Pelvic Floor Dysfunction

Role of Ultrasound

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NO DISCLOSURES

Hello, incontinence helpline - can you hold?

Objectives

• Background
• What are the Issues in Pelvic Floor Dysfunction
  ▪ Urinary (UI) & Fecal Incontinence (FI)
  ▪ Pelvic Organ Prolapse (POP)
  ▪ Levator ani trauma
  ▪ Post operative - Slings and Things
• Conclusion
Pelvic Floor Imaging - Choices

• Transperineal ultrasound (TPUS)
• Endoanal ultrasound (gold standard AS)
• MRI with rectal contrast – dynamic; defecography (limited availability)
• Fleuroscopic Techniques - Traditional
  • Voiding cystourethrography (VCUG), dynamic cystoproctography, Fluoroscopic Defecography

TPUS – Why Now?

• US imaging pelvic floor available many years
• Why Now?
  • 3D/4D obstetrical image has made physicians comfortable with the tools
  • Improved resolution – MPR – real-time with cineloops/volumes can review
  • Tomographic CT style slices
    • Fleuroscopy is out of favor – MRI expensive

Why Bother?

Pelvic Floor Dysfunction

• Affect 50% women by age 50
  • 1/10 have surgery by age 70
  • 1/3 repeat surgeries
  • Pelvic organ prolapse (POP) affect 1/3 PMW
• Societal costs in billions for UI and millions for POP and AI
• Project huge demand increase service

Pelvic Floor Disorders

• Challenges
  • Pelvic floor anatomy complex
  • Requires advanced US imaging techniques
  • Limited FOV as compared to MRI
**Risk Factors**

- Female gender
- **prolonged 2nd stage labor (vaginal delivery**
- Plus
  - Increasing age
  - Pelvic surgery - especially hysterectomy
  - Chronic increased abdominal pressure eg obesity, weight lifting,
  - Poor pelvic support
  - Connective tissue disorders, post radiation

**Compartments Pelvic Floor**

- **Anterior** - Bladder, urethra
- **Central** - Uterus-cervix-vagina
- **Posterior** - Anal sphincter and rectum

**Reference Slide**

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<thead>
<tr>
<th>Level</th>
<th>Anterior compartment</th>
<th>Posterior Compartment</th>
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<tr>
<td>1</td>
<td>Highest</td>
<td>Bladder base</td>
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<tr>
<td>2</td>
<td>Mid</td>
<td>Bladder neck</td>
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<td>3</td>
<td>Low</td>
<td>Midurethra</td>
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<td>4*</td>
<td>Lowest</td>
<td>Distal urethra</td>
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* Level measure AP diameter UG hiatus { pubosymphysis-perineal body distance}
Urinary Incontinence

- Women more susceptible
- Anatomy: Urethra shorter thus less resistance to outflow when bladder contracts
- Life style Risks: Vaginal Delivery/2nd stage labor prolonged

Urinary Incontinence

- Stress: (SUI) - increase abdominal pressure (cough, laugh, sneeze) results involuntary loss urine
  - Sphincteric defect / hypermobility urethra
- Urge urinary incontinence (UUI) - detrusor overactivity (destrusor thickness > 5mm) or damage innervation bladder
- Overflow: Leakage

Anterior Compartment: UI & Prolapse
Key role of Ultrasound

- ID position bladder neck / urethra, assess PVR
- Assess UVJ for rotation and descent - maintain RVA (retrovesical angle > 120 degrees)
- Assess develop cystocele (if UVJ stable may kinked urethra and bladder dysfunction/retention
- Distinguish between cystocele with urethral hypermobility versus a cystocele without urethral rotation

Bladder neck remains closed
Hypermobility urethra descends & rotates horizontal
Borderline small cystocele develops

Rest

Strain

Classic SUI
**Retrovesical angle now > 120 degrees**  
Associated SUI

**Isolated Cystoceles**
- Less common
- Bladder neck remains in place
- Voiding dysfunction rather than SUI
- Association with levator ani trauma

**Posterior Compartment**
- Anal continence - Anorectal angle 90-130 degrees rest & anorectal junction above or at level PS
- POP with perineal hypermobility - descent rectal ampulla
- Rectovaginal defect with diverticular outpouching anterior wall rectum into vagina is rectocele, also sigmoidocele, enterocele
- Rectal intussception
- Anal sphincter trauma

**EAUS gold standard assess anal sphincter**
- Distinguish incontinent patients with intact anal sphincter vs sphincteric lesions (defect, scarring, atrophy) 90% sensitivity/specificity
- MRI good big picture/muscles
• Important to have maximum effort
• Rest normal ARA which is above pubic symphysis
• Valsalva develop rectocele, loss acute ARA, descent rectal ampulla
• Rectocele measure depth perpendicular to wall expected contour anterior rectal wall in continuity with AS > 1-1.5 cm.

Development sigmoidocele

Fecal Incontinence

TPUS: Normal AS
Not the Gold Standard

Useful for rapid assessment AS but more importantly bigger picture thinking puborectalis / levator tears, abnormal RVA and dev rectocele/enterocele/sigmoidocele

TPUS - Anal Sphincter

IAS =2-3mm, EAS variable thickness
US sensitivity/specificity muscular defect ~ 90%

Pannu et al Radiographics 2010
Yagel et al., Vasky et al., UOG 2006,
Pelvic Organ Prolapse (POP)

- Descent of the pelvic organs beneath a theoretical line between PS and ARA
  - Cystocele – bladder
  - Rectocele – anterior wall rectum
  - Into widened rectovaginal space is enterocele or sigmoidocele
  - Vaginal prolapse or pocidentia (uterus)
- Critical pre surgery to evaluate all compartments
- Also important to recognize only important if clinically symptomatic

Pelvic Organ Prolapse (POP)

- 9% women clinical symptoms
- 30% undergo repeat operation
- Negative impact on quality of life including sexual function
- LA avulsion from pubic bone or pelvic sidewall is associated with POP
- LA avulsion is associated with vaginal delivery
MR - Pubococygeal line

Pelvic Organ Prolapse (Anterior)

Pelvic Organ Prolapse (posterior)

3D & Volume Rendered Critical

- Dimensions urogenital hiatus
- POP
- Levator Ani Trauma
- Slings and Things
Display Modes: MPR/Rendered
- MPR/orthogonal display mode shows cross-sectional planes through the volume in question.
- Imaging planes on 3D US can change either at the time of acquisition or offline at a later time.
- D = standard rendered image of the levator hiatus, with the rendering direction set from caudally to cranially.

Urogenital Diaphragm
- Largest natural hiatus in body
- Mean 16 cm young nullip
- Mean 25 cm overall
- Most caudal layer pelvic floor
  - Composed of CT and peroneus muscle run from ischial rami to perineal body and EAS
  - Perineal body is site attachment for endopelvic fascia, UG diaphragm, bulbocavernosus muscle and pubococcygeus muscle

Urogenital Hiatus
Biometric Indices:
- AP diameter 4.5 - 4.8 cm
- Laterolateral diameter 3.3 - 4.7 cm
- Hiatal area 11.3 - 12 cm

Functional Assessment
- Valsalva and PFMC allow its functional assessment.
- Ballooning of the hiatus (excessive distensibility of LA)
  - Increase in hiatal area to > 25 cm² on Valsalva maneuver
  - Generally associated with full pelvic organ prolapse (POP)

Dietz et al and Santoro et al.
Levator Avulsion
- Common (10-35%) post vaginal delivery
- Forceps triple risk
- Will result
- Reduction contraction strength
- Increased risk prolapse (ant/central) 2-3x
- Increased risk prolapse recurrence post surgery
- May not affect SUI or FI

Levator Ani (LA) Avulsion
- Direct signs is the avulsion of LA
- Indirect sign is the disruption of “H” configuration vagina suggested by posterior displacement vaginal fornix

Pelvic Floor Musculature
- Levator ani muscles symmetric broad muscular sheet attached internal surface pelvis
- Key point maintain constant tone except during voiding, defecation, Valsalva
- Stretched during vaginal delivery with maximal strain occurring in most medial aspect pubococcyges

Levator ani (puborectalis) avulsion
Dietz and Lanzarone, Obstet Gynecol 2005; Dietz et al. IUGJ 2010

Normal

TUI : Right-side levator ani defect measure ~ 2 cm (AP) retraction muscle
Slings – Mesh Suburethral

- Concept:
  - Continence maintained at midurethra instead of the bladder neck
  - Failure of the pubourethral ligaments
  - Propylene mesh
  - Pore size minimum 75 microns
  - Permit entry macrophages, fibroblasts, collagen fibres

Complications

- Mesh erosion rate ~ 9%
- Bleeding pv 31%
- Pain 13%
- Voiding dysfunction 21%
- PS - Mesh gap in Valsalva < 1cm
- < 7mm increase probability functional obstruction thus may consider tape division
- 20% mesh arm dislodge - mesh mobile
- Line straight or obtuse, wide gap ? not anchored
- Mesh can fold up into itself, migrate, perforate

Warning: FDA and mesh

July 2011

- Concern re use of mesh in prolapse surgery
  - 70,000 such procedures done in the US /yr
- Complications are attracting the attention of lawyers soliciting for class action lawsuits.
- Concern for surgeons if they should stop
  - New evidence show that they markedly reduce recurrence rates (Altman et al, NEJM 2011, Wong IUGJ 2011)
Conclusion: FDA & MESH

- Mesh use in patients at high risk of recurrence is appropriate
- Age (the younger the worse), prolapse stage, previous failed surgery, levator avulsion
- Inciting factors (obesity,....)
- Mesh use in patients at low recurrence risk?
- Newer studies demonstrate higher rate of treatment success


Evaluation TOT

**PS:** Mesh Gap – Too Narrow
Problem: Voiding Dysfunction
Typically > 1cm
Typically cut mesh to cure this

**PS:** Mesh Gap – Too wide/high
PROBLEM: Recurrent UI
Mesh high in location
Bladder neck opens wide with stress although remains fixed high in position
Problem – Post-Operative – Urinary Dysfunction
Cut Sling

Problem – Post-Operative - Pain
Tomographic Slice
TVT – curve anchoring anterior, deshiscient
Mesh frayed & migrated into vagina.

Problem – Post Operative
TVT perforation / migration into urethra

Rendered Image
TVT – curve anchoring anterior,
the left side is split in two and not obviously anchored, concern
Edges migrated into vagina.
Pelvic floor disorders common
• Complex area
• Best for POP, LA avulsion defects, hiatal ballooning, SUI
• Biofeedback pelvic floor contraction
• Does not always correlate well with clinical symptoms
• More research needed

References

• Broekhuis SR, Futterer JJ, Hendriks JCM, Barentsz JO, Vierhout ME, Kluivers KB. Symptoms of pelvic floor dysfunction are poorly correlated with findings on clinical examination and dynamic MRI imaging of the pelvic floor. Int Urogynecol J 2009; 20: 1169–1174.