Sonographic Changes of the pelvic floor in Chinese Women after delivery

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Introduction

• Possible mechanisms
  – Direct muscle damage e.g. anal sphincter, levator ani
  – Pudendal nerve damage
  – Damage to supporting fascial structure
Anatomy of Levator Ani Muscle

• “There is no considerable muscle in the body whose form and function are more difficult to understand than those of the levator ani” Dickinson 1889

• Levator ani plays a critical role in pelvic organ support and regulation of pelvic floor function

• Details of levator ani anatomy remained poorly understood

• Confusing terminology regarding different portions of the muscle
Levator ani anatomy by origin-insertion pairs

• 5 pairs of origin-insertion described:
  • Pubovisceral (Pubococcygeal)
    – Puboperineal
    – Pubovaginal
    – Puboanal
  • Puborectal
  • Iliococcygeal

Studies on Pelvic Floor changes after delivery

- **MRI of levator ani muscle**
  - 20% multiparous women had defect in levator ani
  Delancey JOL, Kearney R, Chou Q, Speights S, Binno S. The Appearance of Levator Ani Muscle Abnormalities in Magnetic Resonance Imaging After Vaginal Delivery

- **Biometry of the pubovisceral muscle and levator hiatus by three-dimensional pelvic floor ultrasound**
  - Three-dimensional (3D) ultrasound has shown to be able to demonstrate the pubovisceral muscle

- **Validation of three-dimensional perineal ultrasound and magnetic resonance imaging measurements of the pubovisceral muscle at rest**
  - Measurements by 3D perineal ultrasound and those by MRI showed very good agreement (range, 0.80-0.97)
Studies on Pelvic Floor changes after delivery

- Interobserver and interdisciplinary reproducibility of 3D endovaginal ultrasound assessment of pelvic floor anatomy
  - overall interobserver repeatability for levator hiatus dimensions was good to excellent

- State of the art: an integrated approach to pelvic floor ultrasonography. [Review]
  - ultrasonography, including 2D, 3D and 4D imaging emerged as a procedure that is relatively easy to perform, cost-effective and widely available
S = symphysis pubis, U = urethra, B = bladder, Ut = uterus, V = vagina, R = rectal ampulla, A = anal canal, L = levator ani

Dietz, H P. American Journal of Obstetrics & Gynecology APRIL 2010
A, Midsagittal, B, coronal, and C, axial planes and D, rendered axial plane
A, anal canal; P, puborectalis muscle; R, rectal ampulla, S, symphysis pubis; U, urethra; V, vagina.

Dietz, H P. American Journal of Obstetrics & Gynecology APRIL 2010
Studies on Pelvic Organ Mobility / Levator Ani Trauma after delivery

• Translabial Ultrasound before and after delivery for pelvic Organ Mobility on Translabial USG
  – Highly significant increase in organ mobility after vaginal delivery
  – CS associated with less pelvic organ descent
  Dietz HP, Bennett MJ. Obstet Gynecol 2003; 102 (2) 223-228

• 3D Translabial Ultrasound before and after delivery
  – Levator Avulsion injury in 36% who delivered vaginally
  – No defect seen in those delivered by CS
  Dietz HP, Lanzarone V. Obstet Gynecol 2005; 106(4) 707-712
levator trauma as seen on exploration of large vaginal tear after vaginal delivery (*left*), as imaged on translabial 4-dimensional ultrasound (*middle*), and on magnetic resonance
Typical right-sided levator defect (*) measuring about 2 cm in (dorsoventral) width and at least 1.75 cm in (craniocaudal) depth as it is apparent in all slices.

Dietz, H P. *American Journal of Obstetrics & Gynecology* APRIL 2010
Hiatal area measurements (A, normal narrow hiatus; B, moderate ballooning in parous patient; C, severe ballooning in patient with bilateral avulsion and 3 compartment prolapse)
No Imaging studies that demonstrated pelvic muscle changes after delivery in Chinese Women
Changes in the pelvic floor on ultrasound after delivery in Chinese nulliparous women

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Methods

• Nulliparous women seen at 36 to 40 weeks, and at 3 to 6 months after delivery
• Questionnaire on urinary and bowel symptoms
• Translabial ultrasound
  – Supine, after voiding
  – Rest / Pelvic Floor Contraction / Valsalva manoeuvre
  – 2D USG - Bladder neck mobility, cystocele descent, uterine descent
  – 3D USG – Genital Hiatus Diameters and area, Presence of Levator Ani Defects
Demographic Data

• n = 64
• Mean Age 29.8 years (SD 4.9)
• Mode of Delivery
  – Normal vaginal delivery 44 (68%)
  – Vacuum Extraction 7 (11%)
  – Caesarean Section 13 (20%)
• Mean Infant Birth Weight 3.1kg (SD 0.44)
Pelvic Organ Mobility on 2D USG

- All women - No significant difference in mobility of all compartments postpartum vs antepartum
- Vaginal Delivery vs Caesarean section – Trend towards higher mobility of the bladder neck postpartum (2.48cm vs 1.92cm, P=0.17)
3D methods

• Philips IU22
• 3D Volume obtained at rest, on Valsalva and on pelvic floor contraction
• Volume Data saved for offline analysis on a later date by second assessor blinded to delivery data
Midsagittal translabial view at rest
3D results

• Genital Hiatus diameters and area - no significant difference between vaginal delivery and Caesarean section

• 7 levator defects seen in vaginal delivery group (n=44) (13.7%)
  – 4 left, 2 right, 1 bilateral
  – None seen on antepartum USG
  – None seen in Caesarean section group
Levator Ani Defects

• Those with levator ani defects vs those without defects
  – Higher rate of postpartum stress incontinence (71% vs 14%, P=0.002)
  – More mobile bladder neck (2.86cm vs 2.02cm, P= 0.02)
  – More uterine descent postpartum (1.62 cm vs 0.84cm, P=0.015)
  – Higher genital hiatus lateral diameter on Valsalva (4.7cm vs 3.7cm, P=0.014)

• No significant difference in infant birth weight, maternal age, antepartum stress incontinence, postpartum fecal incontinence
Conclusions

Our results showed that
- No significant change in Pelvic Organ Mobility after vaginal delivery
- Levator ani defect occurs after vaginal delivery in Chinese women
- Associated with higher bladder neck descent, uterine descent and postpartum stress incontinence
- 3D Imaging is easily accessible before and after delivery
- Can provide useful information on clinical symptoms and association with morphological changes
- Longitudinal Studies on natural history and change in symptoms for future management