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# USES OF ULTRASOUND IN PELVIC FLOOR BIOMETRY: A REVIEW ARTICLE

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## ABSTRACT

Ultrasound imaging of pelvic floor biometry, in particular translabial or transperineal ultrasound is in the process of becoming a new diagnostic standard in urogynecology. Ultrasound has several practical advantages compared with MRI, such as shorter examination time, fewer exclusion criteria, relatively low cost, high patient compliance and easy accessibility, furthermore it is easier to perform real-time assessment during dynamic maneuvers such as Valsalva or pelvic floor muscle contraction on ultrasound. Pelvic floor ultrasound provides a useful screening tool for women with defaecatory dysfunction.

**KEYWORDS:** Pelvic floor, Levator ani muscle, Ultrasound.

## INTRUDUCTION

Pelvic floor is a term that refers to all the muscles and connective tissue supporting organs that are in the pelvic cavity. It is a network of muscles that plays a very important role in supporting and ensuring a correct functioning of the organs of the pelvis, vaginal birth is the major risk factor for developing a pelvic floor disorder (PFD) such as genital prolapse, urinary, or anal incontinence. During delivery, distension of the levator ani allows the hiatus to widen during crowning of the fetal head.[1] Age, ethnicity, multiparty, mode of delivery, history of pelvic surgery, pregnancy, chronic cough, obesity, spinal cord disorders, family history, and genetics are the most common identifiable risk factors for the development of PFD. Reported pregnancy-related risk factors include pregestational body mass index (BMI). The other risk factors include past histories of previous lower abdominal surgeries such as laparoscopic and hysteroscopic procedures, uterine curettage, and urinary incontinence surgery.[2] Pregnancy and childbirth are believed to cause significant changes in the pelvic floor. These changes include an increase in urethral and pelvic organ mobility, an increase in hiatal distension and in levator ani muscle (LAM) injury. However, many of the studies that described these changes assessed women only from the third trimester to 3–6 months after delivery. Recently, other studies have reported longer follow-up periods of 1–3 years after childbirth, and in these a consistent finding was a larger hiatal area after vaginal delivery as compared to that after Cesarean section (CS). One study also showed morphological improvement in levator ani muscle avulsion. In the longer term, vaginal delivery has also been shown to lead to increased risk of pelvic organ prolapse.[3] During pregnancy and childbirth, changes in the pelvic floor may be anticipated due to hormonal changes, weight of gravid uterus and possible trauma during delivery. For instance, enlargement of the hiatal area, distal movement of bladder neck, cervix and anorectal junction of women in pregnancy advances have been documented.[2,3] Findings on pelvic floor biometry have been shown to be associated with symptoms of pelvic floor disorder in women for example, urethral mobility is associated with urinary incontinence and the hiatal area is correlated with signs and symptoms of prolapse.[2,3] Pelvic organ prolapse (POP) is a highly prevalent condition, but its exact aetiology remains unclear and it is probably complex and multifactorial, the reported prevalence of pelvic floor dysfunction varies between different populations. Ethnic differences have long been suggested as a significant factor for POP. A better understanding of the differences in morphology and mobility of the pelvic organs may enable improved evaluation and treatment of POP with advances in the study of pelvic biometry and organ mobility by ultrasound imaging.[4] The availability of ultrasound equipment and the development of translabial three/four-dimensional (3D/4D) ultrasound have stimulated interest in using this technique for imaging pelvic floor anatomy as a key to understanding pelvic floor dysfunction. With the help of 3D/4D ultrasound, it is possible to obtain information on the levator ani hiatus and morphological abnormalities of the LAM.[5] MRI has not been adopted in clinical practice for pelvic floor assessment most MRI systems have poor dynamic assessment capabilities and require that the person being assessed remain in supine position. Clinically, therefore, US is a much more feasible method than MRI for evaluating pelvic floor anatomy and function: it is more easily accessible, less costly, shorter examination time, fewer exclusion criteria, high patient compliance; furthermore it is easier to perform real-time assessment during dynamic maneuvers such as Valsalva or pelvic floor muscle contraction on ultrasound and many US systems are portable.[5,6,7] To date, two-dimensional ultrasonography has been used to assess bladder neck mobility as an indicator of stress urinary incontinence and the integrity of the puborectal fascicle of the LAM. With the emergence of 3D ultrasonography, assessment of the LAM becomes easier due to the ability of this technique to visualize the axial plane, which could be accessed by magnetic resonance imaging. Rendered 3D volumes and 4D cine loop capabilities of ultrasonography enable the assessment of the functional anatomy with good spatial and superior temporal resolution, and multiple volume data sets obtained per second.[2] EDESSY PELVIC FLOOR INTEGRITY SCORE [EPIS]: This is a scoring system based on trans-perineal ultrasonographic evaluation of LAM morphology and biometric measures. This scoring system has 4 items [levator hiatus area LHA], [levator ani avulsion side], [levato urethral gap LUG], and [levator ani avulsion size].[1]

**EDESSY PELVIC FLOOR INTEGRITY SCORE[1]**
**Items**

| Score | 0 | 1 | 2 |
|---|---|---|---|
| Levator hiatus area | ≥ 35 CM2 | 25→ 35 CM2 | ≤ 25 CM2 |
| Levator ani avulsion side | BILATERAL | UNILATERAL | NO AVULSION |
| Levator urethral gap | ≥ 3.5 CM | 2.5→ 3.5 CM | ≤ 2.5 CM |
| Levator ani avulsion size | complete | partial | NO |

**Interpretation**
Score from 0 → ≤ 3 considered severely malfunctioning female pelvic floor.
Score from 4 →≤ 6 considered mildly malfunctioning female pelvic floor.
Score > 6 up to 8 considered well-functioning female pelvic floor.

Ultrasound imaging is rapidly replacing radiological methods in the investigation of PFD. Transrectal, transvaginal/introital and transperineal/ translabial methods are being employed, with the latter probably the most widespread due to ease of use and availability of equipment. Position and mobility of the bladder neck, bladder wall thickness, pelvic floor muscle activity and uterovaginal prolapse can be quantified, and colour Doppler may be used to document stress urinary incontinence. Ultrasound imaging has simplified audit activities and enhanced our understanding of the effects of incontinence and prolapse surgery, such as the new synthetic suburethral slings. In recent years, imaging methods have contributed significantly to our understanding of the traumatic effects of childbirth on the pelvic floor. Finally, the assessment of pelvic floor biomechanics may have implications for clinical obstetrics and ultimately for the prevention of delivery-related pelvic floor trauma.[8] Pelvic floor Ultrasound imaging, current 3D ultrasound technology and its use for imaging pelvic floor structure and function are described. Recent technical developments enable rapid automated volume acquisition in real time, and currently available transducers designed for abdominal use are well suited for translabial/transperineal imaging. To date, such systems have been used to image the urethra, the levator ani and paravaginal supports, prolapse and implants used in pelvic floor reconstruction and anti-incontinence surgery. While 3D pelvic floor imaging is a field that is still in its infancy, it is already clear that the method has opened up entirely new opportunities for the observation of functional anatomy.[9,10] total pelvic floor ultrasound provides a useful screening tool for women with defaecatory dysfunction (rectocele, intussusception, enterocele and dyssynergy).[11] Pelvic floor 3D ultrasonography is becoming more widespread, due to the increasing availability of 3D-capable ultrasound systems. The ability of ultrasonography to reflect the functional anatomy of the pelvic floor muscles has added another dimension to the information already gained by MRI. In the clinical setting, changes in the LAM post-delivery are easily demonstrable on ultrasonography, and it seems that such alterations are associated with an increased risk of significant pelvic organ prolapse. This confirmed earlier clinical work which found a relationship between pelvic organ prolapse and the size of the levator hiatus. Furthermore, a recent study has shown an inverse association between hiatal area on contraction and length of second stage of labor. This raises the possibility of using 3D ultrasonography as an easy, reliable diagnostic tool, not only for PFD, but also for risk assessment before delivery.[12] Translabial 3D/4D ultrasound measures of functional pelvic floor anatomy and used in the diagnostic evaluation of PFD.[13] Perineal or introital ultrasound can be used to assess the mobility of the bladder neck when the patient presses or coughs (hypermobility of the urethra, funnel formation), to detect vesical and urethral diverticula, to visualize elevation of the bladder neck on contraction of the LAM (pelvic floor exercise), and to clarify the extent of prolapse of the anterior vaginal wall. It can also be used to visualize avulsions of the LAM and to monitor the condition of suburethral artificial slings and meshes.[14]

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