Preamble

- Pathophysiology & Etiology of SUI
  - Epidemiology
  - Enhorning’s Theory & Hammock Theory
- Assessment of UI
  - Management of SUI
    - Conservative & Surgery
  - Management of intra & post operative complications
  - Case studies

Definition of urinary incontinence

- Urgency symptoms
- Stress symptoms
- Mixed symptoms

Types of urinary incontinence

- Stress Urinary Incontinence (SUI)
- Urgency Urinary Incontinence (UUI, OAB Wet)
- Mixed Urinary Incontinence (MUI = SUI + UUI)
- Overflow

Symptoms assessment

- Type of UI (SUI vs UUI)
- SUI – what activity
- OAB – Freq (D/N)
- Urgency & UUI
- pain hematuria dysuria
- Void – hesitancy, poor stream, incom emptying, intermittent flow

Initial assessment of UI

- Symptoms assessment
- History and general assessment
- Physical examination
- Baseline tests
General history

• Sexual – coital incontinence
• Anorectal evacuatory difficulty
• Prolapse bulge/protrusion, perineal discomfort
• Medical, neurological, psychological, Obstetric (Pregnancy outcomes, completion of family), childhood enuresis
• Surgical history (abdominal, pelvic and spinal)
• Review medications
• Diet, Habits (caffeine, tobacco use, fluid intake)

Clinical examination

• General physical mobility, mental state, fitness for surgery, neurological, oestrogenisation of tissues
• Abdominal examination mass/obesity, diastasis recti, organomegaly, ascites, scars (prev), distended bladder
• Pelvic examination degree of prolapse, pelvic mass, pelvic floor muscle tone & voluntary contraction, perineal skin condition, palpation of anterior vaginal wall and urethra, determine degree of oestrogenization, bladder neck support, observation of leakage on coughing
• Sacral neurological examination perineal sensation, reflex, foot movements

Co-existent pelvic organ prolapse

Pelvic Examination

• Tissue estrogenisation
• Prolapse

Pelvic Examination

• Cough stress test
  • Comfortably full bladder (200+ml)
  • Ask to cough/valsalva for 5 secs
  • If Prolapse, can perform reduction stress test digitally but not reliable.
  • Check if loss is consistent with symptoms.

Pelvic Examination

Bladder neck support/Hypermobility

Fritel J Urol 2002
• Hypermobility correlates with the pathophysiology of SUI
• A mobile urethra is a key indicator of good outcomes all continence surgeries
• Median rotation of proximal urethra 67 degrees primary SUI, 33 degrees I prior continence Sx
• Prior continence surgery and poor urethral mobility risk factors for failure

Liapis Eur Urology 2009 (repeat MUS SUI)
• Both ISD and poor urethral mobility independent risk factors for failure:
  Mobile urethra  fixed urethra no ISD  fixed urethra ISD
  Success: 67% 63% 40%
Pelvic Examination

- PF tone (bilateral)
- Levator defects

Digital palpation

Documentation scheme

Intact levator

Red star = defect


Baseline investigation

- Mid-stream specimen of urine (MSU) e.g.:
  - Presence/absence of bacteria
  - Presence/absence of red cells
  - Cytology status
  - Other

Exclude UTI (>1x 10^5 CFU)

Pelvic Examination

Digital palpation

Red star = defect

Baseline investigation

Mid-stream specimen of urine (MSU) e.g.:

- Presence/absence of bacteria
- Presence/absence of red cells
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- Other

Exclude UTI (>1x 10^5 CFU)

Bladder Diary

Your Daily Bladder Diary

<table>
<thead>
<tr>
<th>Time</th>
<th>Volume (mL)</th>
<th>Flow Rate</th>
<th>voided?</th>
<th>post void volume?</th>
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</thead>
<tbody>
<tr>
<td>10:00</td>
<td>200</td>
<td>100</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>11:00</td>
<td>150</td>
<td>50</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>12:00</td>
<td>220</td>
<td>80</td>
<td>No</td>
<td>Yes</td>
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</tbody>
</table>

Exclude UTI (>1x 10^5 CFU)

Baseline investigation

- Mid-stream specimen of urine (MSU) e.g.:
  - Presence/absence of bacteria
  - Presence/absence of red cells
  - Cytology status
  - Other

Exclude UTI (>1x 10^5 CFU)

2D Translabial Ultrasound

Can use any 2D Ultrasound machine used in obstetrics with a 3-6MHz curvilinear probe to image:

- Bladder:
  - Pre and post-void volume
  - Bladder neck mobility
  - Bladder masses

- Urethra:
  - Descent
  - Leakage
  - Overflow
  - Position of previous sling

A Transducer placement on perineum
B — Schematic of mid-saggital pelvic anatomy

Bladder volume

Post-Void Residual = X * Y * 5.6

Urethral imaging

Rest

Valsalva
### USS Urethral mobility and SUI

<table>
<thead>
<tr>
<th>Point</th>
<th>SI (yrs, n=140, n=92)</th>
<th>USI (yrs, n=133, n=62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point 1 (nadir neck)</td>
<td>3.01 (SD 1.49) vs 2.99 (SD 1.19)</td>
<td>3.14 (SD 0.99) vs 2.98 (SD 1.09)</td>
</tr>
<tr>
<td></td>
<td>P=0.29</td>
<td>P=0.08</td>
</tr>
<tr>
<td>Point 2</td>
<td>2.83 (SD 0.64) vs 2.25 (SD 0.82)</td>
<td>2.72 (SD 0.66) vs 2.29 (SD 0.86)</td>
</tr>
<tr>
<td></td>
<td>P=0.03</td>
<td>P=0.00</td>
</tr>
<tr>
<td>Point 3</td>
<td>2.9 (SD 0.77) vs 1.94 (SD 0.87)</td>
<td>2.38 (SD 0.88) vs 1.98 (SD 0.73)</td>
</tr>
<tr>
<td></td>
<td>P=0.001</td>
<td>P=0.001</td>
</tr>
<tr>
<td>Point 4</td>
<td>2.6 (SD 0.6) vs 2.67 (SD 0.44)</td>
<td>2.67 (SD 0.44) vs 2.67 (SD 0.40)</td>
</tr>
<tr>
<td></td>
<td>P=0.92</td>
<td>P=0.92</td>
</tr>
<tr>
<td>Point 5</td>
<td>1.86 (SD 0.51) vs 1.75 (SD 0.59)</td>
<td>1.85 (SD 0.56) vs 1.74 (SD 0.55)</td>
</tr>
<tr>
<td></td>
<td>P=0.12</td>
<td>P=0.08</td>
</tr>
<tr>
<td>Point 6</td>
<td>1.85 (SD 0.98) vs 1.75 (SD 0.85)</td>
<td>1.95 (SD 1.04) vs 1.75 (SD 0.97)</td>
</tr>
<tr>
<td></td>
<td>P=0.26</td>
<td>P=0.26</td>
</tr>
</tbody>
</table>

Segmental urethral mobility in women with and without SI and USI on urodynamic testing.

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### Urethral rotation measurement

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### 2D imaging of suburethral slings

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### Urethral Diverticulum – 2D USS

Can present as an “innocent looking lump”.

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### Urethral diverticulum – 3D USS

Can present as an “innocent looking lump”.

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### Urethral Diverticulum

Can present as an “innocent looking lump”.

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Recurrent symptoms – urethral diverticulum

MUS “hiding diver; culum”: presents as recurrent cyst

Role of surgery for UI (failed conservative)

Verify, quantify incontinence

Benefits of UDS for clinicians

• Pathophysiological explanation for symptoms
• Verify, quantify incontinence
• Role of surgery for UI (failed conservative)
• Counselling/What to expect
  • Efficacy for intervention
  • Risk factors failure
  • Functional outcomes (OAB/DO, Voiding Dysfunction)
  • Prediction of de novo symptoms

Why Urodynamics?

“Pure sui” symptoms reflect only 5% patients attending urogynaecology clinic. Even if only symptom is stress incontinence, 26.1% will have another important diagnosis as cause.

Agur 2009 BJU

“The bladder is an unreliable witness” - patients reported symptoms may not reflect the underlying pathology

Botes, 1970

Why Urodynamics?

Women with USI had better continence outcomes for SUI than those without urodynamic diagnosis OR 2.7 (1.0, 5.2).

Nager 2008 I Urog

Urodynamic testing in clinical practice is to evaluate a person’s lower urinary tract function with at least one complete and representative filling-emptying/post-voiding cycle by testing with relevant pressures and flowmetry.

Auxiliary testing: ultrasound bladder outlet closure function or simultaneous registration of pelvic floor muscle activity and/or simultaneous addition of anatomic or morphologic information with dosimetry, magnet or other imaging can complete, or augment the value of, urodynamic testing for specific indications.

Hosker ICI 2009 Rosier ICI 2013

Role for UDS

• To identify or rule out all factors that contribute to the LUT symptoms (e.g. urinary incontinence) and assess their relative importance;
• To obtain information about all other aspects of LUT function or dysfunction whether or not expressed as a symptom or recognizable as a sign;
• To allow a prediction of the possible consequences of LUT dysfunction for the upper urinary tract;
• To allow a prediction of the outcome, including undesirable side effects, of a contemplated treatment;
• To confirm the effects of intervention, or elucidate the mode of action of a particular type of treatment for a LUT dysfunction, especially in new and or experimental pre-clinical one;
• To understand the reasons for failure of previous treatments for urinary incontinence or for LUT dysfunction;

Hosker ICI 2009 Rosier ICI 2013

Spectrum of UDS

Cystometrography, Leak point & Closure pressure, Pressure Flow Study

Bladder triiary

Uroflowmetry & post void Residual

Free uroflowmetry & post void Residual

Retrograde Cystography/Micturition Voiding

Urine dip MSU

Hosker ICI 2009 Rosier ICI 2013

Lesso invasive

Transurethral α-blocker

Transurethral MSU

Transurethral SSE

Transurethral TUR
**Spectrum of UDS**

**More invasive**

- Video Urodynamics
- Cystourethroscopy

**Non-invasive or office urodynamics**

Many aspects of a formal urodynamic assessment can be performed in the office without urodynamic equipment, including:

- Detailed history – eg patient reported outcome tools / questionnaire
- Freq Val Chart, Bladder diary
- Clinical cough stress test, empty supine CST Free uroflowmetry
- Post void residual – transabdominal, perineal USS

**Indications for multichannel urodynamic testing**

- Previous surgery for incontinence
  - Suspected intrinsic sphincteric deficiency (positive empty supine stress test)
  - Recent pelvic surgery
  - History of pelvic radiotherapy
  - Abnormal voiding (increased postvoid residual)

- External vaginal prolapse

- Significant symptoms of urinary urgency

- Neurologic disease

- Diabetes or other conditions that may affect bladder function

**Formal urodynamics procedure**

- **Free flowmetry**: Flow rate, pattern and post-void residual
- **Cystometry**: Measures and subtracts abdominal from intravesical pressure to determine detrusor pressure during filling and voiding
  - With filling: assessment of sensation, compliance, incontinence with filling, increased abdominal pressure
  - Provocation manoeuvres:
    - Stress/valsalva stress test in supine and standing position
    - Water provocation test to stimulate detrusor contraction
  - **Urethral function**: Urethral pressure (MUCP/VLPP) at set bladder volume
  - **Voiding cystometry**
    - Pressure-flow studies – Void with pressure catheters in-situ, measuring flow rate, abdominal, detrusor +/- urethral pressures.
    - Post void residual

- **/+ Cysto-urethroscopy**: Exclude diverticulum, stones, foreign bodies, Lesions- benign or malignant

- **/+ EMG**: to assess sphincter activity – rarely performed

**Uroflowmetry and PVR**

- Small catheters inserted bladder (pressure and filling) and vagina/rectum

- Bladder filled at 50ml/minutes with normal saline

- Measures sensation, abdominal and detrusor activity and pressure; compliance, capacity, urethral pressures and incontinence with filling, increased abdominal pressure, provocation (water)

- Flowmetry at maximal capacity measuring:
  - Urine flow, abdominal and detrusor activity and pressures, urethral function

**Cystometry**


*Haylen et al, Neurourology and Urodynamics 21:261-274 (2002)*
Cough induced detrusor contraction

Homma et al, ICI 2nd edition, 2001

Tests of urethral function

“Normal range” for urethral pressures based on higher rates of failure were observed in Burch (MUCP), Sand et al 1987, or an open bladder neck seen on fluoroscopy (VLPP), Maguire et al 1993 and commonly defined as:

- Maximal Urethral Closure Pressure ≤ 20cmH2O
- Valsalva Leak Point Pressure ≤ 60cmH2O

While there is a large overlap in urethral function between those with SUI and no SUI, failure rates appear to be higher with lower pressures:

- Low MUCP (≤ 30cmH2O) MUS independent risk failure, OR 4.5, p=0.016
- Lower quartile VLPP or MUCP (VLPP <86 cm H2O, MUCP <45 cm H2O)
  OR 2.3, p=0.011 and OR 1.18, p=0.04, respectively for failure for MUS.

Nager J Urol 2011

Conclusion: Poor urethral function is associated with higher rates of failure which may assist clinicians with sling selection and patient counseling

What UDS for what patient

<table>
<thead>
<tr>
<th>Detailed history / PRO (Qs)</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea Nitrate / MSU</td>
<td>all</td>
</tr>
<tr>
<td>Electrolyte</td>
<td>all</td>
</tr>
<tr>
<td>Clinical cough stress test</td>
<td>all</td>
</tr>
<tr>
<td>Free-output Volume / Post void residual</td>
<td>Voiding difficulty, surgery, OAB</td>
</tr>
<tr>
<td>Cystometry: Pressure Flow studies</td>
<td>Voiding difficulty, surgery, OAB</td>
</tr>
<tr>
<td>Videourodynamics (VCU)</td>
<td>Neurological, complex, MUCP</td>
</tr>
<tr>
<td>ALP R CLPP</td>
<td>Surgery</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>CHBD</td>
</tr>
</tbody>
</table>

What was the cause of UI? Treatment plan

Standardised Urodynamics report

Patient identifier, date, clinicians, consent
Free uroflow: Void Volume, Max Flow, Post void residual
Cystometry: Capacity, Volume @ diff sensation
Abnormal/dysunctional (with or without symptoms)
Imaging: Urethral & bladder neck mobility
Voiding Pressure Flow study assess void function
Provocative tests: confirm presence of UI
Maximal Urethral Closure pressure
Was urodynmaics abnormal?
Did it explain the patients symptoms?
What was cause of UI?
After UDS – impact on management

**Diagnosis**
- Pure DO – avoid sling/continence surgery
- Mixed UI + DO – OAB may persist, DO beware

**Severity**
- IS (MUCP <20 / VCLPP <60) – RP beware

**Voiding**
- Poor function highly correlated with Vti issues
- TC better? Minifling?

**Occult SUI**
- Counsel, discuss (manage expectations)
- Risk of SUI vs Risk of VD
- 2 step approach?

Evidence for role of urodynamics

If pure or predominant SUI the evidence is variable:
- NICE (2012): Prep Assessment using basic office evaluation was not inferior to invasive UDS regarding treatment success at 12 months, however
  - Study group estimated to reflect on only 5% patients attending tertiary referral Urogynaecology clinic
  - Did not address complicated patients with urge-predominant incontinence, previous surgery for incontinence, ISD, neurologic disease, or planned concomitant surgery for pelvic organ prolapse.
- NICE (2013): in women with a clearly-defined clinical diagnosis of pure stress urinary incontinence, use of multi-channel cystometry is not recommended.
- ICI 2013 asserts pure stress incontinence represents 5% patients seen in tertiary referral clinic, and suggest urodynamics warranted in evaluation of SUI and should be carried out in all women prior to surgical intervention for stress urinary incontinence (Grade B)

POP surgery and concomitant SUI surgery

- If patients are asymptomatic of SUI, there is a limited role for UDS.
- Such women should be counselled that there is a ~20% chance of revealed occult SUI but only ~7% overall go on to have subsequent SUI surgery with no difference in outcomes with the delayed procedure.

Recommendations on UDS

- **Uncomplicated SUI with normal bladder diary, normal flowmetry and without relevant post-void residual urine** –
  - Symptomatic pure SUI with no symptoms or signs of voiding difficulties = for treatment with pelvic floor muscle training.
  - Symptomatic pure UI with no symptoms or signs of voiding difficulties = for treatment with pharmacological means planned treatment should be non-invasive and be simply reversible

- **Recommended for patients that have had failed first therapies, surgery planned, doubt on pathophysiology** – to base rational treatment decision & prognosis

Preamble

- Pathophysiology & Etiology of SUI
- Epidemiology
- Entering’s pressure equalisation Theory & Hammock Theory (urethral backstop)
- Assessment of UI
- Management of SUI
- Conservative & Surgery
- Management of intra & post operative complications
- Case discussions