GENERAL GYNECOLOGY

Pelvic floor ultrasound: a review

Hans Peter Dietz, MD, PhD

Imaging currently plays a limited role in the investigation of pelvic floor disorders. It is obvious that magnetic resonance imaging has limitations in urogynecology and female urology at present due to cost and access limitations and due to the fact that it is generally a static, not a dynamic, method. However, none of those limitations apply to sonography, a diagnostic method that is very much part of general practice in obstetrics and gynecology. Translabial or transperineal ultrasound is helpful in determining residual urine; detrusor wall thickness; bladder neck mobility; urethral integrity; anterior, central, and posterior compartment prolapse; and levator anatomy and function. It is at least equivalent to other imaging methods in visualizing such diverse conditions as urethral diverticula, rectal intussusception, mesh dislodgment, and avulsion of the puborectalis muscle. Ultrasound is the only imaging method able to visualize modern mesh slings and implants and may predict who actually needs such implants. Delivery-related levator trauma is the most important known etiologic factor for pelvic organ prolapse and not difficult to diagnose on 3-/4-dimensional and even on 2-dimensional pelvic floor ultrasound. It is likely that this will be an important driver behind the universal use of this technology. This review gives an overview of the method and its main current uses in clinical assessment and research.

Key words: female pelvic organ prolapse, levator ani, pelvic floor, 3-dimensional ultrasound, translabial ultrasound

It has taken more than 2 decades for imaging to develop as a mainstream diagnostic tool in the investigation of female pelvic organ prolapse, urinary and fecal incontinence, and defecation disorders. Physicians have been slow in realizing that clinical assessment alone is a poor tool to assess pelvic floor function and anatomy. Our examination skills are quite simply inadequate, focusing on surface anatomy rather than true structural abnormalities. Because the best procedure in the hands of a highly competent surgeon will be a failure if performed on the wrong patient, it is not at all surprising that recurrence after pelvic reconstructive surgery is common.[1] The problem is not poor treatment–it is poor diagnostics. Sonography is an accepted component of any clinical assessment in both obstetrics and in gynecology–so why should it be any different in urogynecology and female urology?

Imaging techniques can provide immediate objective confirmation of findings obtained on examination. In some instances this can lead to markedly enhanced clinical assessment skills. To give just one example: the missing link between vaginal childbirth and prolapse (major levator trauma in the form of avulsion of the anteromedial aspects of the puborectalis muscle off the pelvic sidewall[2,3]) is palpable, but palpation of levator trauma requires considerable skill and teaching,[4-6] preferably with imaging confirmation. Certainly, diagnosis by imaging is more reproducible than diagnosis by palpation,[6] and it is easier to teach. After all, vision is our primary sensory organ. And suspected levator trauma or abnormal distensibility (ballooning) of the hiatus is by no means the only reason to perform pelvic floor imaging (Table).

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Equipment and examination technique

This review will be limited to translabial/transperineal ultrasound, and this is reflected in the following comments on equipment and examination technique. However, many clinical questions can be answered just as well by what some investigators call "introital ultrasound," a technique that is generally understood to involve the use of front-firing vaginal endoprobes placed in the introitus. Although such probes can provide higher resolutions, there are obvious downsides to their use, especially when it comes to assessing the effect of maneuvers and imaging of the levator ani, and this technique will not be discussed further in this review.

Standard requirements for basic 2-dimensional (2D) translabial pelvic floor ultrasound include a B-mode capable 2D ultrasound system with cineloop func-

TABLE
Indications for pelvic floor ultrasound

- Recurrent urinary tract infections
- Urgency, frequency, nocturia, and/or urge urinary incontinence
- Stress urinary incontinence
- Insensible urine loss
- Bladder-related pain
- Persistent dysuria
- Symptoms of voiding dysfunction
- Symptoms of prolapse, ie, sensation of lump or dragging sensation
- Symptoms of obstructed defecation, eg, straining at stool, chronic constipation, vaginal or perineal digitation, and sensation of incomplete bowel emptying
- Fecal incontinence
- Pelvic or vaginal pain after antiincontinence or prolapse surgery
- Vaginal discharge or bleeding after antiincontinence or prolapse surgery

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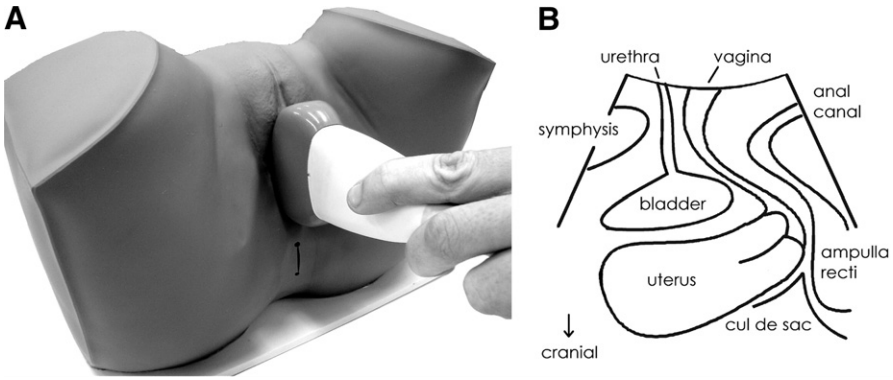
FIGURE 1
Transducer placement for translabial/perineal ultrasound



A, Transducer placement on perineum and **B,** schematic representation of imaging in midsagittal plane.

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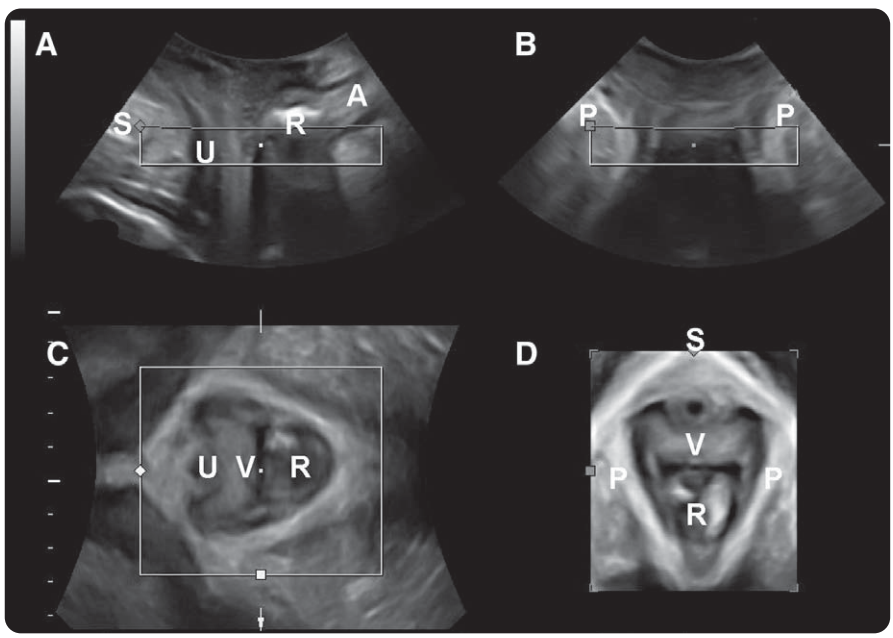
tion, a 3.5- to 6-MHz curved array transducer and a monochrome videoprinter. In essence, any setup used for imaging of the fetus (or a child's or adult's kidney) will be appropriate. We obtain a midsagittal view by placing a transducer (usually a curved array with frequencies between 3.5-6 MHz) on the perineum (Figure 1, A) after covering the transducer with a nonpowdered glove, condom, or thin plastic wrap. Powdered gloves should be avoided as they can substantially impair imaging quality due to reverberations. Alcohol wipes are usually considered sufficient for transducer cleaning after removal of gel and debris.

Imaging is performed in dorsal lithotomy position, with the hips flexed and slightly abducted, or in the standing position. Requiring the patient to place her heels close to the buttocks will often result in an improved pelvic tilt. Bladder filling should be specified; usually prior voiding is preferable. The presence of a full rectum may impair diagnostic accuracy and sometimes necessitates a repeat assessment after bowel emptying–especially if there is a degree of fecal impaction. Parting of the labia can improve image quality. The latter will also depend on the hydration state of tissues, which generally is best in pregnancy and poorest in elderly women with marked atrophy. Vaginal scar tissue can also reduce visibility, especially in the posterior compartment, but obesity virtually never seems to be a problem.

The transducer can be placed firmly against the symphysis pubis without causing significant discomfort, unless there is marked atrophy. A cough will part the labia, expel air bubbles and detritus, and ensure good contact between the transducer and tissues. It is essential to not exert undue pressure on the perineum so as to allow full development of pelvic organ descent. The standard midsagittal view includes the symphysis anteriorly, the urethra and bladder neck, the vagina, cervix, rectum, and anal canal (Figure 1, B). Posterior to the anorectal junction a hyperechogenic area indicates the central portion of the levator plate. The cul-de-sac may also be seen, filled with a small amount of fluid, echogenic fat, or bowel. Parasagittal or transverse views often yield additional information, eg, confirming urethral integrity, enabling assessment of the puborectalis muscle, and for imaging of mesh implants.

There is no agreement on image orientation, and the published literature contains at least 3 different options. The first published translabial images were either obtained with the perineum at the top and the symphysis pubis on the left[7,8] or the same rotated by 180 degrees.[9] Other authors have used mirrored versions of the same.[10] The author of this review

FIGURE 2
Standard acquisition screen of 3-dimensional pelvic floor ultrasound



A, Midsagittal, **B,** coronal, and **C,** axial planes and **D,** rendered axial plane (ie, semitransparent representation of all pixels in *box* [region of interest] seen in **A**-**C**).

A, anal canal; *P*, puborectalis muscle; *R*, rectal ampulla, *S*, symphysis pubis; *U*, urethra; *V*, vagina.

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