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Three Dimensional Ultrasonograghic Evaluation of Effect of Pregnancy on Pelvic Floor Muscles

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Abstract:

Ultrasound gives direct visualization of pelvic floor muscle (PFM) contraction and can be used as an adjunct to the standard physiotherapy assessment of women with PFM dysfunction to assess PF elevation. The most common methods of ultrasound used by physiotherapists are transperineal ultrasound (TP). Transperineal ultrasound was established as a reliable method of evaluating women with incontinence.

Keywords: Ultrasound, Pelvic Floor, Transperineal ultrasonography.

Introduction:

Pelvic floor dysfunction in women encompasses a wide range of clinical disorders such as urinary incontinence, pelvic organ prolapse, fecal incontinence, and pelvic-perineal region pain syndrome. **(1).**

For instance, pelvic organ prolapse- (POP) is a common condition that can lead to genital tract dysfunction and diminished quality of life. It affects millions of women worldwide. In the United States, it is the third most common indication for hysterectomy. Moreover, a woman has an estimated cumulative lifetime risk of 12 percent to undergo surgery for POP **(2).** Signs include descent of one or more of the following: the anterior vaginal wall, posterior vaginal wall, uterus and cervix, vaginal apex **(3).** Symptoms can vary from mass protuding per vulva with or without straining and dragging pain to urine and stool incontinence.

Another common disorder is urinary incontinence, as in Western societies, epidemiologic studies indicate a prevalence of urinary incontinence of 25 to 51 percent and even higher among nursing home patients **(4, 5).** This wide range is attributed to variations in research methodologies, population characteristics, and definitions of incontinence. According to International Continence Society guidelines, urinary incontinence is a symptom, a sign, and a condition **(6).**

Large, population-based epidemiological and cross-sectional observational studies have documented the relationship between parity, childbirth, and PFDs. In the Pelvic Organ Support Study (POSST), increasing parity was associated with prolapse risk **(7).** Specifically, the risk of POP increased 1.2 times with each vaginal delivery. In the Reproductive Risks for Incontinence Study at Kaiser (RRISK) study, **Rortveit and colleagues (8)** found that the prolapse risk increased significantly in woman with one vaginal delivery (odds ratio [OR] 2.8), two (OR 4.1), or three or more (OR 5.3) deliveries compared with nulliparas. It is not clear to what extent pregnancy itself versus mode of delivery contributes to the development of PFDs in later life.

To detect such changes in pelvic floor contributing to PFDs- apart from thorough history taking and clinical examination, various methods were used throughout literature including urodynamics, urethro cystography, MRI, neurophysiologic tests, and ultrasonography. Trans-perineal ultrasound has been proven as a readily available and reliable way of detecting changes in pelvic floor **(9, 10).**

Transperineal ultrasonography In pelvic floor evaluation

Out of the previously mentioned evaluation methods, trans-perineal ultrasonography is a simple, noninvasive, reproducible method of evaluating bladder-neck position and mobility together with pelvic floor muscles. The technique is readily available, has good interobserver and interdisciplinary reliability, and allows for dynamic assessment of pelvic organs at rest and during straining, with visualization of the integrity of the pelvic floor supportive structures **(9, 10).**

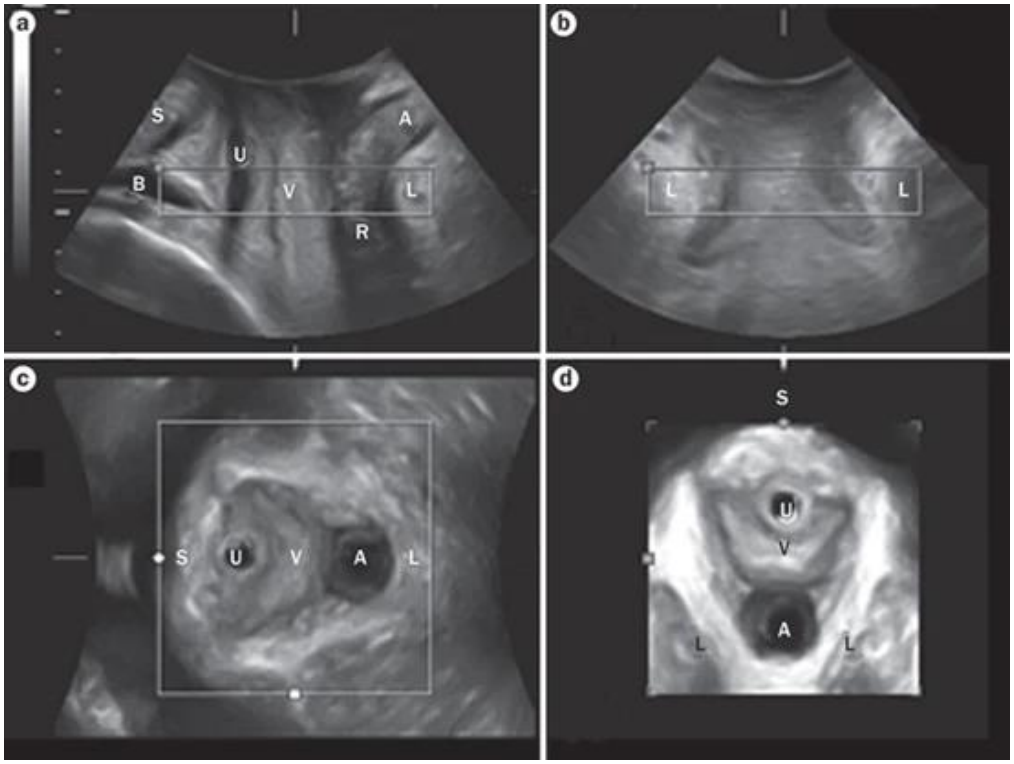

Figure (1): The usual acquisition and evaluation screen on Voluson type systems shows the three orthogonal planes: **a** | sagittal, **b** | coronal and **c** | axial; as well as **d** | axial plane rendered volume. A rendered volume is a semitransparent representation of all grayscale data in the region of interest (that is, the box visible in a–c). Abbreviations: A, anal canal; B, bladder; L, levator ani; R, rectum; S, symphysis pubis; U, urethra; V, vagina **(10).**

During the last two decades, 2D and 3/4D translabial or transperineal US has been a highly valuable diagnostic tool in evaluating levator ani morphometry and function. Under standardized conditions, identical system settings, and in skillful hands, this investigational technique is reproducible and shows good correlation with MRI in detecting major levator ani defects **(11-13).** However, there is a substantial learning curve in carrying out the procedure and interpreting images, as—even in asymptomatic nulliparous women—interindividual differences in levator ani morphometry exist **(14).**

Several researches have found correlation between pregnancy, mode of delivery and bladder-neck mobility, which was in turn correlated with stress urinary incontinence **(15, 16).**

Furthermore, larger hiatal area persists in women who deliver vaginally compared with women delivering by pre-labor or early-labor cesarean delivery. However, all women show greater hiatal distensibility after delivery, which is potentially a factor in later pelvic floor dysfunction **(17).**

Many parameters have been used by Braeken H. et al and Mao et al to detect changes of pelvic floor by using trans-perineal ultrasound:

- Bladder neck position in both rest and Valsalva and calculating bladder neck descent.
- Alpha angle: angle between the proximal urethra and central axis of symphysis pubis at both rest and Valsalva, and calculating urethral rotation.
- Beta angle (retro-vesical angle): angle between proximal urethra and posterior vesical wall.
- Urethral Funneling: the internal urethral orifice being open during valsalva.
- Levator hiatus area: the area bordered by the LA muscle, the postero-inferior margin of symphysis pubis, and the inferior ramus pubis **(18, 19).**
- Comparative studies found a good correlation between radiologic scanning of the bladder neck and pelvic floor diseases (PFDs) **(20).** Both rotation of proximal urethra and bladder neck descent are strongly correlated with stress urinary incontinence **(21).**
- However, bladder-neck mobility is common in asymptomatic nonpregnant nulliparous women and may vary from 4 to 32 mm during coughing and from 2 to 31 mm during Valsalva Consequently, there is overlap between continent and incontinent women, and an internationally accepted US definition of bladder-neck hypermobility is lacking **(22, 23).**

Conclusion:

Using three-dimensional ultrasonography has provided valuable insights into the impact of pregnancy on the pelvic floor muscles. It has been demonstrated that pregnancy, particularly in the later stages, can cause significant changes in the structure and function of the pelvic floor muscles, including muscle thinning, reduced muscle tone, and altered muscle contractions. These changes are likely a result of both increased intra-abdominal pressure and hormonal influences during pregnancy. Furthermore, the three-dimensional imaging technique has proven to be an effective, non-invasive tool for assessing these changes in detail, providing more accurate measurements than traditional methods. The data suggests that pregnancy leads to long-term adaptations in the pelvic floor, which may contribute to pelvic floor dysfunction (PFD) in the postpartum period, including urinary incontinence and prolapse. Early intervention and physical therapy targeting the pelvic floor muscles may help in reducing the potential negative impact of pregnancy on pelvic health, improving both the short-term and long-term quality of life for women.

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