Introduction

- Anatomy Overview
- Pelvic Organ Prolapse
- Urinary Incontinence
Pelvic Organ Prolapse and Urinary Incontinence – Towers

Anatomy

- General Pelvic Support
- Anterior Compartment
- Posterior Compartment

General Support

- [Image of anatomical diagram]

General Support

- [Image of anatomical diagram]
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Endopelvic Fascia: Vaginal Support

- **Level I**: Upper Vagina & Cervix
  - Cardinal & Utero-Sacral Ligament complex
- **Level II**: Mid-Vagina, Bladder, Rectum
  - Anteriorly: Pubo-cervical fascia
  - Laterally attaches to Arcus Tendineus
  - Posteriorly: Recto-vaginal fascia
- **Level III**: Lower Vagina, Urethra
  - Anteriorly: Perineal Membrane
  - Posteriorly: Perineal Body

General Support

- Fusion
- Attachment
- Suspension

Endopelvic Fascia
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Retropubic Anatomy

Posterior Compartment

Pelvic Organ Prolapse

- ACOG Practice Bulletin #176 (April 2017)
- Peak sx ages 70-79
- Number of women with sxs expected to increase by 50% by 2050
- 41-50% women have some pelvic relaxation on examination
- 3-6% of these have symptoms

ACOG Practice Bulletin #176 (April 2017)
Peak sx ages 70-79
Number of women with sxs expected to increase by 50% by 2050
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Pelvic Organ Prolapse and Urinary Incontinence – Towers

Epidemiology of POP
- 300,000 surgeries in U.S. annually for POP
- Incidence of surgery 1.5-1.8 surgeries per 1,000 women-years
  - 13% lifetime risk.
- Natural hx: 78% stable over 1 year
  - Most will not worsen if don’t want treatment.

Pathophysiology of POP
- Upright position: the Levator Ani muscles form the Pelvic Floor (Horizontal)
- Levator Ani (3 muscles):
  – Pubococcygeus, Ileococcygeus, & Coccygeus
- Attaches to:
  – Pubic symphysis, Arcus tendineus, Ischial spine, & Coccyx
- Urethra, Vagina, & Rectum pass through the Levator Ani

Pathophysiology of POP
- Normal:
  - Levator Ani: horizontal
  - Upper 1/3 vagina: horizontal
  - With increased abdominal pressure:
    – the rectum, uterus, & upper vagina are pushed down & backward on top of Levator Ani
- Prolapse:
  - Levator Ani: oblique or vertical
  - Upper 1/3 vagina: oblique or vertical
  - With increased abdominal pressure:
    – the rectum, uterus, & upper vagina fall through the genital hiatus of L.A.
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**P.O.P. – Risk Factors**
- Advancing Age
  - Post-menopausal >> Pre-Menopausal
- Caucasian >> African
- Parity

**Risk Factors for POP**
- Childbirth injury
- Aging
- Denervation
- Genetics / poor collagen
- Constipation
- Prior pelvic surgery
- Chronically increased intra-abdominal pressure
- Occupation
- Congenital factors

**Risk Factors for POP: Childbirth Injury**
- Risk Factors:
  - Routine Episiotomy - Forceps
  - 3rd & 4th degree tears - OP position
  - Prolonged 2nd stage of labor - Macrosomia
- Pudendal nerve Neuropathy (Tetzchner, 1997)
  - Present: SVD & C-sec for 2nd stage arrest of labor, equal occurrence
  - Absent: Elective C-sec
  - Pushing & straining lead to Neuropathy
Risk Factors for POP: Childbirth Injury
- Damage to Internal & External Anal sphincters
  (Sultan, 1993, N Engl J Med; 329:1905)
  - Anal Ultrasound: assess Int. & Ext. sphincters
  - Primiparous: 35% damaged sphincters, only 3% injuries recognized
  - Multiparous: 40% preexisting defects, 44% after delivery
  - Only 1/3 with defects had anal incontinence
  - other protective mechanism exists

Risk Factors for POP: Aging
- Pelvic muscles weaken with age
- Kegel exercises strengthen Levator Ani
- Decreased estrogen after menopause
  - ERT: - Strengthens vaginal tissues
  - Increases skin collagen content
  - Increases urethral closing pressure
  (Versi, 1998)
- Decreased elastic collagen fibers with age

Risk Factors for POP: Denervation of Pelvic Floor
- EMG studies (Pudendal nerve):
  - Prolonged motor terminal latencies after SVD, not C-sec
  - 5-yr F/U: persistent abnormal EMG's, parous > nullip
- Increased denervation associated with:
  - Aging, Childbirth (with reinnervation), SUI, POP
  - POP & SUI: Prolonged conduction to urethral muscle
  - POP, no SUI: Prolonged conduction only to pelvic floor
    (Smith, Br J Ob Gyn; 1989;96:24-32)
Risk Factors for POP: Genetics / Poor Collagen

- Family history: POP or SUI
- Congenital weakness:
  - Nulliparous with POP: Defective utero-sacral & cardinal ligaments
- Poor collagen
  - with POP: more Type III collagen - weaker (Norton, 1992, Neurol Urodyn; 11:2)
  - with SUI: 30% less total collagen (Falconer, 1994, Ob Gyn; 84:583)

Risk Factors for POP: Constipation

- Excessive straining
- Stretching of pudendal nerve --> damage
- Progressive neuropathy & dysfunction
- Case-control study:
  - with POP: 61% constipated
  - normal: 4%
  - (Spence-Jones, 1994, Br J Ob Gyn, 101:147)

Risk Factors for POP: Prior Pelvic Surgery

- Predisposes to prolapse at a site opposite to the original repair
- Enterocoele/ Rectocele after Urethropexy
  - 27% (Wiskind, 1992)
- Cystocele after Sacrospinous Ligament Fixation
  - 15-30% (several studies)
- Neurologic damage from surgery (Benson, 1993; Ob Gyn; 82:387)
Risk Factors for POP: Increased Abdominal Pressure
- Chronic increased intra-abdominal pressure
  - Smoker
  - COPD
  - Obesity
- Gradually damages supporting tissues

Risk Factors for POP: Occupation
- Airborne paratroopers
  - Parachute jumps led to paravaginal defects (Davis, 1996)
- Assistant nurses
  - Repetitive heavy lifting
  - Odds ratio of 1.6
  - (Denmark, 1994)

Risk Factors for POP: Congenital Factors
- Spinal cord pathway disease:
  - Spina bifida
  - Muscular dystrophy
  - Myelodysplasia
  - Trauma
- All lead to flaccid paralysis of pelvic floor muscles
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Types of Prolapse Defects
- Anterior Compartment:
  - Cystocele, Urethrocele
- Upper Compartment:
  - Uterine Prolapse, Vaginal Vault Prolapse, Enterocoele
- Posterior Compartment:
  - Rectocele, Perineal Body Defect, Descending Perineal Syndrome, Anal Sphincter Defect, Rectal Prolapse

POP: Associated Findings
- Urinary Disorders
- Fecal Disorders
- Sexual Dysfunction
- Pelvic Pain

POP: Urinary Disorders
- Urinary Incontinence
  - Stress Urinary Incontinence
  - Potential SUI
  - Urge Incontinence
- Detrusor Instability
- Urinary Retention
  - Urethra kinks & obstructs with advancing prolapse
  - 30% with PVR > 100 cc (Coates, 1997)
  - 8% with hydronephrosis (Beverly, 1997)
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Diagnosis

- History
  - Pelvic Pressure/Pain
  - Something Falling Out
  - Incontinence
  - Splinting
- Physical Examination (complete)
  - POPQ
  - Baden-Walker
  - Assessment of tone

POPQ

- Stands for "Pelvic Organ Prolapse Quantification"
- Adapted by the International Continence Society
- Also AUGS, SGS
- Standard System of Terminology
- Objective, Site-Specific, Reproducible
Cystocele

- May involve Urethra
  - Cystourethrocele
- DDX:
  - Diverticulum
  - Skene’s Gland
  - Mass Lesion
- Associated with incontinence
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**Cystocele**
- Can be midline or lateral
- Lateral cystocele requires special attention
  - Lateral attachment to AFP
  - Apical support/suspension is key

**Repair of Midline Cystocele**

**ATFP Detachment (L I/II)**
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Rectocele
- Look for associated enterocele
- Splinting with Bowel Movements
- Often associated with perineal defect
- Site-specific repair preferred over levator plication
- Suspension (level I) often necessary

Enterocle
- True Hernia
- Contains Bowel/Omentum
- Need to repair if found
- High index of suspicion
Enterocele Repair

Vault/Uterine Prolapse

- Similar sxs to other prolapse
  - Obstructive voiding
    - May be severe!
  - Irritation/ulceration
  - Stasis/rubbing
  - Cervical Elongation

Vault prolapse with enterocele
Vault Prolapse Management

- Apical support
  - Pessary
    - 4000+ years of experience
    - Excellent for select patients
  - Surgery
    - Abdominal vs. Vaginal Approach
    - Restore “normal” anatomy
    - Suture repair vs. Mesh
    - Mesh “kit”? 
  - No treatment

Rectal Prolapse

Rectal prolapse
Pelvic Organ Prolapse and Urinary Incontinence

Rectal Prolapse

Pelvic Organ Prolapse

- All 3 are inter-related:
  1. Pelvic Organ Prolapse
  2. Urinary Incontinence
  3. Anal Incontinence

- History, Exam, and Testing need to address all 3 of these possible diagnoses

Urinary Incontinence

- ACOG/AUGS Practice Bulletin #155 (Dec 2015)
- Good Review
Normal Function

- **Storage**
  - Keep urine in bladder
- **Micturition**
  - Let urine OUT of the bladder
- **It's all physics!**
  - If bladder pressure > urethral pressure, urine flows.

Prevalence of Incontinence

- Young women 25%
- Middle aged/postmenopause 44-57%
- Older Women 75%
- Only 45% of women in U.S. with at least weekly urine leakage seek care.

Urinary Incontinence Definitions

- **Urinary Incontinence:**
  - Involuntary loss of urine that is a social or hygienic problem. 3 Main Types:
- **Stress Urinary Incontinence:**
  - Physical exertion: cough, sneeze, laugh, exercise, lifting
- **Urge Urinary Incontinence:**
  - Assoc. with urge to void, more bothersome than SUI
- **Mixed Urinary Incontinence**
Costs of Incontinence

- The estimated 2.6 million elderly community dwelling incontinent women spent approximately 4.8 billion dollars on incontinence care.
- 2.2 billion of this was on pads, briefs, other protective garments and supplies.

Anatomy of Stress Incontinence

- Loss of urethral support allows unequal transmission of abdominal pressure with stress events
  - Also loss of posterior urethrovesical angle (PUV)
- Urethra displaced instead of compressed
- IVP>mUCP WET
- "Garden hose in the mud…"
- Position of urethra more important than PUV

Urge Urinary Incontinence

- Frequency/Urgency
- "Can’t make it"
- Difficult to hold urine with urge
- "Toilet mapping"
- Physiologic
  - Loss or impairment of normal neurologic feedback pathways
  - “Detrusor-sphincter dyssynergia”
**Pelvic Organ Prolapse and Urinary Incontinence – Towers**

**Physiology of Micturition**

- **Detrusor Function**
  - Parasympathetic = contraction = micturition
    - Acetylcholine (muscarinic) receptors (M2, M3)
  - Sympathetic = relaxation = Storage
    - Adrenergic (Beta) receptors
Neurotransmitter Receptors of Bladder & Urethra

Rohner, 1983

Neurophysiology

- Four basic autonomic and somatic loops
  - I- Cerebral cortex to brainstem (modifies sensory stimuli from loop II)
  - II- Sacral micturition center (SMC, S2-S4) and detrusor to brainstem (and back, to activate III, if not inhibited by I)
  - III- Bladder wall to SMC, to urethra (relaxation of urethral sphincter as bladder contracts)
  - IV- Cerebral cortex to SMC to urethral striated muscle (voluntary relaxation and initiation of voiding)

Droegemueller Ch. 21
Normal Micturition

Diagnosis

Differential Diagnosis

Genitourinary Etiology
- Filling/Storage disorders
  - Urodynamic SUI
  - Detrusor Overactivity (idiopathic/neurogenic)
  - Mixed
- Fistula
  - Vesical
  - Urethral
  - Ureteral
- Infectious
  - UTI
  - Vaginitis
- Congenital
  - Ectopic ureter
  - Epispadias
Differential Diagnosis

- Nongenitourinary Etiology
  - Functional
    - Neurologic
    - Cognitive
    - Psychologic
    - Physical Impairment
  - Environmental
  - Pharmacologic
  - Metabolic

DIAPPERS

- D Delirium / confusion
- I Infection
- A Atrophic urethritis/ vaginitis
- P Pharmaceuticals
- P Psychological esp depression
- E Endocrine (hypercalcemia, hyperglycemia)
- R Restricted mobility
- S Stool impaction

Basic Office Evaluation

- Thorough history
- Physical examination
- Screening Urinalysis
- Post-void residual volume measurement
- Demonstration of stress incontinence
- Assessment of urethral mobility
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**History**
- Most important!!
- Characterization
- Duration
- Precipitating events
- Fluid intake
- Frequency
- Effect on life
- Storage/Micturition
- Treatment goals

**Storage**
- Frequency
- Nocturia
- Urgency
- Incontinence

**Micturition**
- Hesitancy
- Stream abnormality
- Straining
- Retention
- Pain

**History**
- PMHx
  - MS
  - DM
  - CVA
  - Back problems
- PSHx
- Allergies
- Medications

- Voiding diary
  - Include volumes!
- Validated questionnaires

**Medication Effects**

<table>
<thead>
<tr>
<th>Medication Type</th>
<th>Effect on Urethral Resistance</th>
<th>Effect on Detrusor Contractility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dopaminergic Agonist</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Cholinergic Agonist</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>Beta-adrenergic Agonist</td>
<td>↑</td>
<td>↓</td>
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<tr>
<td>Methyl Xanthine (Caffeine)</td>
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Urinalysis
- CC or cath specimen
- Treat any UTI empirically as uncomplicated UTI prior to any further workup
- Send for culture
- If microscopic hematuria (>2 RBC/HPF on microscopy) then cystoscopy and CT

Physical Exam
- Exclude confounding or contributing factors
- Diverticulum
- Fistula
- Prolapse
- Pelvic floor musculature/neurologic exam
- Discharge
- Rectal examination
Demonstration of Stress Incontinence

- Cough stress test
  - Full bladder (or backfill to 300cc)
  - If recumbent negative then test standing
  - If both negative despite SUI complaints then needs multichannel urodynamic testing

Cough Stress Test: Spurt of Urine

- Urethral Mobility
  - At least 30 degrees from horizontal
  - Point Aa
  - Q-tip
  - Visualization
  - Palpation
  - Ultrasound
  - If absent, 1.9x increase in sling failure
    - Consider bulking or fascial sling
Assessment of Urethral Mobility

Displacement angle at least 30 degrees from horizontal

Post-void residual volume

- Measure by catheter or ultrasound
- Normal is <150cc
- If elevated, then re-test at different time
- If elevated, consider further testing (voiding pressure-flow study)

Multichannel Urodynamics

- Not required for initial evaluation of uncomplicated SUI
- Indicated for:
  - Unclear diagnosis on basic evaluation
  - Failure to improve with treatment
  - Prior pelvic floor or incontinence surgery
  - Symptoms not correlating with objective findings
  - Based on clinical judgment
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### Treatment Strategies

- **UTI first**
- **Behavior/Lifestyle modification**
  - 50% reduction in incontinence compared with controls in RCT
  - Bladder training
  - Weight Loss (obesity 4.2x risk for SUI)
    - RCT 47% reduction SUI with 8% reduction baseline weight
  - Diet/Fluid Management
    - Eliminate irritants (coffee, tea, artificial sweeteners)
- **Pelvic muscle exercises/PT**
  - Objective 1-year cure SUI 59% compared to 77% with sling

### Pharmacotherapy

- **Antimuscarinic**
  - Multiple options
  - Affect M2 and M3 receptors
  - All have antimuscarinic side effects (dry mouth)
- **Beta Agonist**
  - Mirabegron
    - B-3 adrenergic receptor in detrusor
    - Not for patients with severe HTN, renal dx, liver dx
  - Onabotulinumtoxin A (BOTOX)
    - Injected cystoscopically (100 units)
    - Similar reduction to antimuscarinic
    - Better rate of complete resolution (27% vs. 13%)
    - Higher UTI (33%) and voiding dysfunction (5%)
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Treatment

- What type of receptors at urethra?
  - alpha-receptors: contractile
    - alpha agonists (theoretically) treat S.U.I.

- What type of receptors at bladder?
  - beta-receptors: Inhibitory
  - cholinergic: contractile
    - anti-cholinergics treat D.O.
    - Beta agonists treat D.O.
    - BOTOX treats D.O.

Neurotransmitter Receptors of Bladder & Urethra

Rohner, 1983

CONTINENCE  MICTURITION

SYMPATHETIC  PARASYMPATHETIC

SYMPATHETIC

PARASYMPATHETIC
Anticholinergic Drugs
- Tolterodine (Detrol)
- Oxybutynin (Ditropan)
- Solifenacin (VESICare)
- Darifenacin (Enablex)
- Trospium Chloride (Sanctura)
- Fesoterodine Fumarate (Toviaz)
- Imipramine (Tofranil)
- Amytriptyline (Elavil)

Beta Agonist
- Mirabegron (Myrbetriq)

Alpha Agonists
- Pseudoephedrine (Sudafed)
- Phenylephrine
- Phenylpropanolamine
- Similar drugs, often found OTC
- Risk – Hypertension!
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Treatment Strategies
- Sacral Neuromodulation
  - 62% clinical success rate (26% completely dry, 36% with >50% reduction in episodes)
  - For UUI refractory to first-line treatment/medical management
  - Also indicated for non-obstructive retention and fecal incontinence

Treatment Strategies
- Intradetrusor Botulinum Toxin-A (BOTOX)
  - 100-300 units in 20cc saline, injected at 20 sites posterior dome.
  - For UUI refractory to first-line treatment/medical management
  - Complete continence 42%-87% (300U)
  - Urinary retention/CISC 17%, UTI 49%
  - Duration limited (6 months)

Treatment Strategies
- Incontinence pessary
  - May improve sx of SUI and MUI
  - No objective evidence reported
  - Good option for young women who have not completed childbearing
  - Level B evidence
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**Treatment Strategies**

- Bulking Agents (level B evidence)
  - For ISD, non-mobile urethra, persistent sx after surgery, women with medical co-morbidities that preclude surgery
  - Generally less effective than other surgical treatment (factor of 1.7-4.8)
  - Prone to need for repeat injections

- Surgery
  - Aimed at restoring anatomic support to urethra and/or bladder base
  - Midurethral Sling (TVT/TOT or similar)
  - Burch colpourethropexy
  - Suburethral (Bladder Neck) Sling
  - Trans/Peri-urethral injections (adds bulk to urethra, specifically for ISD)

**Treatment Strategies**

- Surgical Treatment (SUI)
  - Can be first-line for uncomplicated SUI in appropriately counseled patient (better cure rates compared to PT)
  - Midurethral mesh sling is “standard of care”
    - TOT and TVT essentially equal in effectiveness
      - TOT less obstruction, fewer significant injuries, more groin pain
      - TVT more vascular/visceral injury, more blood loss, more obstruction
      - Mesh complications equal (2%)
      - Single incision slings are LESS effective
    - Burch colpourethropexy
    - Fascial sling (fixed urethra, mesh complication)
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SUI and Prolapse
- 40% of women without SUI will develop SUI after prolapse surgery (occult SUI)
- Screen for it
- Colpopexy and Urinary Reduction Efforts (CURE) trial
  - Significant reduction in postoperative SUI with Burch at time of ASC in stress-continent patients (24% vs. 44%)
- Vaginal Prolapse Repair and Midurethral Sling trial
  - Similar finding, but with risk of adverse effects from incontinence procedure

Summary
- Pelvic organ prolapse and urinary incontinence closely related and interdependent
- Many risk factors
- Comprehensive evaluation needed
- Understanding the anatomy and physiology is essential for accurate diagnosis and treatment

Questions?