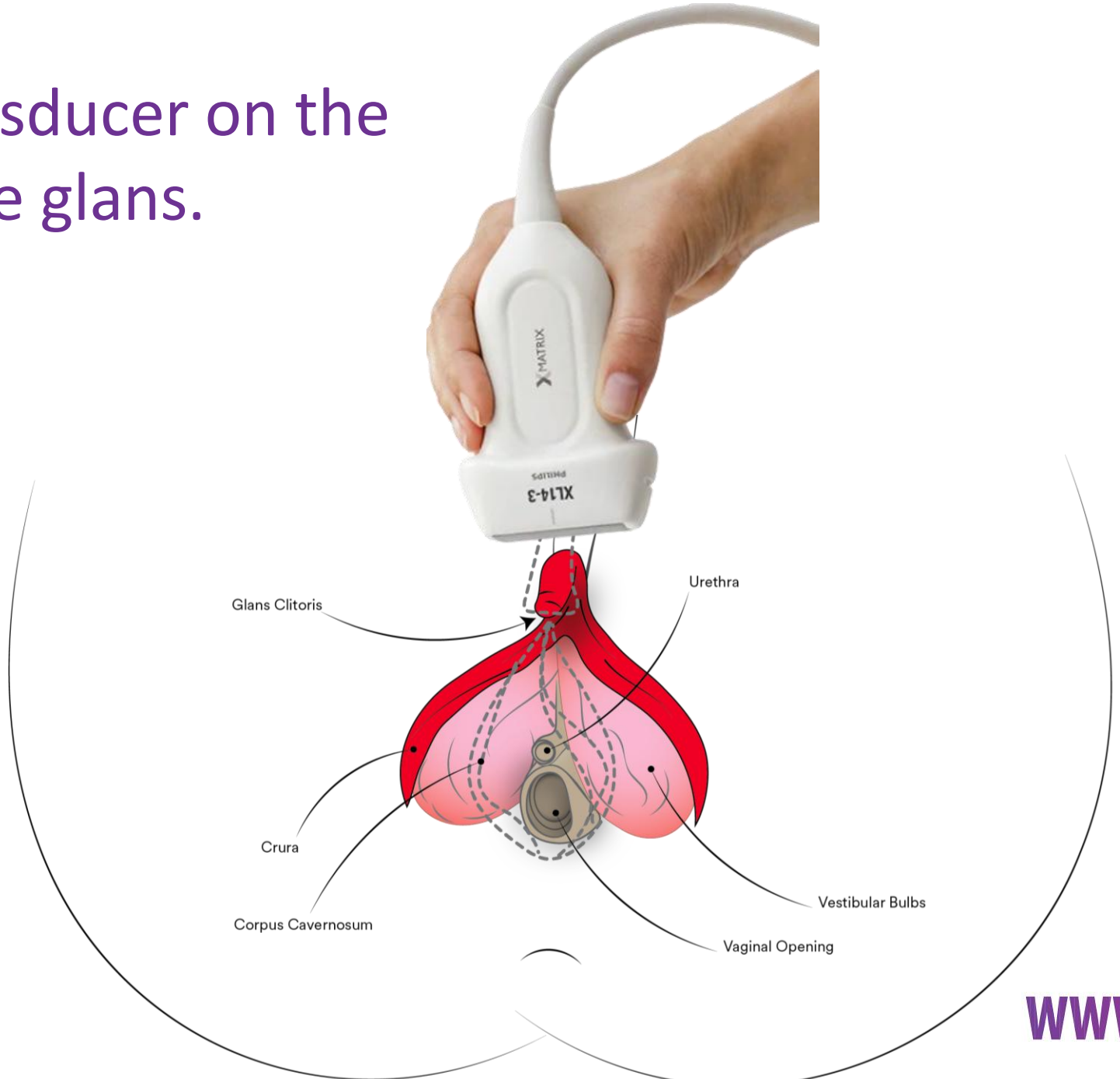
Practical points

Apply light pressure with the transducer to avoid distorting the dimensions of the clitoris, and to avoid compressing the deep or dorsal clitoral arteries.

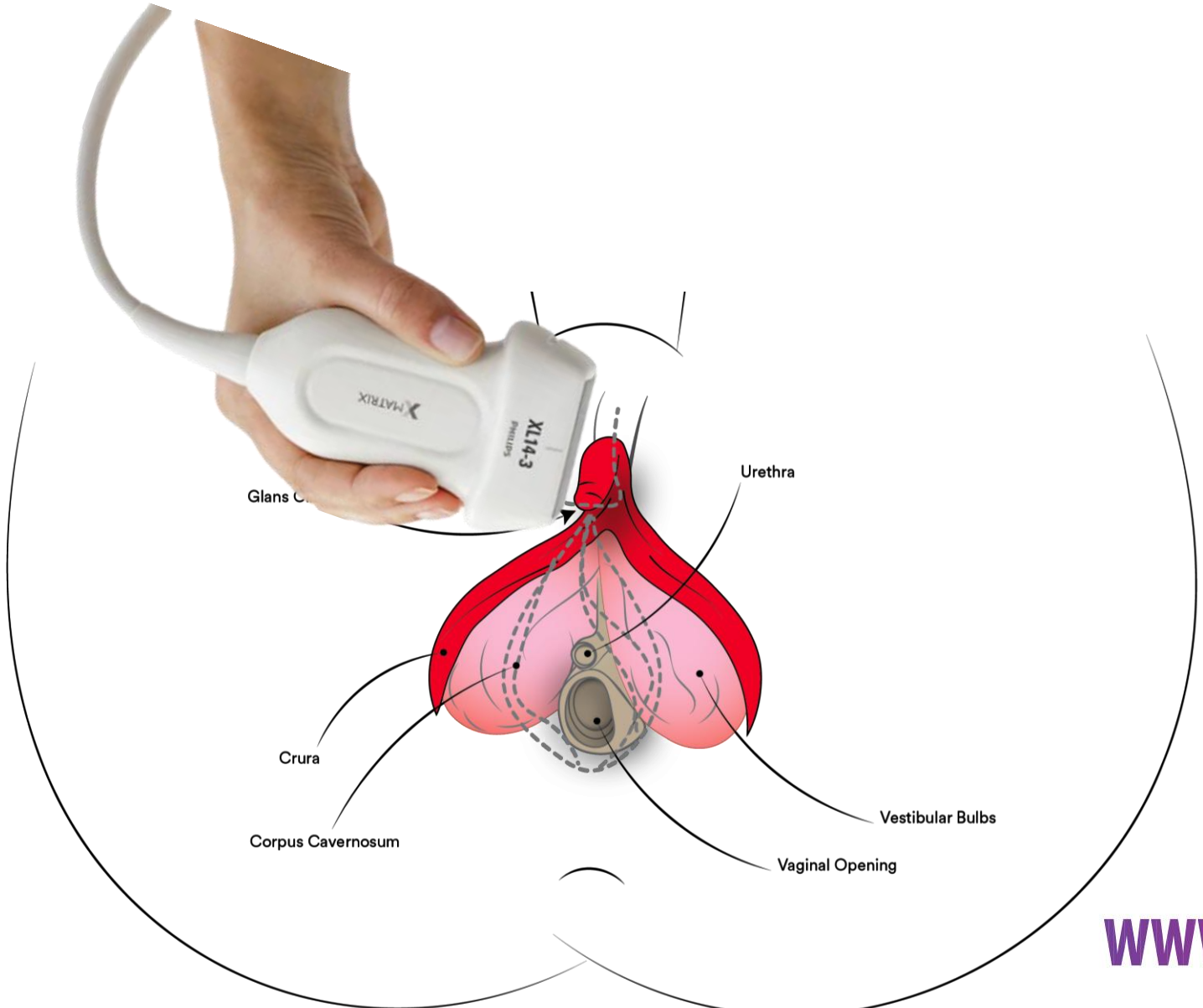
3. Clitogram™ Protocol

Start by placing the patient in the
dorsal lithotomy position

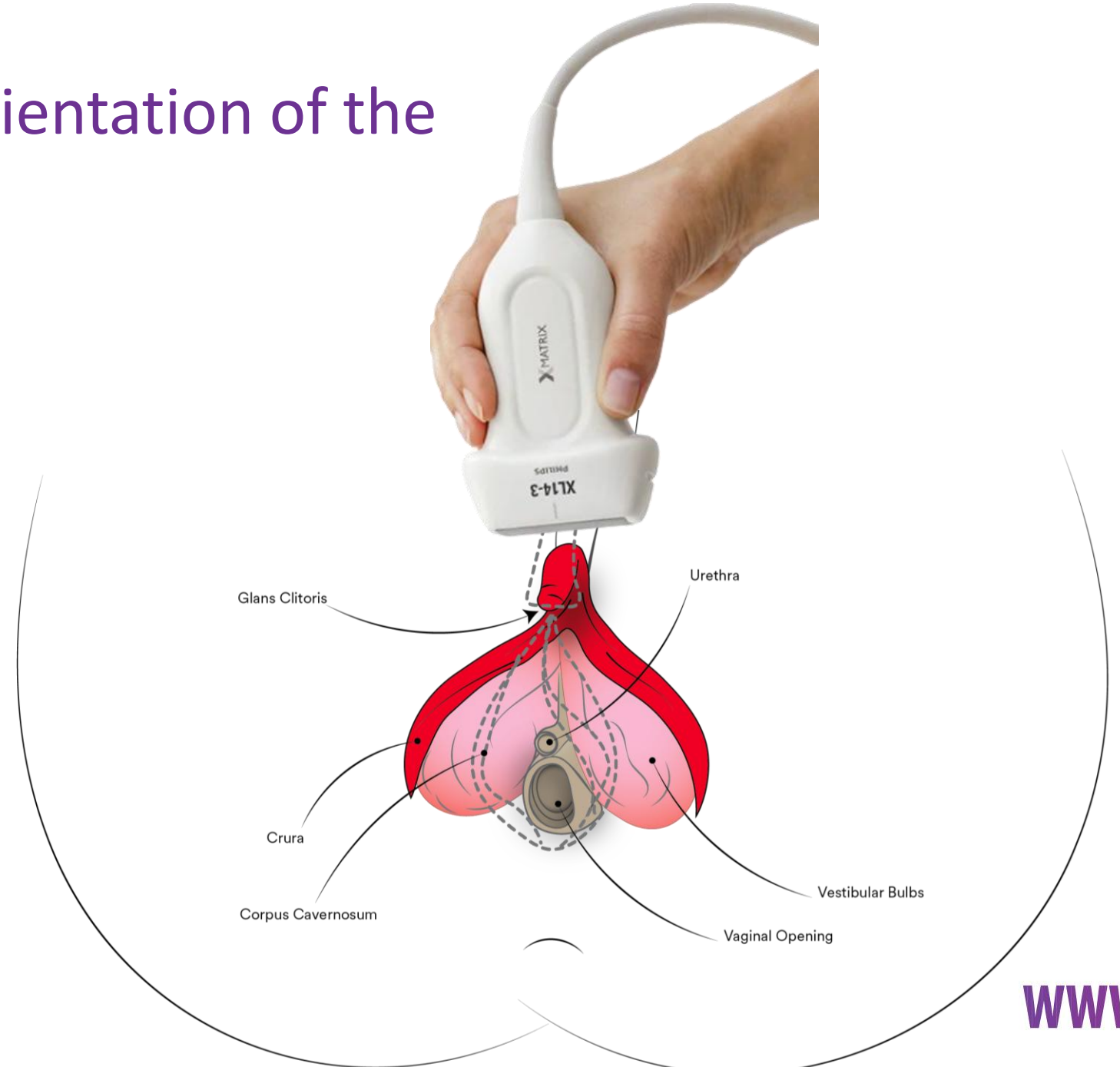
Place the transducer on the vulva, over the glans.



Sagittal orientation of the transducer



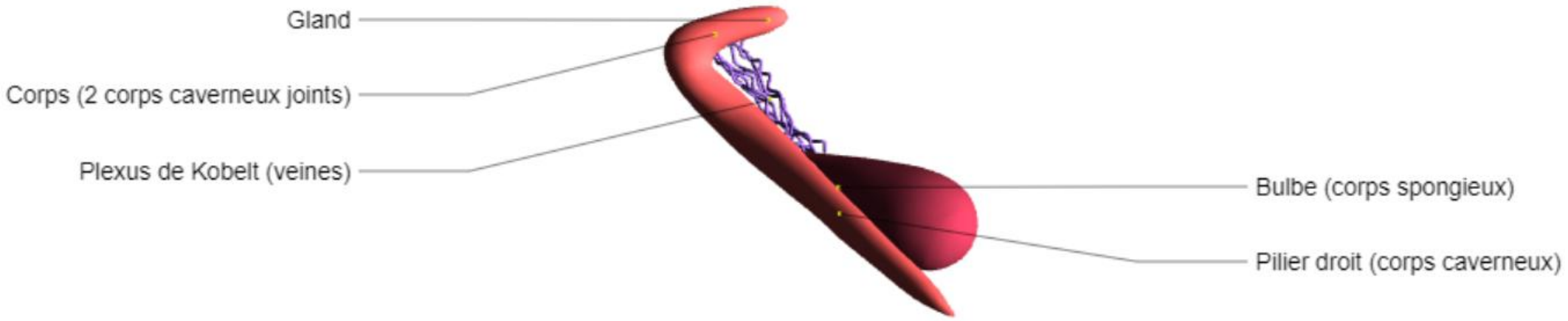
Transverse orientation of the transducer



Sagittal


0
2
2.5cm
P
Rest SAG
TIB
0.0
Frame Rate
25 Hz
Gain
56
Depth
2.5 cm
Transducer
L12-4
Preset
MSK
Power
-0.3 dB

3D Model to Help with **Sagittal** Orientation

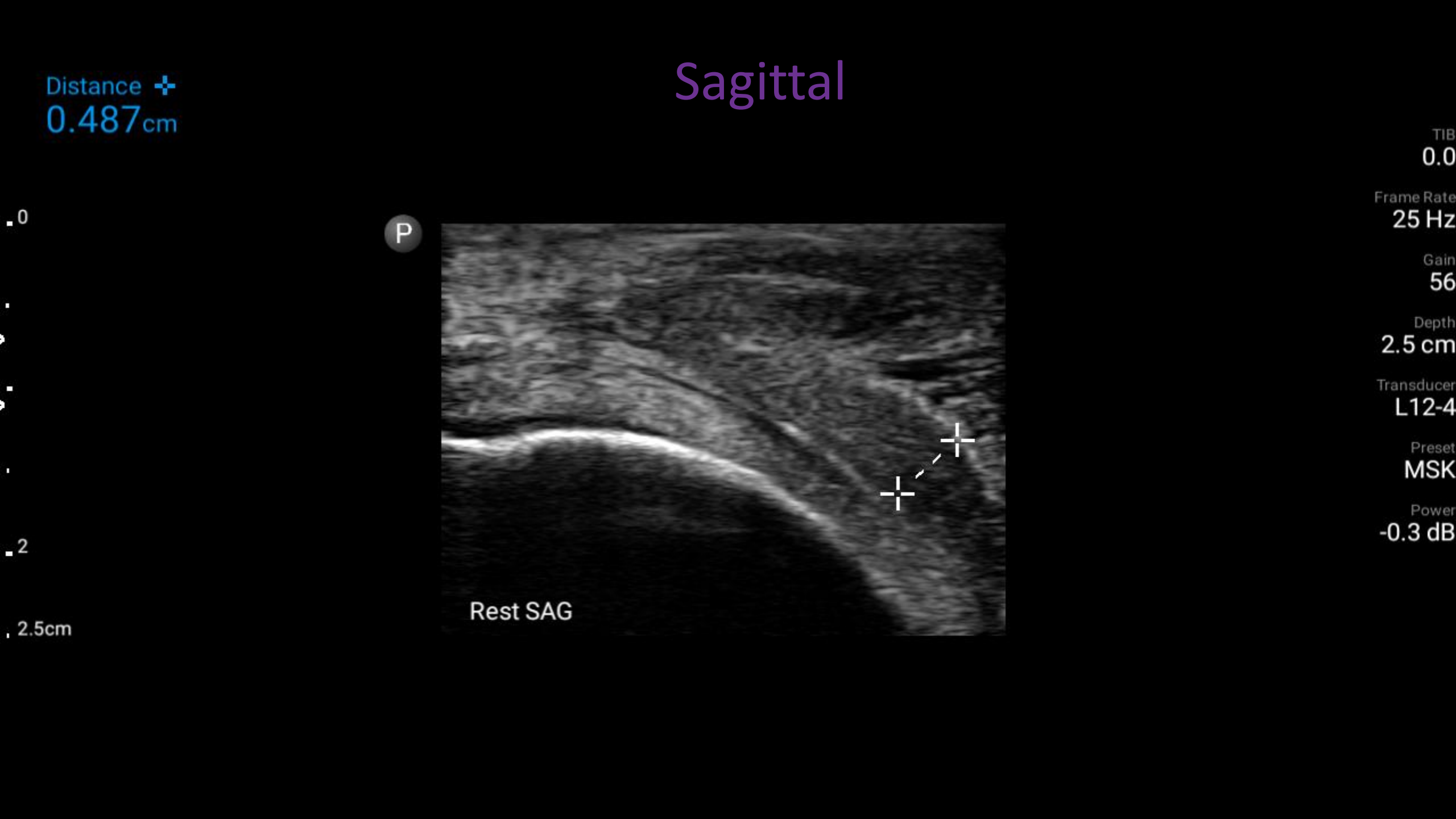


3D Model clitoris courtesy of P. Cosentino, based on data, sketches, and instructions from O. Fillod. March 2017. http://odile.fillod.free.fr/3DClitFR.htm Anatomy labels auto-translated from the original French.

Sagittal

Paired corpus spongiosum = vestibular bulbs (CB), glans (GL), raphe (RA), ischiopubic ramus (IR), and vagina (VA), Bartholin gland (BU).

Sagittal


Distance
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Frame Rate
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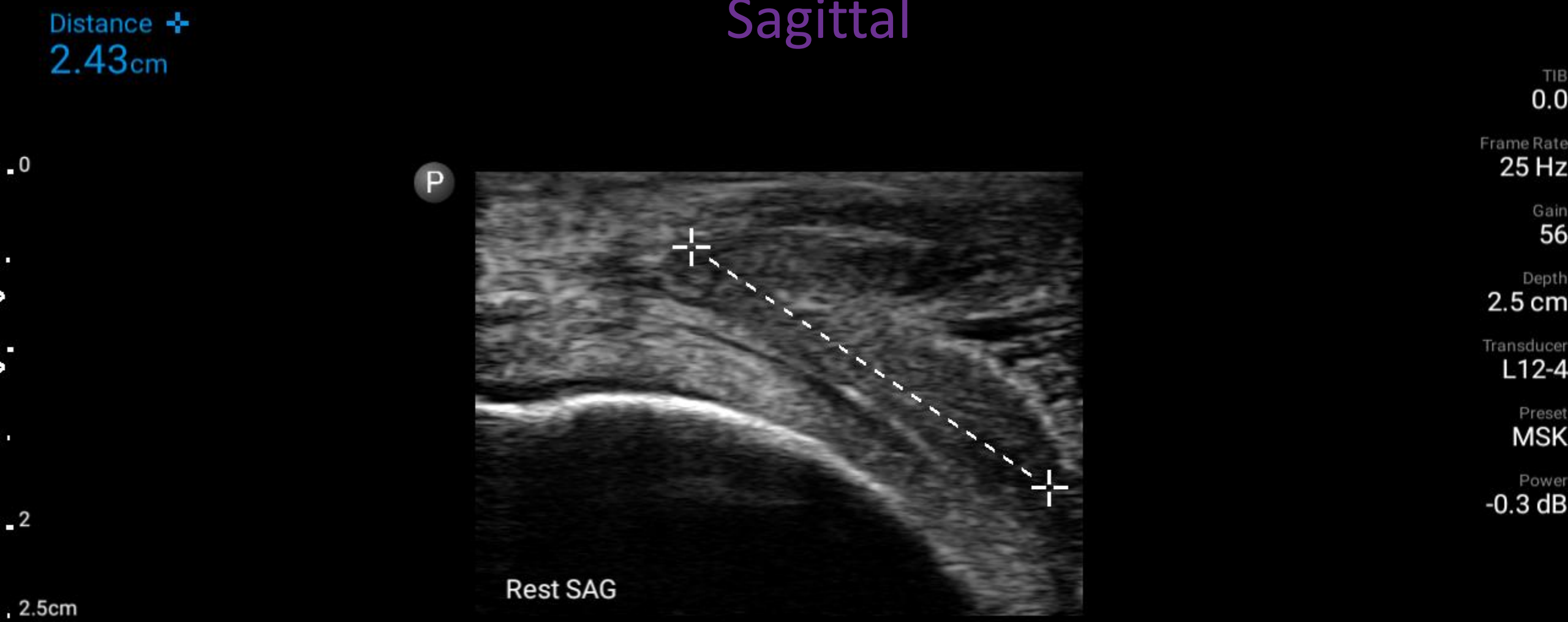
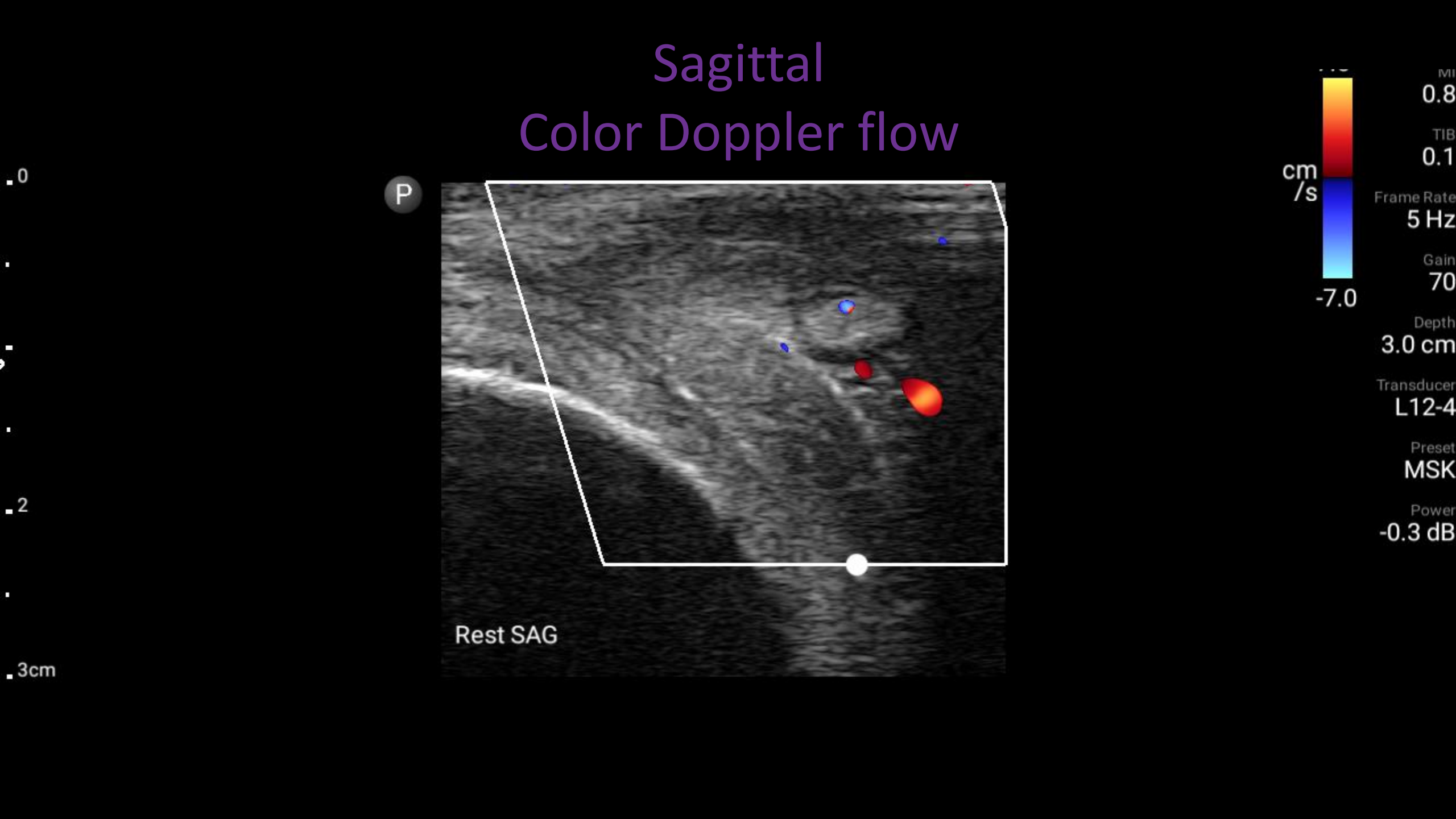
Sagittal

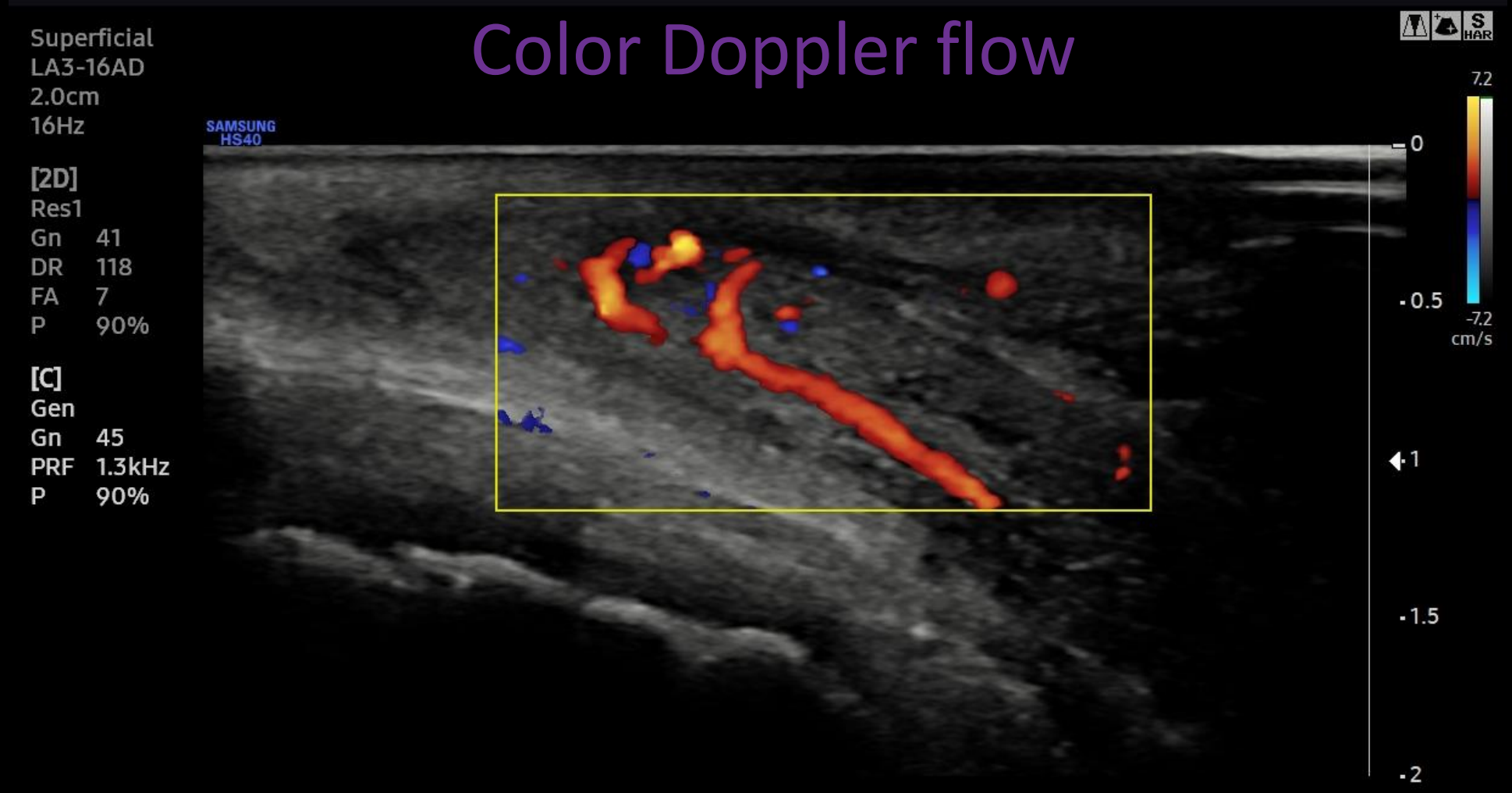


This length can be thought of as the Clitoral Erectile Length (CEL).

Sagittal
Color Doppler flow

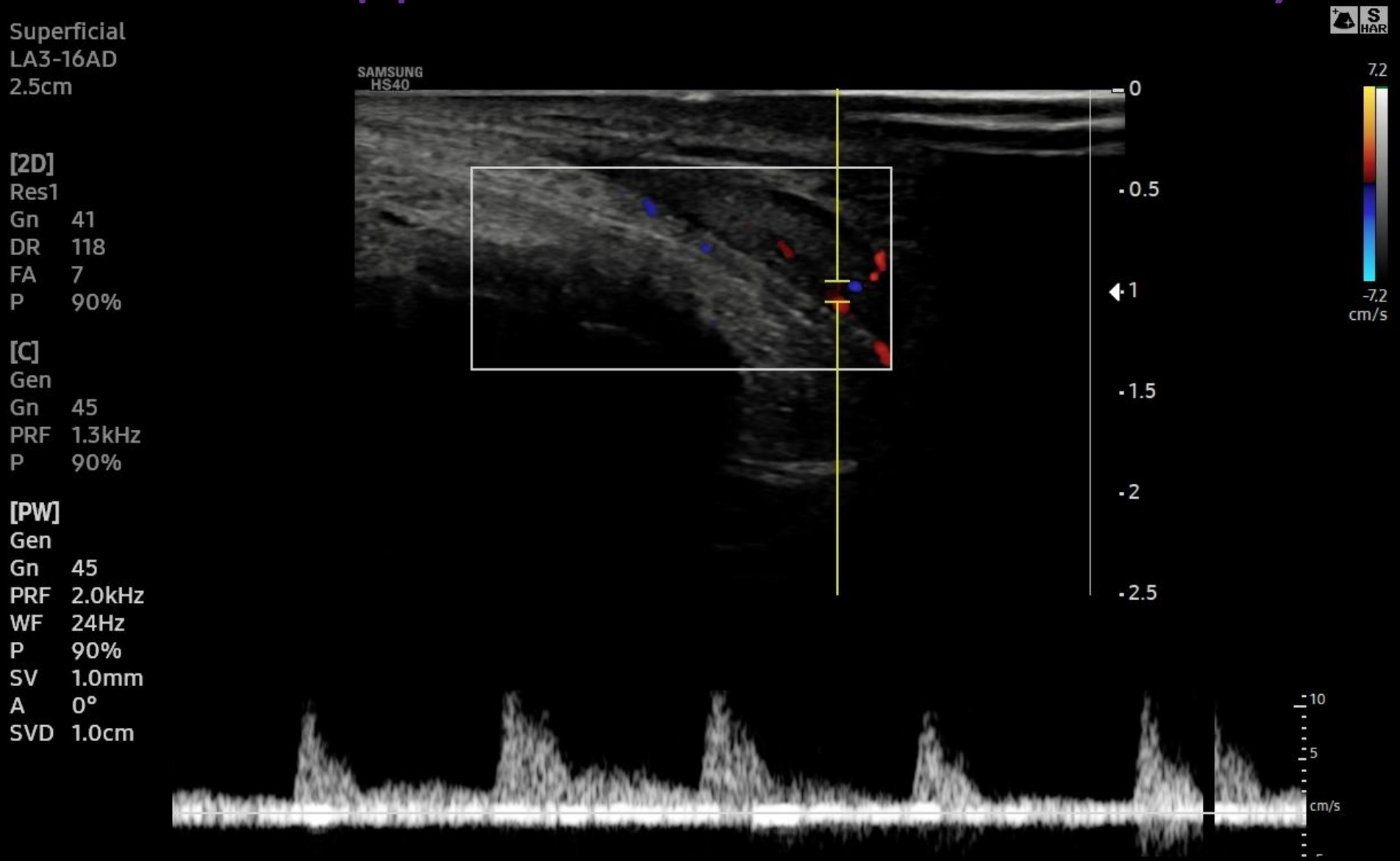


Sagittal
Color Doppler flow

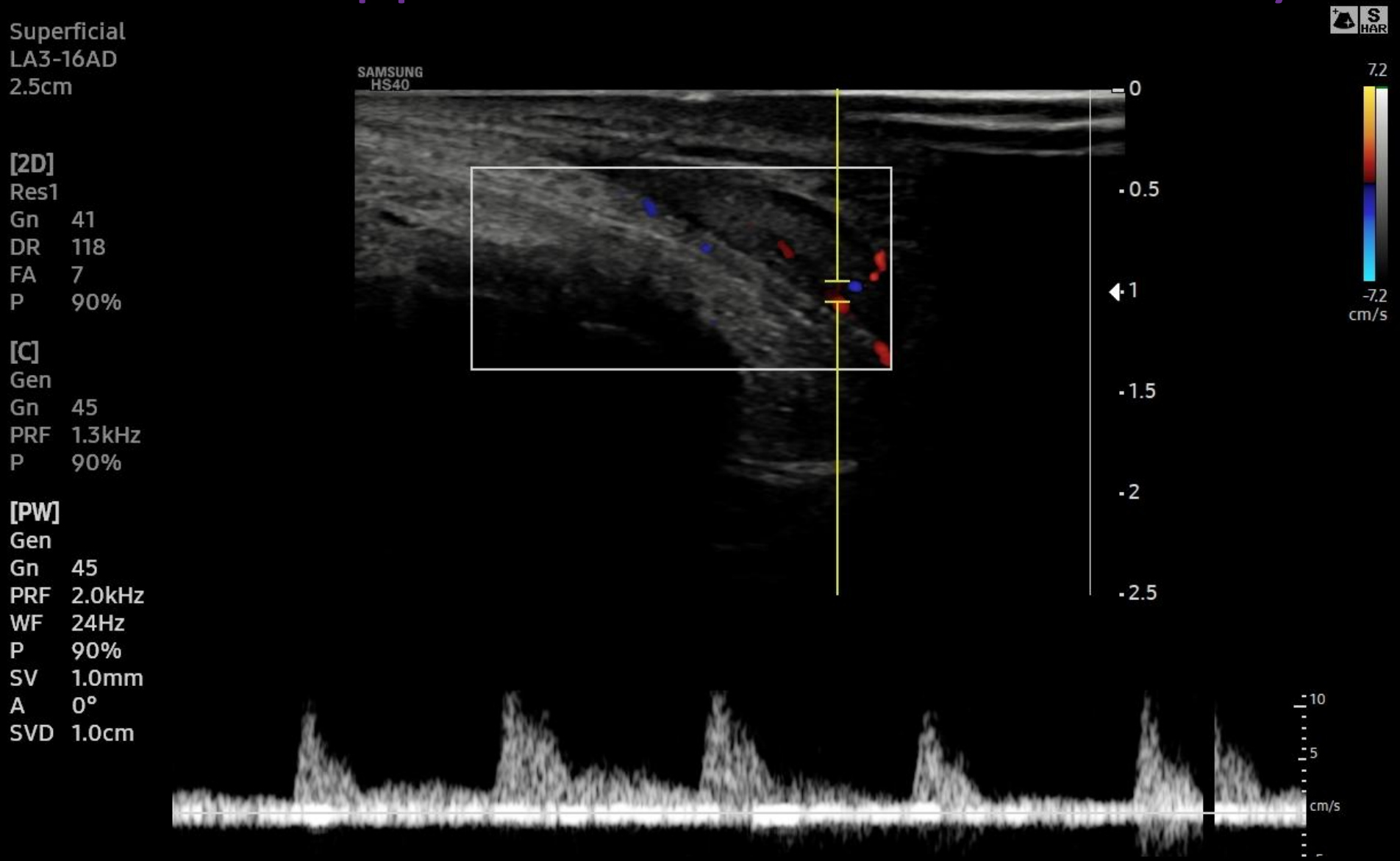


Dorsal artery of the clitoris

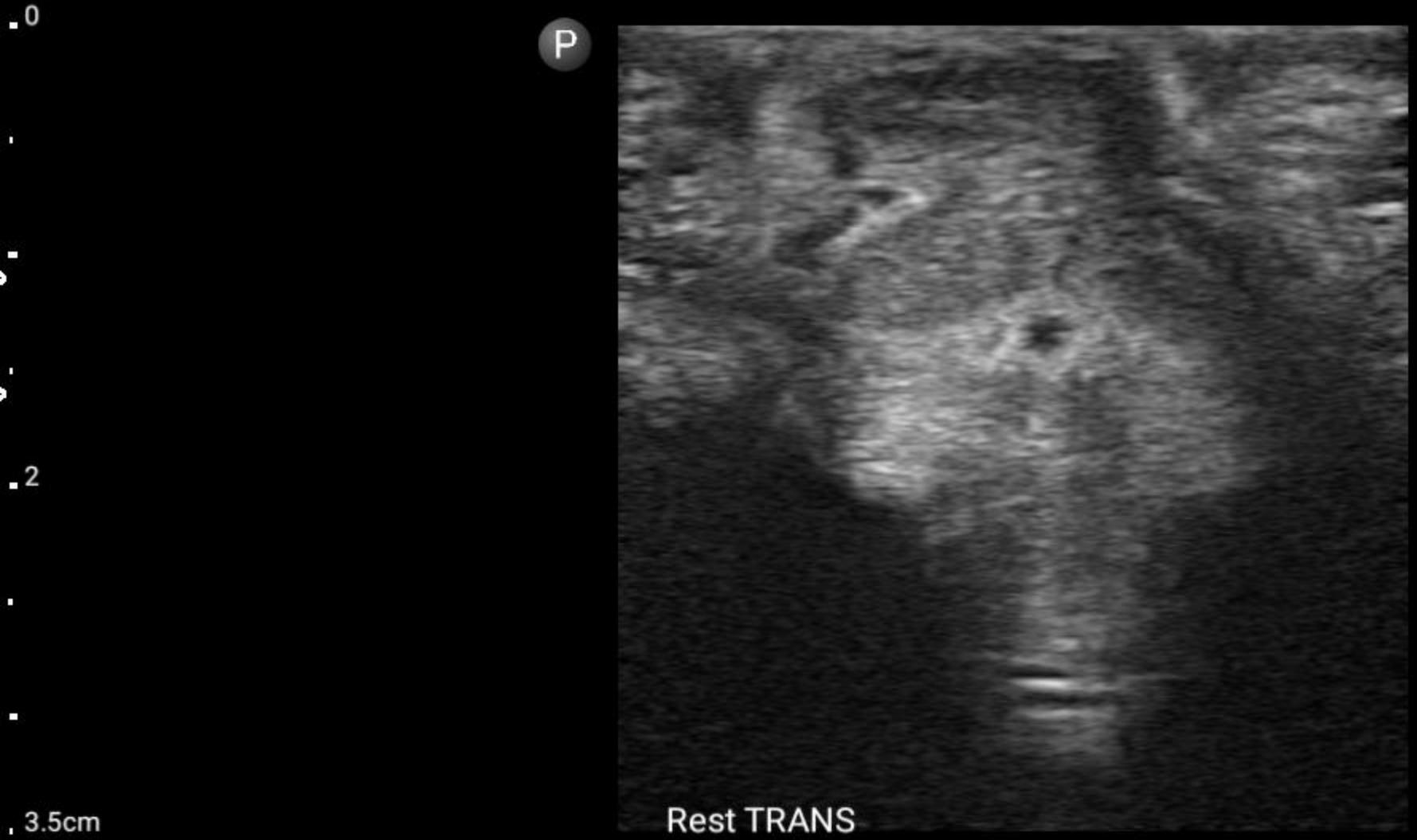
Sagittal
Color Doppler flow with arterial velocity



Sagittal
Color Doppler flow with arterial velocity



Transverse


0
2
3.5cm
P
Rest TRANS
MI
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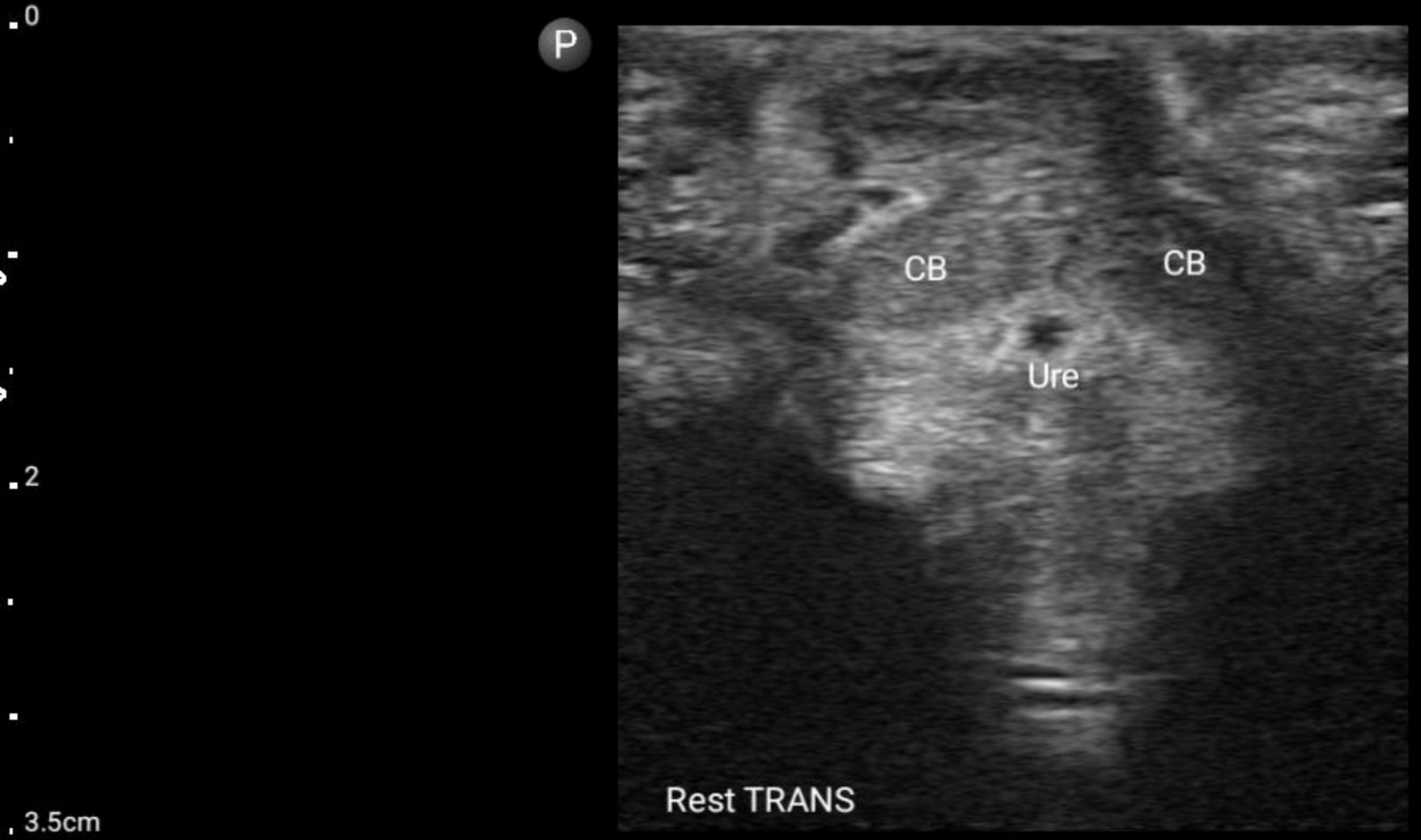
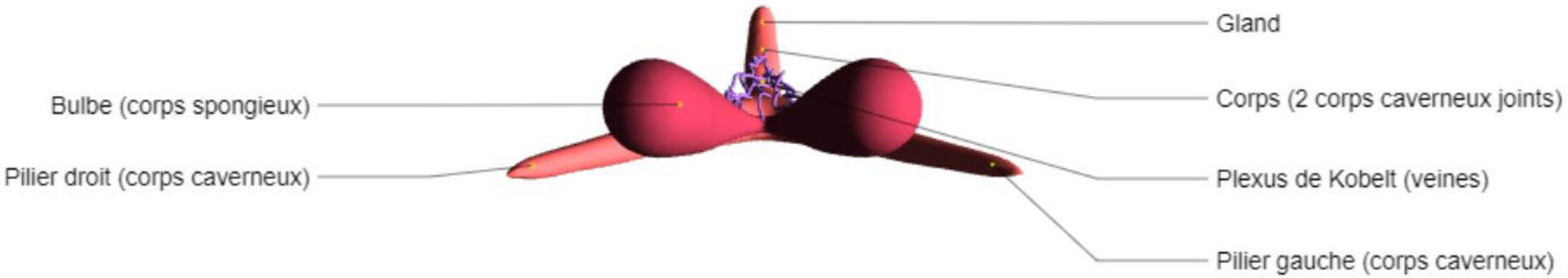
0.0
Frame Rate
24 Hz
Gain
74
Depth
3.5 cm
Transducer
L12-4
Preset
MSK
Power
-0.3 dB

Transverse



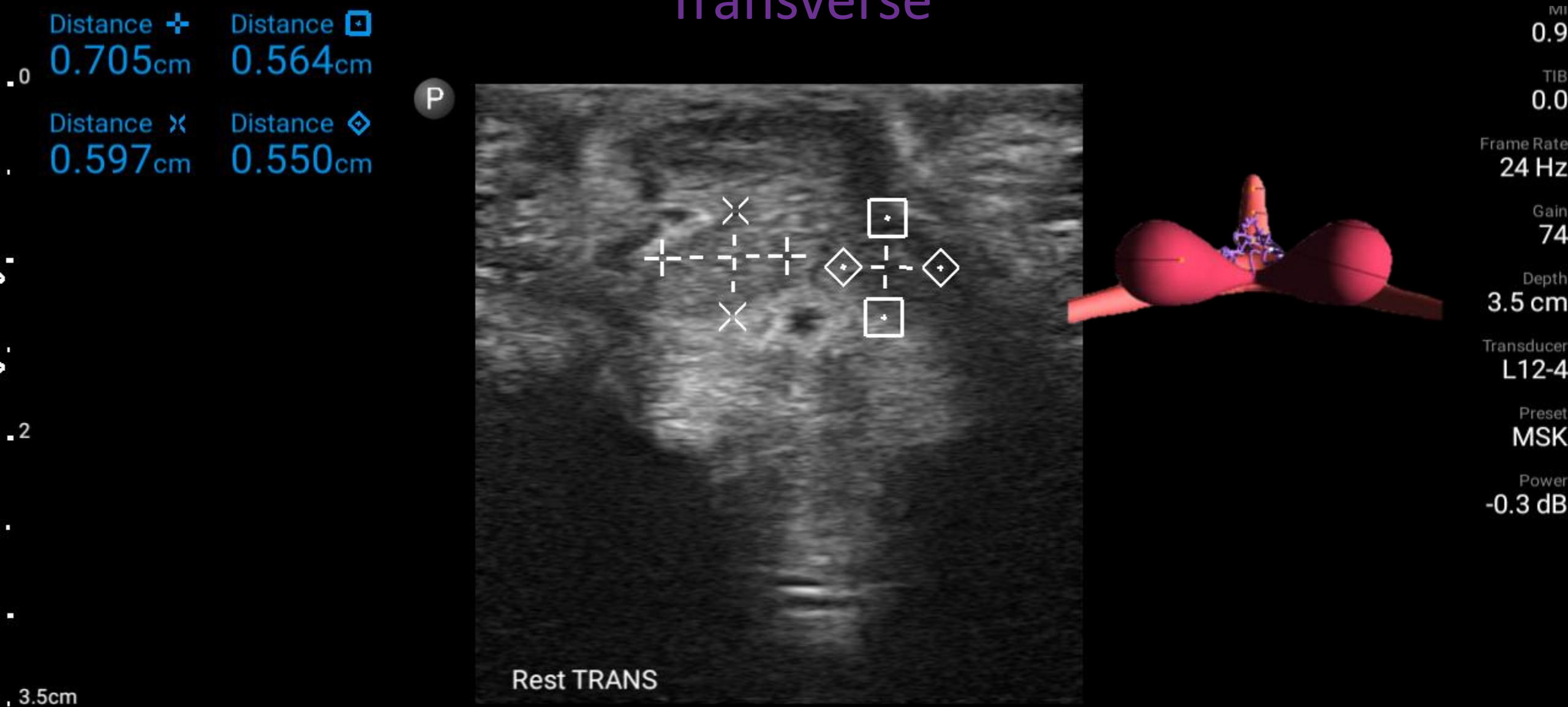
Paired vestibular bulbs = corpus spongiosum (CB), urethra (Ure).

3D Model to Help with **Transverse** Orientation

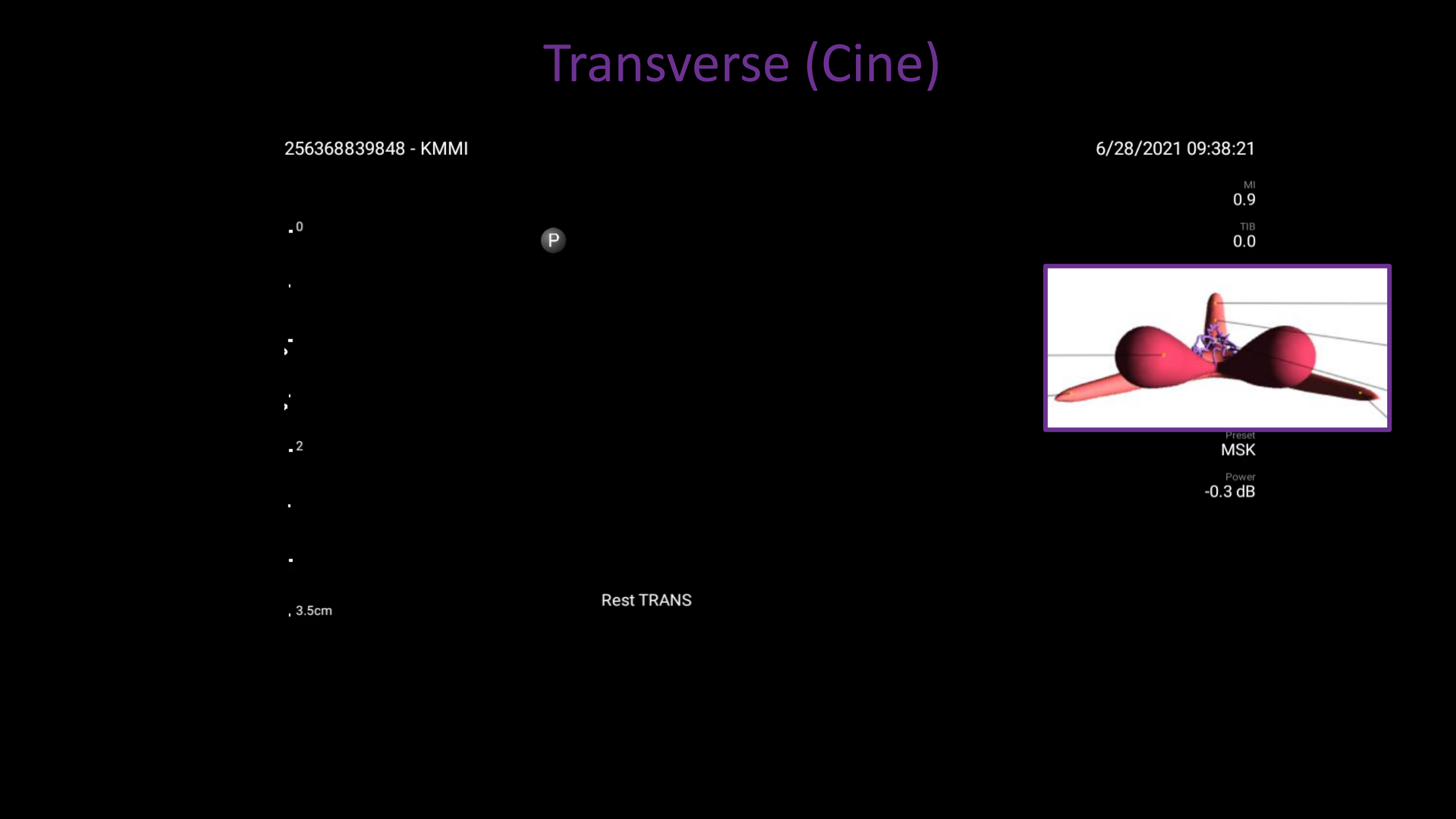


3D Model clitoris courtesy of P. Cosentino, based on data, sketches, and instructions from O. Fillod. March 2017. http://odile.fillod.free.fr/3DClitFR.htm Anatomy labels auto-translated from the original French.

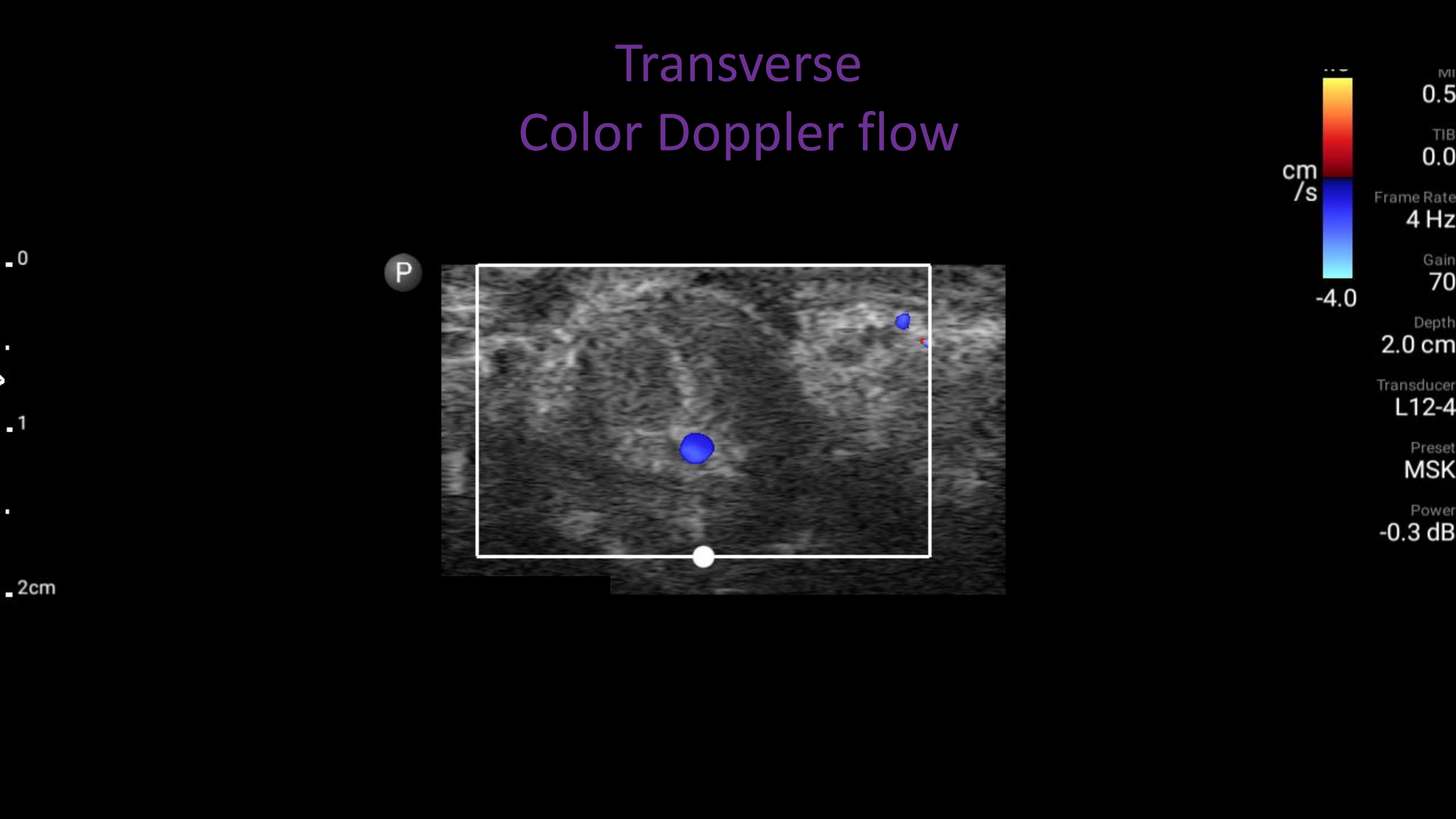
Transverse


Distance
0.705cm
Distance
0.564cm
Distance
0.597cm
Distance
0.550cm
0
2
3.5cm
P
Rest TRANS
MI
0.9
TIB
0.0
Frame Rate
24 Hz
Gain
74
Depth
3.5 cm
Transducer
L12-4
Preset
MSK
Power
-0.3 dB

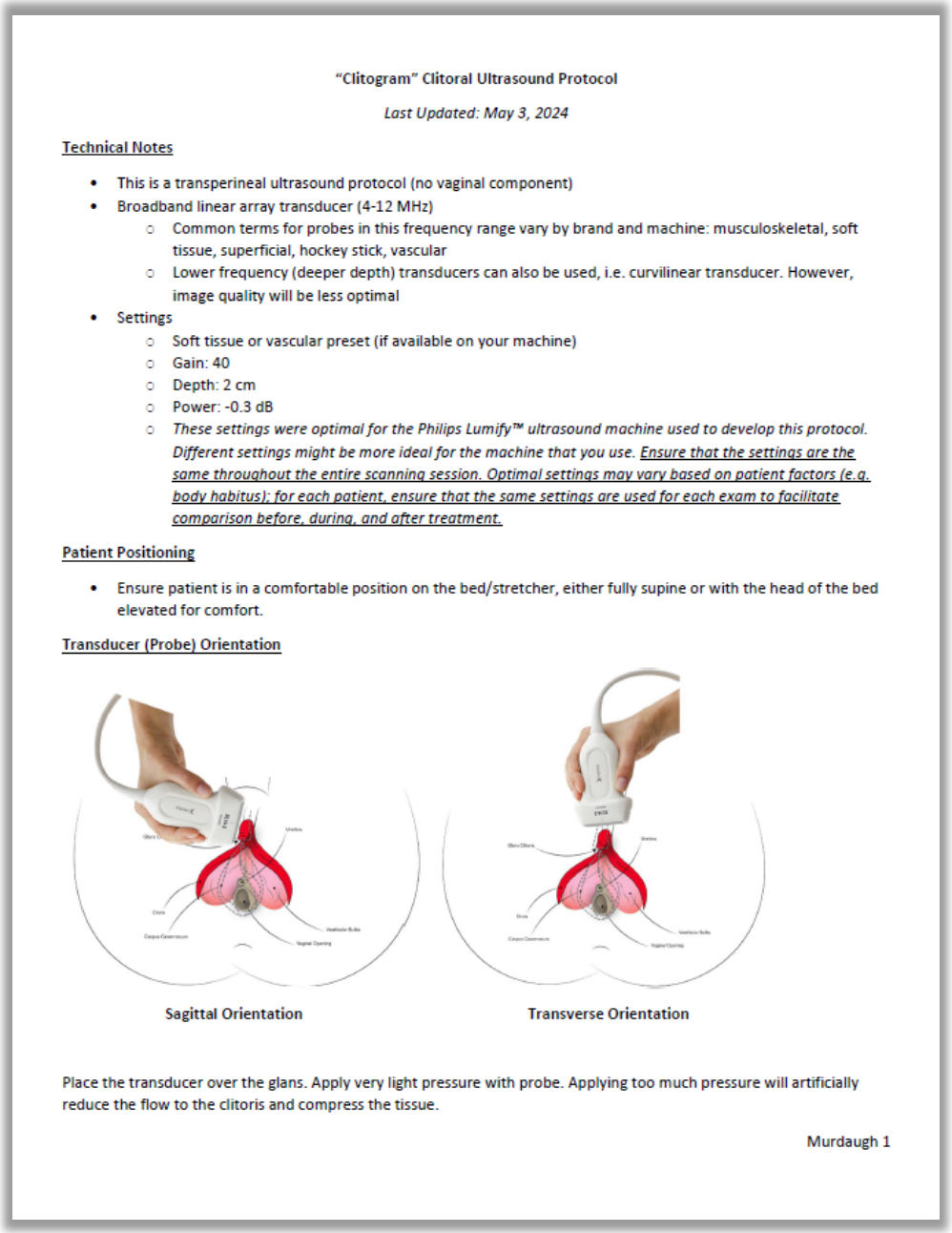
Transverse (Cine)



Transverse
Color Doppler flow



Download the Checklist



"Clitogram" Clitoral Ultrasound Protocol

Last Updated: May 3, 2024

Technical Notes

- This is a transperineal ultrasound protocol (no vaginal component)
- Broadband linear array transducer (4-12 MHz)
  - Common terms for probes in this frequency range vary by brand and machine: musculoskeletal, soft tissue, superficial, hockey stick, vascular
  - Lower frequency (deeper depth) transducers can also be used, i.e. curvilinear transducer. However, image quality will be less optimal
- Settings
  - Soft tissue or vascular preset (if available on your machine)
  - Gain: 40
  - Depth: 2 cm
  - Power: -0.3 dB
  - *These settings were optimal for the Philips Lumify™ ultrasound machine used to develop this protocol. Different settings might be more ideal for the machine that you use. Ensure that the settings are the same throughout the entire scanning session. Optimal settings may vary based on patient factors (e.g. body habitus); for each patient, ensure that the same settings are used for each exam to facilitate comparison before, during, and after treatment.*

Patient Positioning

- Ensure patient is in a comfortable position on the bed/stretcher, either fully supine or with the head of the bed elevated for comfort.

Transducer (Probe) Orientation

Sagittal Orientation

Transverse Orientation

Place the transducer over the glans. Apply very light pressure with probe. Applying too much pressure will artificially reduce the flow to the clitoris and compress the tissue.

Murdaugh 1

https://www.dropbox.com/scl/fi/ct9fz1o1ihzkn33eu3d70/Murdaugh_Clitoral-Ultrasound-Protocol-Checklist.pdf?rlkey=xvvb30i730fykwughb7jqyl3l&st=qc258x64&dl=0

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4. Clinical Applications

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4. Clinical Applications

- Establishing patient baseline and changes on follow-up
  - Morphology and blood flow
- Evaluating female sexual dysfunction (FSD)
  - Might provide a physiological explanation or anatomic insight into underlying cause for some patients
- Groin trauma
  - Standard of care for men in emergency room: scrotal and/or penile ultrasound
- Pre- and post-vulvar procedures
- Survivors of FGM/C

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- **Pre- and post-vulvar procedures**
- **Survivors of FGM/C**

4. Clinical Applications

Pre- and Post-Vulvar Procedures

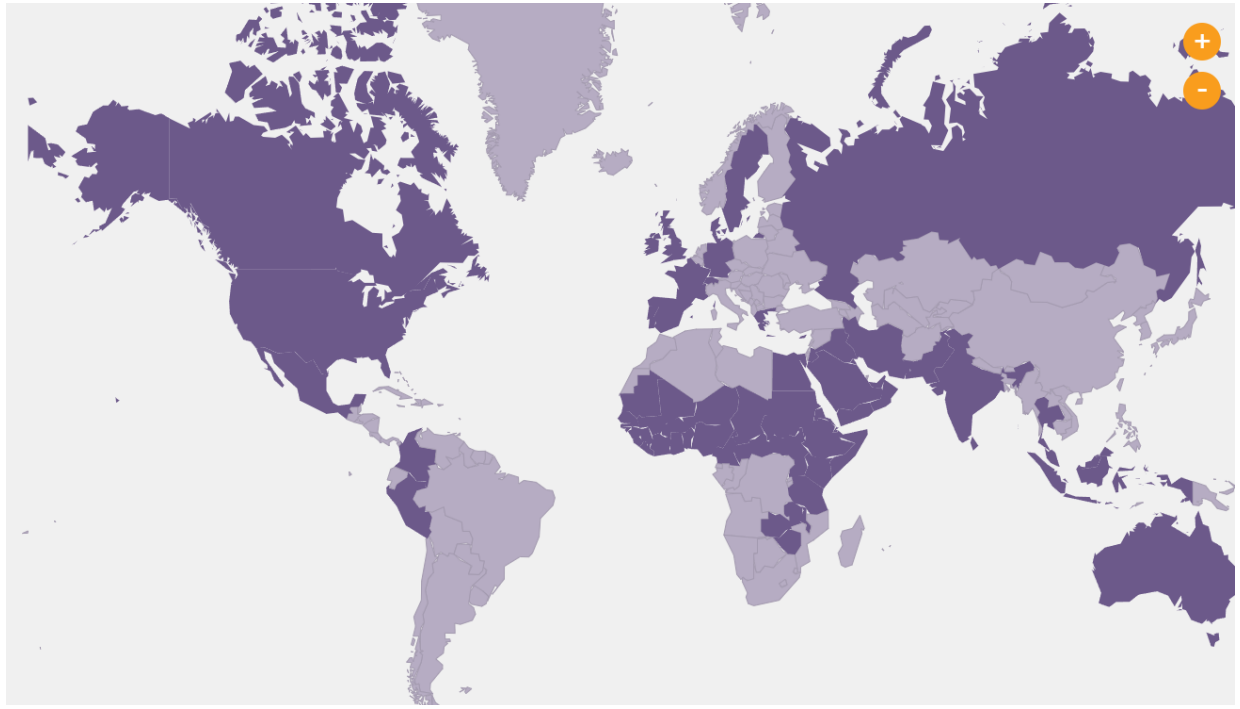
- Surgery
  - Intra-operative imaging
    - Nerves are **not** visualized on the Clitogram™ protocol
    - “Nerves and vessels run together”
  - Evaluate for vulvar and clitoral hematoma

- Radiation Therapy
  - Change in clitoral architecture and blood flow with radiation therapy?
    - Dr. Deborah Marshall, Mount Sinai

4. Clinical Applications

Survivors of FGM/C

- Female Genital Mutilation/Cutting (FGM/C) encompasses all procedures involving the partial or total removal of the external female genitalia or other injury to the female genital organs for non-medical reasons
- Often performed on girls before the age of five
- Deeply rooted in tradition and perpetuated by societal norms and community expectations



+200 million women and girls are impacted by FGC

FGC occurs in over **90 countries** globally

4.1m girls are at risk each year

ORCHID PROJECT

WORKING TOGETHER TO END FEMALE GENITAL CUTTING

https://www.orchidproject.org/about-fgc/where-does-fgc-happen/

4. Clinical Applications

Survivors of FGM/C

- Many survivors of FGM/C believe that their entire clitoris has been removed
- We scanned survivors and showed them that most of the clitoris (hidden beneath the skin) is preserved and can stimulated
- Trauma-Informed approach is key
  - Some women might want to see their ultrasound images, and others might not
  - It is important to reassure patients that any of these reactions during the clitoral ultrasound
  - Can be a life-changing scan: tend to emotion

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5. Creative Research Applications

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CLINICAL CASE

Clitoral blood flow after use of gel containing L-arginine and L-citrulline

K. Lovie*, A. Marashi

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KEYWORDS
Clitoris;
Sonography;
Arginine;
Citrulline

Summary L-arginine and its precursor and metabolite, l-citrulline, are two amino acids involved in the production of nitric oxide (NO). As a result, they increase blood flow and have been used to treat male sexual dysfunction. We aimed to evaluate whether a topical gel containing l-arginine and l-citrulline could increase blood flow to the clitoris. Sonography of the clitoris was performed on a healthy 32-year-old volunteer before and after applying the gel externally to the vulva. The ''before'' scans were obtained using a neutral ultrasound gel (without l-arginine or l-citrulline). This allowed us to verify that the observations were due to the active ingredients of the gel, and not from massage associated with its application. Control images without gel could not be obtained, since acquisition of ultrasound images requires ultrasound gel in order to reduce acoustic impedance. The scans were obtained with a Philips Lumify™ ultrasound (Koninklijke Philips N.V., Amsterdam, Netherlands) with a L12-4 linear array transducer (4—12 MHz). Clitoral blood flow was assessed qualitatively (color Doppler images), as well as quantitatively (peak systolic velocity, end diastolic velocity, and resistive index of the deep artery of the clitoris). Clitoral blood flow and velocities increased after application of the gel containing l-arginine and l-citrulline at the time points assessed (5 and 15 minutes). Difficulty achieving clitoral stimulation is a major cause of sexual dysfunction. Clinicians can use these findings to counsel patients about using gels to increase clitoral blood flow.

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Clitoral Blood Flow After Use of Gel Containing L-Arginine and L-Citrulline

Amir Marashi, MD, FACS, FACOG[1], Kimberly Lovie, MD, MS[1]

1: Department of Medical Imaging and AI, New H Medical, PC, 176 Johnson Street #6H Brooklyn, New York 11201

Introduction

L-arginine and its precursor, l-citrulline, are two amino acids involved in the production of nitric oxide (NO). As a result, they increase blood flow and have been used to treat male sexual dysfunction. Some lubricants and gels contain l-arginine and are applied directly to the genital area to increase blood flow in men and women. Although these products have been evaluated subjectively through patient reports of increased warmth, arousal, and orgasm, to our knowledge, they have not been evaluated quantitatively on the clitoris. Moreover, the effect of gels combining both l-arginine and l-citrulline have not been reported in the medical literature.

Aim

To use sonography to evaluate whether a topical gel containing l-arginine and l-citrulline could increase blood flow to the clitoris.

Methods

- Sonography of the clitoris was performed on a healthy 32-year-old volunteer before and after applying the gel externally to the vulva.
- The “before” scans were obtained using a neutral ultrasound gel (without l-arginine or l-citrulline). This allowed us to verify that the observations were due to the active ingredients of the gel, and not from massage associated with its application.
- Control images without gel could not be obtained, since acquisition of ultrasound images requires ultrasound gel in order to reduce acoustic impedance.
- The scans were obtained with a Philips Lumify™ ultrasound (Koninklijke Philips N.V., Amsterdam, Netherlands) with a L12-4 linear array transducer (4-12 MHz).
- Clitoral blood flow was assessed qualitatively (color Doppler images), as well as quantitatively (peak systolic velocity, end diastolic velocity, and resistive index of the deep artery of the clitoris).

Results

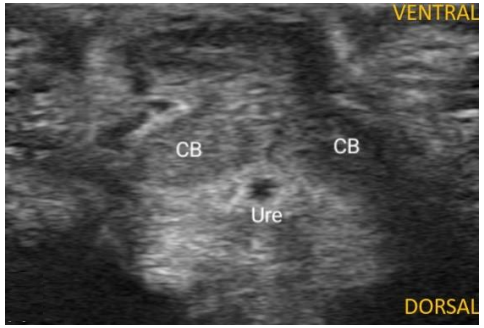

Figure 1. Transverse view of the clitoris depicting the paired cavernous bodies (CB) and urethra (Ure).

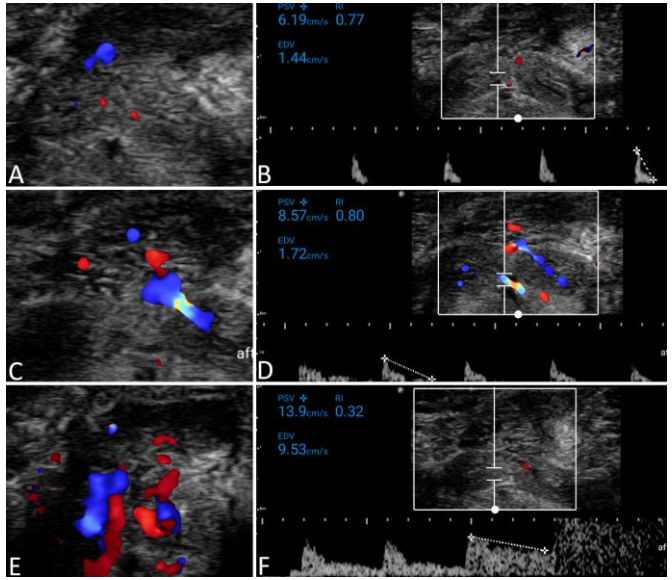

Figure 2. Qualitative and quantitative assessments of clitoral blood flow before (a-b), at 5 minutes (c-d), and at 15 minutes (e-f) after application of gel containing l-arginine and l-citrulline.

Conclusions

• Clitoral blood flow and velocities increased after application of a gel containing l-arginine and l-citrulline at the time points assessed (5 and 15 minutes).

•Difficulty achieving clitoral stimulation is a major cause of sexual dysfunction. Clinicians can use these findings to counsel patients about using gels to increase clitoral blood flow.

Acknowledgements

We thank Dr. Nima Nouri Naini for his support and helpful radiology discussions from the beginning of our research endeavors.

Contact and Collaboration

Interested in collaborating with us? Please contact us to continue the discussion.

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RESEARCH

Pilot sonographic study of clitoral blood flow and size after use of sexual devices

Étude exploratoire échographique du débit sanguin et de la dimension du clitoris après l'utilisation de sex toys

K. Lovie*, A. Marashi

Department of Medical Imaging and AI, New H Medical, PC, 176 Johnson Street #6H Brooklyn, New York 11201, United States

KEYWORDS
Clitoris;
Orgasm;
Sexual device;
Sonography

Summary
Objectives. — Over 50% of women in the United States report using sexual devices. These devices, which are often used recreationally to increase the likelihood of arousal and orgasm, can also be used therapeutically in the setting of sexual dysfunction. Despite their widespread use and association with improved sexual wellness, their effect on the clitoris has not been investigated. We aimed to evaluate changes in clitoral blood flow and size in response to stimulation with various sexual devices.
Methods. — Clitoral sonography was performed on a healthy volunteer before and after stimulation with each of the following sexual devices: wand applied externally, internal vibrator inserted vaginally, and air pulse stimulation of the glans clitoris. The scans were obtained with a Philips Lumify™ ultrasound (Koninklijke Philips N.V., Amsterdam, Netherlands) using a L12-4 linear array transducer (4—12 MHz) and a C5-2 broadband curved array transducer (2—5 MHz).
Results. — We observed that stimulation with sexual devices increased blood flow to different areas of the clitoris, and led to changes in clitoral area and clitoral erectile length (CEL).
Conclusion. — Our findings suggest that female orgasms are of more than one or two types (clitoral versus vaginal), and likely occupy a spectrum. This may provide insight into using sexual devices as treatment options for female sexual dysfunction.

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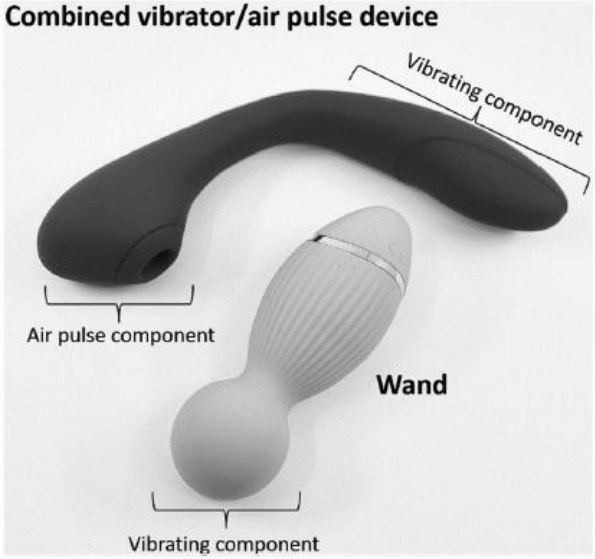

Figure 2 Combined vibrator/air pulse device, with a vibrating component designed to be vaginally inserted, and air pulse component for clitoral stimulation. Wand with a vibrating component for vulvar stimulation.

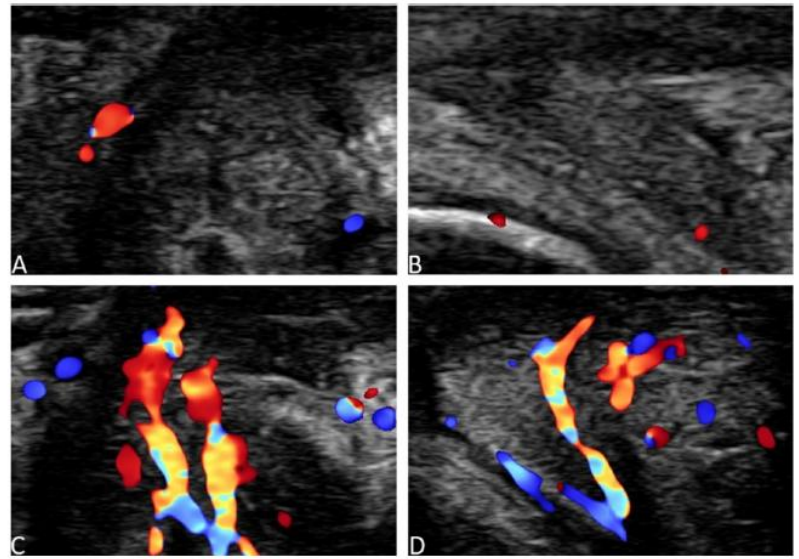

Figure 3 Transverse and sagittal views of the clitoris before (a—b) and after (c—d) stimulation with a wand.

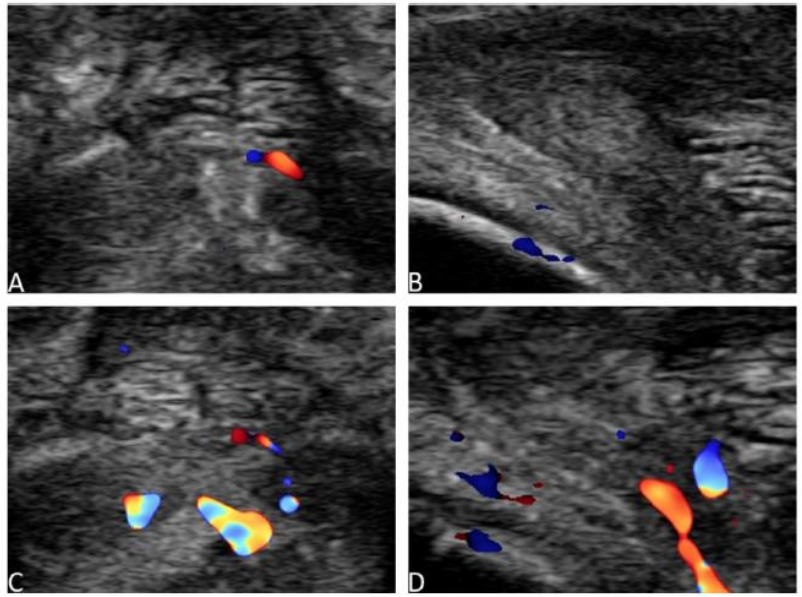

Figure 5 Transverse and sagittal views of the clitoris before (a—b) and after (c—d) stimulation with a vibrator inserted inside the vagina.

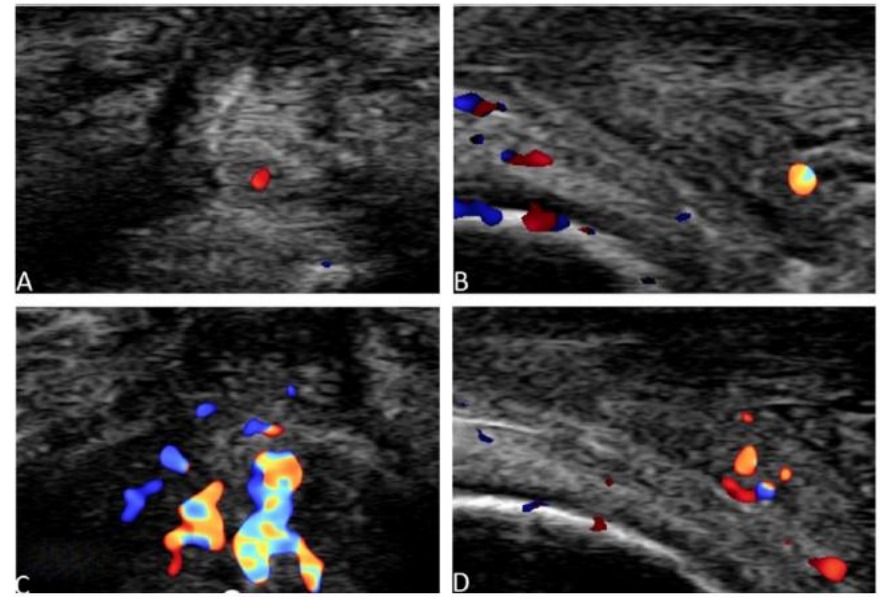

Figure 6 Transverse and sagittal views of the clitoris before (a—b) and after (c—d) stimulation with an air pulse device.

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6. Challenges and Need for Advocacy

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Scanning Challenges

- Technically difficult scan to perform
  - Steep learning curve for ultrasound in general
  - Confidence in identifying structures comes with practice (10+ scans)
  - Compression of small clitoral vessels
- Limited number of trained clinicians
- Multi-disciplinary approach needed
  - Collaboration between Radiologists, Urologists, OB/GYN, PT

6. Challenges and Need for Advocacy

Clinical Challenges

- No CPT code for clitoral ultrasound
  - Barrier to billing and reimbursement
  - Consider CPT 76856 (Ultrasound Pelvic – Non-OB)
  - Consider CPT 76870 (Genitalia/Scrotal)

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  - Barrier to billing and reimbursement
  - Consider CPT 76856 (Ultrasound Pelvic – Non-OB)
  - Consider CPT 76870 (Genitalia/Scrotal)

What is CPT Code 76870

CPT code 76870 is used to describe an ultrasound examination of the scrotum and its contents. This non-invasive imaging procedure is typically performed to evaluate conditions such as testicular pain, swelling, or masses. It helps healthcare providers assess the anatomy and detect any abnormalities in the scrotal area, including the testicles, epididymis, and surrounding tissues.

6. Challenges and Need for Advocacy

Clinical Challenges

- Serial clitoral ultrasound scans across the patient's life course may be necessary to establish their baseline, as "normal" parameters may vary significantly
  - Athletic status, chronic medical conditions may influence blood flow without being predictive of sexual dysfunction
- Individualized baselines might be helpful for accurate diagnosis and management

6. Challenges and Need for Advocacy

Research Challenges

- Funding opportunities can be limited
- Multi-disciplinary approach needed
- Recruitment can be difficult for sensitive scans

Give it a try!

The only way to get comfortable scanning is to do MANY scans!

"Clitogram" Clitoral Ultrasound Protocol

Last Updated: May 3, 2024

Technical Notes

- This is a transperineal ultrasound protocol (no vaginal component)
- Broadband linear array transducer (4-12 MHz)
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  - Lower frequency (deeper depth) transducers can also be used, i.e. curvilinear transducer. However, image quality will be less optimal
- Settings
  - Soft tissue or vascular preset (if available on your machine)
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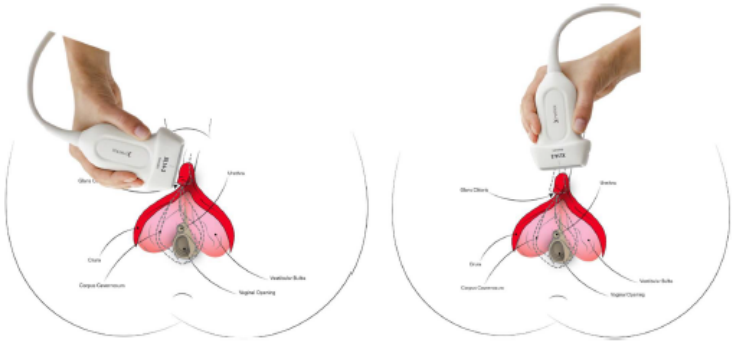
Patient Positioning

- Ensure patient is in a comfortable position on the bed/stretcher, either fully supine or with the head of the bed elevated for comfort.

Transducer (Probe) Orientation



Sagittal Orientation | Transverse Orientation

Place the transducer over the glans. Apply very light pressure with probe. Applying too much pressure will artificially reduce the flow to the clitoris and compress the tissue.

Murdaugh 1

https://www.dropbox.com/scl/fi/ct9fz1o1ihzkn33eu3d70/Murdaugh_Clitoral-Ultrasound-Protocol-Checklist.pdf?rlkey=xvvb30i730fykwughb7jqyl3l&st=qc258x64&dl=0

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Thank you!

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