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PICTORIAL REVIEW

Surface transperineal ultrasound and vaginal abnormalities: applications and strengths

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ABSTRACT

The role of ultrasound in the assessment of the female pelvis whether using transabdominal/transluminal approach is well established. Little was reported about the use of the superficial transperineal approach that could provide a full assessment of the lower cervix and vagina, which may be overlooked in the standard examinations. The proximity of the probe to the vagina helps not only the detection of organ abnormalities but also proper characterization and differentiation of vaginal masses. We discuss the diagnostic role of this superficial ultrasound approach in improving the perception and interpretation of the anatomy and different diseases of the vagina.

INTRODUCTION

Little attention is given to the vagina during imaging and interpretation of the female pelvis. Unless having a gross pathology; the vagina could be easily underestimated: on transvaginal ultrasound due to the position of the endovaginal probe rendering the vagina out of the field, on computed tomography (CT) due to poor soft tissue discrimination of the vaginal walls and on magnetic resonance imaging (MRI). The operator should focus on the vagina with thin slice thickness and proper choice of the degree of angulation and used MR sequence, otherwise there is limited evaluation of the vagina.¹

In this article, we demonstrate the transperineal approach of the ultrasound imaging in the assessment of the vagina. We propose the use of this surface ultrasound scanning of the perineum as a chance for proper evaluation of the different vaginal pathologic processes including the subtle ones. Through the current review, we discuss the indications, technique of scanning, strengths and limitations.

TRANSPERINEAL ULTRASOUND

Indications

Transperineal is an underused approach of the ultrasound. The considering of this superficial approach could enhance the diagnostic performance of the ultrasound modality in the assessment of the vaginal lesions especially those in virgin ladies who had pathologies obscured behind the hymen, where the trans-abdominal approach is not suitable and the trans-vaginal approach is not feasible.

Also, it is a dynamic real-time examination, so we can detect subtle abnormalities as small vaginal fistulae and pelvic floor functional abnormalities that are not seen in the static imaging. This renders transperineal ultrasound to be an alternative/complementary method to MR imaging, yet more available and less expensive.

In our institute, we perform vaginal assessment by the transperineal ultrasound approach in cases of:

Congenital

(i) Suspected lower uterine segment outflow obstruction: to determine the level of obstruction and detect cervical/vaginal atresia; (ii) absent uterus, to detect and measure the lower vaginal pouch (if present) (iii) ambiguous genitalia, urogenital sinus syndrome to detect the confluence between the urethra and vagina.

Traumatic

(i) Vagino-anorectal fistulae (ii) vagino-urethral fistulae (iii) vesical fistulae.

Neoplastic

(i) Palpable vulval/vaginal masses and cysts (ii) Cervical carcinoma to estimate degree of vaginal extension.

Other purposes

(i) In the case of placenta accreta to assess lower uterine segment and its relation with the urinary bladder to exclude/confirm placenta percreta; (ii) pelvic floor

Figure 1. A superficial transperineal ultrasound sagittal orientation. (a) the original ultrasound image and (b) the same image with line tracing and delineation of the different pelvic structures: anterior there is the landmark which is the symphysis pubis (SP): semilunar line, then the urethra (U), followed by the anterior vaginal wall (Va), the posterior vaginal wall (Vb), and the most posterior the rectal walls (R).

disorders especially in cases of stress incontinence and vaginal prolapse.

Technique of approach

Patient should empty the urinary bladder, except in cases of stress incontinence for which moderate filling is needed. Scanning is performed with the patient lying supine in the lithotomy position. In uncooperative children, sedation is required.

The current work was approved by the institutional review board of the Radiology Department, Kasr ElAiny Hospital, Cairo University, and the included patients gave informed consent.

We used the endoluminal probe with frequency 7–8 MHz. The transducer tip is covered with gel, the condom is placed, then the tip is inserted in between the labia minora and gently placed on the vaginal orifice. Such application provides good visualization of the structures in the lower part of the pelvis, which is from anterior to posterior: the symphysis pubis, whole urethra, overlaid

by a partially filled urinary bladder, the vagina, the anal canal and the rectum (Figure 1) and if the probe is introduced deeper into the vagina, it is also possible to assess the cervix (Figure 2).

We first perform real-time two-dimensional (2D) ultrasound scanning in the sagittal plane; bone of the symphysis pubis is used for anatomic orientation, the whole length of the vaginal walls, cervical lips and vaginal fornices are seen. Then we rotate the transducer to get images in the axial plane for evaluation of the vagina and para-vaginal space.

Three-dimensional (3D) ultrasound probe provides depth to the ultrasound image and good anatomical relations. The automatic 3D transvaginal transducer is placed on the perineum, post 2D ultrasound definition of the vagina. For image analysis, volume 3D rendering mode and multiplanar views are obtained off-line from stored 3D data.

Colour Flow mapping is superimposed on the 2D image in cases of vaginal masses and in pelvic floor disorders to assess

Figure 2. Normal vagina with two opposing walls and collapsed lumen. Ultrasound images (a) the original image without and (b) the same image with line tracing and delineation of the different pelvic: anterior is the urethra (U), followed by the anterior vaginal wall (Va), the posterior vaginal wall (Vp), the hyperechoic line in-between is the vaginal lumen. Calibre in the image was placed to show how to measure the thickness of the vaginal wall in a double layer, single layer thickness.

Figure 3. A coronal oblique plane of transperineal ultrasound, a. and b. showing posterior fornix of the normal vagina, during introducing the probe deeper in the vagina to see the whole vaginal length and the vaginal fornices. (a) The probe splaying both vaginal walls (V). UB, Urinary bladder. (b) The cervical lips, upper vagina and in between the vaginal fornices are seen.

vascularity of urethra and vagina. Injection of saline can be used in cases of suspected fistulae.

Normal anatomy of the vagina on transperineal ultrasound

There are differences in vaginal dimensions among females. The length of the vagina from external os to introitus ranged from approximately 4.1 to 9.5 cm. Maximum thickness of 2.9 cm was displayed by double layered measurement of the adherent vaginal walls.²

The best demonstration of the vagina is in the midline sagittal plane where it is seen as a collapsed, tubular structure of comparable echo-pattern to the fibrous cervical stroma. There is a central vertical linear echo that represents the opposed surfaces of the vaginal mucosa (Figure 3).

The vaginal fornices are seen in both sagittal and coronal planes as a potential space around the cervical lips (Figure 2). 3D Reformatted images give a better demonstration of the vagina in the coronal and axial planes, which appear as a butterfly or H shaped (Figure 4).

Figure 4. A multiplanar 3D transperineal ultrasound, (a) sagittal, (b) coronal and (c) axial views that demonstrated the vaginal walls (red arrows). (d) Axial reformatted volume rendering image showing butterfly shaped vagina (white arrow).

CONGENITAL ANOMALIES OF THE VAGINA

Congenital anomalies of the vagina include imperforate hymen, transverse septum, longitudinal septum and vaginal agenesis. Commonly such anomalies show non-specific appearance at regular transabdominal ultrasound of complex cystic mass that represents the obstructed dilated fluid-filled vagina.¹

Transperineal ultrasound is the proper approach for accurate diagnosis, especially in virgin females.

Figure 5. Bicornate bicollis uterus with obstructed hemivagina. Case (1): (a and b) transabdominal pelvic ultrasound, (a) axial plane showing two uterine cavities, (b) sagittal plane showing double vagina with obstructed hemivagina and proximal dilatation that is seen filled with turbid slightly echogenic content (i.e. haematocolpus) and there is another collapsed normal vagina (arrow). (c) Transperineal ultrasound showing the obstructed hemivagina.

Figure 6. Bicornate bicollis uterus with obstructed hemivagina. Case (2): (a) axial Pelvic ultrasound showing bicornuate uterus with distended right horn, (b) sagittal pelvic ultrasound showing haemato-colpus with obstruction in lower vagina, (c) transperineal showing transverse vaginal septum with non-canalized lower vaginal pouch.

Imperforate hymen

Ultrasound using the transperineal technique can confirm the diagnosis and localize the obstruction.

Transverse vaginal septum

The transverse vaginal septum may be complete or partial. For many years, MR imaging was considered as the imaging method that could differentiate between a high transverse septum and congenital absence of the cervix and so alter surgical planning.

Proximity of the ultrasound probe to the vagina can distinguish double from single vaginal lumen, define the level of the

Figure 7. Vaginal atresia in a 5-year-old child (a) Transabdominal pelvic ultrasound, sagittal plane where the uterine cavity is distended and fluid-filled (hydrometra). (b) Transperineal ultrasound, sagittal plane showed cord like hypoechoic vagina suggestive of vaginal atresia (arrows) and anterior to it, note the urethra (arrow head).

septum and distinguish partial from complete obstruction; the septum itself appears as a thin hypoechoic line (Figures 5 and 6).

Longitudinal Septum

Superficial ultrasound scanning can trace longitudinal vaginal septum especially in case of uterus didelphys that may be coincident with an obstructive transverse vaginal septum.³

Vaginal agenesis/atresia

It can be either an isolated anomaly that is present as a linear hypoechoic line at the confine of the vagina, yet with absence of the echogenic linear central echo that represents the vaginal lumen (Figure 7) or it may be associated with abnormality of the uterus, in the named Mayer-Rokitansky-Kuster-Hauser syndrome.⁴

Reconstruction of a neovagina could be successful and safe if the operative procedure is guided by the transperineal ultrasound.

VAGINAL MASSES

Vaginal cysts

Transperineal ultrasound has its place in the detection and characterization of vaginal cysts as Gartner duct cysts (Figure 8) and Bartholin glands. Simple cysts show an anechoic pattern and become echogenic in the case of infection or bloody content.

Figure 8. Pregnant female 31 weeks complaining of vaginal fullness. (a) Transperineal ultrasound showed a large cyst filling the vaginal canal. (b) The four-dimensional transperineal ultrasound showed the exact location of the cyst in the anterolateral portion of the vagina walls consistent with Gartner's cyst.

Figure 9. 70-year-old female presenting sanguinous vaginal discharge. (a) Sagittal transperineal ultrasound revealed an oval hypoechoic mass seen arising from the anterior vaginal wall as presented in “b”. The mass is highly vascular on colour Doppler “c”. (d) Transvaginal pelvic ultrasound showed left larger similar adnexal mass. A biopsy was taken from the vaginal mass that revealed primary vaginal tumour (amelanotic melanoma).

Doppler application is important to detect vascular intracystic solid components.

Solid vaginal masses

Transperineal pelvic ultrasound can provide information about the extension, the vascularity and the internal architect of these masses.

Benign solid masses

Commonly include leiomyoma/fibroma and fibroepithelial polyp that on ultrasound present as a circumscribed hypoechoic solid mass.⁵

Malignant solid masses

Primary: Squamous cell carcinoma is the most common among primary vaginal carcinomas. Malignant melanoma is extremely rare and approximately 15% reported as amelanotic.⁶

Transperineal ultrasound could precisely locate the tumour and describe its morphology (Figure 9).

Metastases: Most of the vaginal metastases are adenocarcinoma, either from the upper genital or the gastrointestinal tract.⁷

Figure 10. Patient complaining of rectovaginal fistula that could not be traced on previous MRI. (a) Transperineal ultrasound supported by injection of saline in the anal canal using a Foleys catheter (curved arrow); note the injected saline is seen within the lumen of the vagina with suspected wall defect. (b) MRI sagittal T2-weighted image; thin cuts guided by the ultrasound findings—the defect could be seen (arrows).

MISCELLANEOUS

Atrophic Vaginitis

Atrophic changes of the vagina are mainly diagnosed by clinical history and physical examination. Imaging only detect superimposed complications as vaginal fistulae or stenosis.⁸

Vaginal Fistulae

Obstetric complications, trauma, neoplasms, perineal infections and radiation could be the cause of the rectovaginal fistula⁹ (Figure 10).

Limitations of the transperineal ultrasound

During our work, we had experienced some limitations: (1) Compression elicited by the probe on the vagina while scanning may underestimate the length of vaginal canal especially in obstructed anomalies, (2) The limited field of view so complementary transabdominal approach is recommended, (3) The technique is sometimes not preferable by the patients.

CONCLUSION

Transperineal ultrasound is a special approach of the pelvic ultrasound examination. On routine pelvic ultrasound, the

main approaches are the trans-abdominal and vaginal ones and the transperineal approach is not considered, but we recommend such a superficial technique of the ultrasound whenever there is a need to assess the lower uterine segment and the vagina.

Transperineal ultrasound is a non-invasive demonstrative tool that could be used for the detection and characterization of the vaginal and perineal masses. The trans-abdominal and the trans-vaginal approaches are not suitable for virgins, but by the use of the transperineal technique, the vaginal pathologies that are obscured behind the hymen can be easily assessed.

Since transperineal ultrasound is a real time study, so it could be an alternative/complementary method to MR imaging in case there is a need to assess vaginal fistulae and pelvic floor functional abnormalities.

The three-/four-dimensional automatic transvaginal transducer is required for proper evaluation of the developmental anomalies and malformation of the vagina.

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