Urodynamics

New England Section of the AUA

2013 Joint Allied Health Program with SUNA

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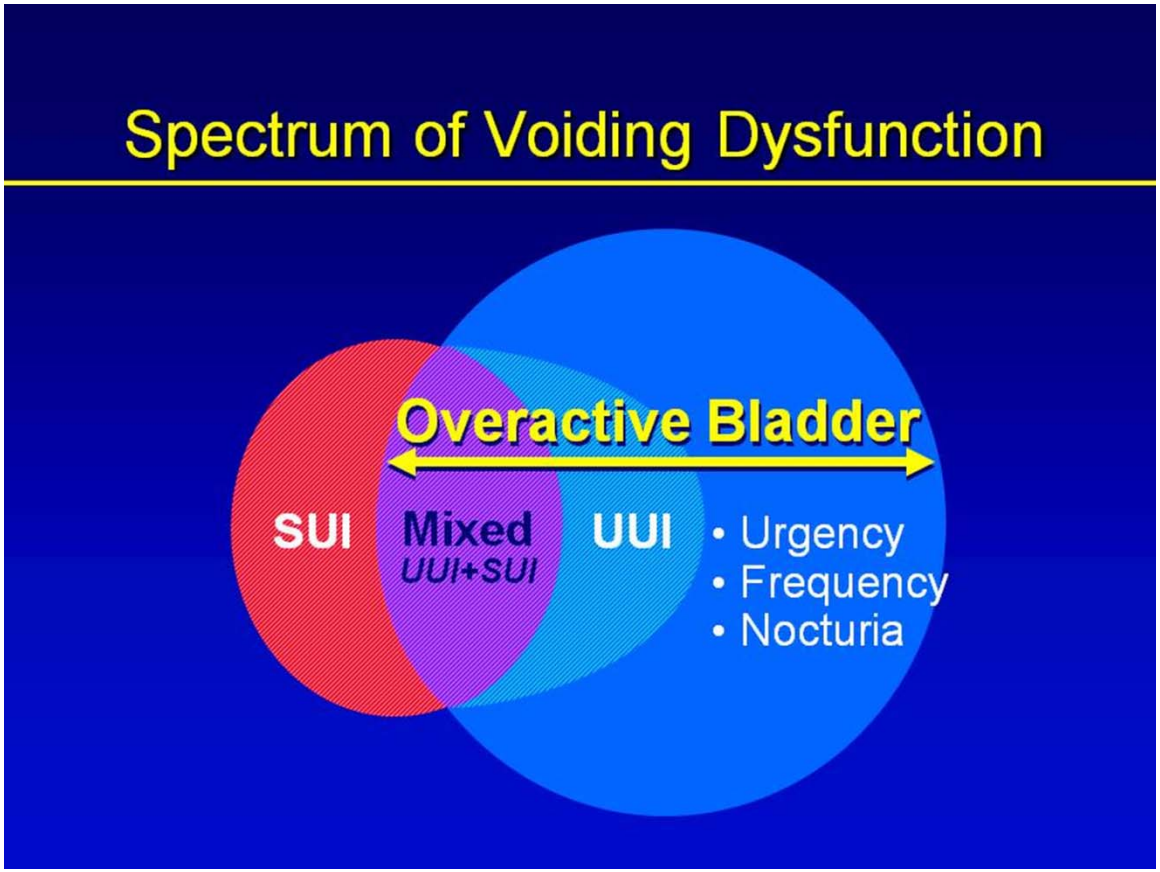
Objectives

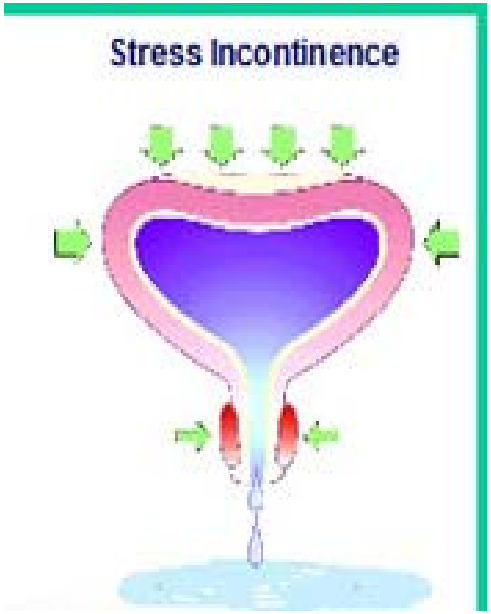
1. Understand Bladder Dysfunction Definitions
2. Explain What Urodynamics Is
3. Review Concord Urology UDS Program
4. Understand the 2012 AUA Adult UDS Guidelines

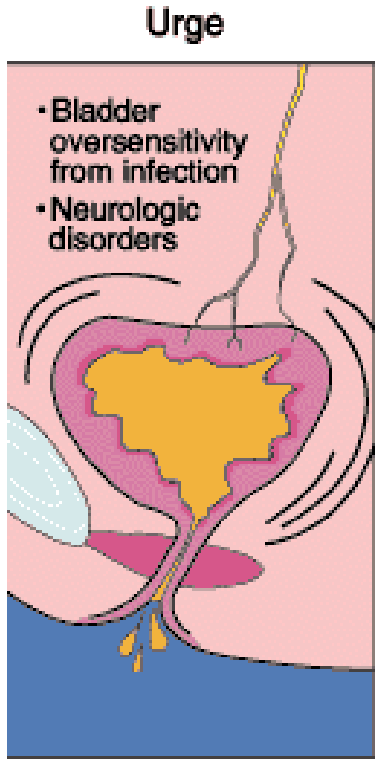
Objective #1
Bladder Dysfunction Definitions



Incontinence

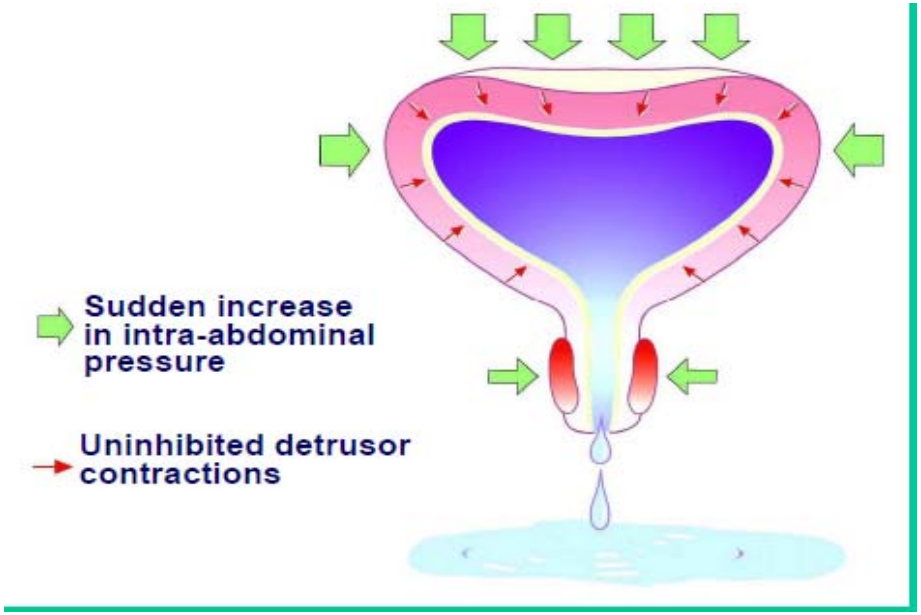
- **Stress Urinary Incontinence** (SUI): is the complaint of involuntary leakage on effort or exertion, or on sneezing or coughing.
- **Urge Incontinence** (UI) : is the complaint of involuntary leakage accompanied by or immediately preceded by urgency.





Incontinence

- **Mixed Urinary Incontinence** (MUI): is the complaint of involuntary leakage associated with urgency and also with effort, exertion, sneezing and coughing



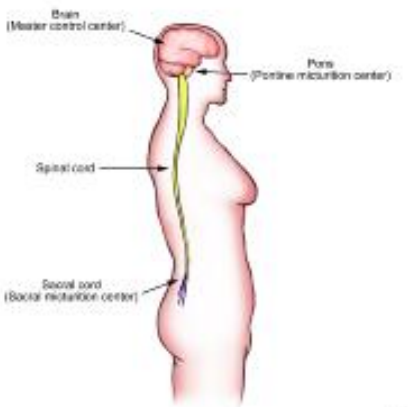
International Continence Society 2002

Overactive Bladder

- **Overactive Bladder** (OAB): is characterized by the storage symptoms of urgency with or without urgency incontinence, usually with frequency and nocturia.

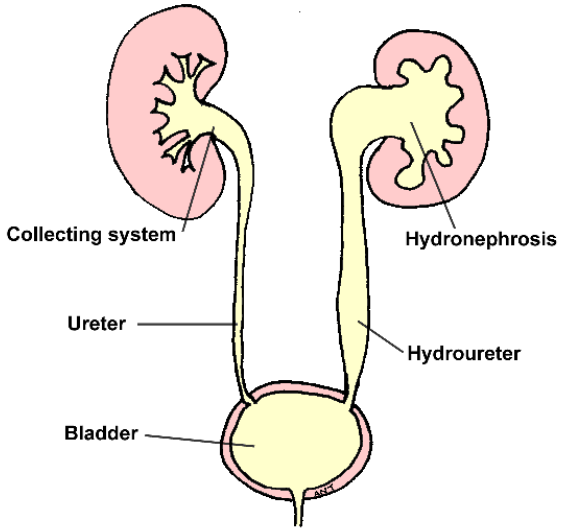
Neurogenic Bladder

- **Neurogenic Bladder** (NGB): Is the disturbance of normal bladder function as a result of a neurologic condition
  - Spinal cord injury, MS, Parkinson's disease, CVA, traumatic brain injury, myelomeningocele, brain or spinal cord tumor, transverse myelitis, back or spine disease (herniated disc, cauda equina syndrome), DM, peripheral nerve injury, lower motor neuron disease.



Neurogenic Bladder

- NGB urinary symptoms include: dysfunction of storage and/or emptying, risk for upper tract injury.
  - Upper tract injury may occur with sustained elevated bladder storage pressures
    - hydronephrosis, hydroureter, vesico-ureteral reflux, reflux nephropathy, UTI, pyelonephritis



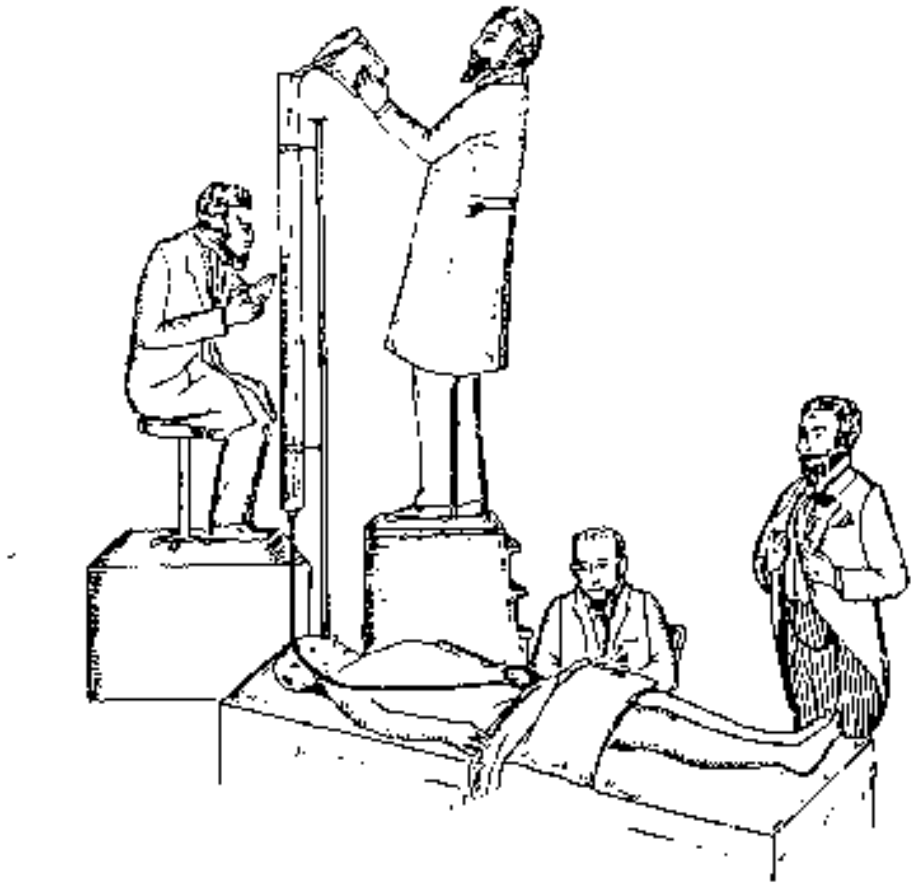
How does the Neurologic Condition Effect Bladder Function

- Spinal Cord Injury:
  - abrupt onset of bladder dysfunction followed by stability and possible improvement of symptoms
- Multiple Sclerosis and Parkinson's disease:
  - bladder dysfunction as disease progressed
- Multiple Systems Atrophy:
  - bladder dysfunction often before other symptoms are noticed
- CVA:
  - neurogenic bladder and functional disturbances

Lower Urinary Tract Symptoms (LUTS)

- Storage LUTS
  - Frequency, urgency, incontinence, nocturia
- Voiding LUTS
  - Force of stream, hesitancy, intermittent stream, post void dribbling
- LUTS are most commonly referred to as a male diagnosis but can be found in females as well
  - Outlet obstruction from previous anti-incontinence procedure

Objective #2
What is Urodynamics?



What is Urodynamics?

- UDS is a dynamic and interactive diagnostic study of the lower urinary tract which consists of a number of tests that can be used to obtain functional information about urinary storage and emptying.
- The test is dynamic: meaning constantly changing and patient dependent
- UDS is only one part of the comprehensive evaluation of bladder dysfunction

Good Urodynamic Practice

- Adhere to correct terminology
- Adhere to consistency and quality of UDS technique and interpretation
- Formulate the UDS question
- Work to reproduce the patient's symptoms during testing
- Identify test artifacts
- Report results in the context of the clinical scenario
- Appropriately select patients for UDS testing

Who Should Have UDS Testing?

- In general conservative, non-invasive treatments may be instituted without UDS testing.
  - ie. behavioral modifications, physical therapy, medications
- UDS is not without risks
  - Infection, urethral trauma, pain, exposure to radiation, embarrassment, anxiety, autonomic dysreflexia
- Patients who may benefit from UDS include:
  - Patients with symptoms that do not improve with conservative treatment
  - Patients who are considering invasive, potentially morbid or irreversible treatment

The Goal of UDS

- Reproduce the patient's symptoms
- Identify the cause of the LUTS
- Predict the risk these LUTS have on the upper tract
- Identify the reasons for treatment failure and refractory symptoms

The UDS Question

- Before beginning a UDS study you must determine the UDS question,
  - What information do I need to obtain from the UDS study?
  - What UDS technique is needed to obtain this information?
  - How will I use this information to guide therapy?

Objective # 3
Review UDS Program at Concord Hospital Center for Urologic Care

UDS Staff

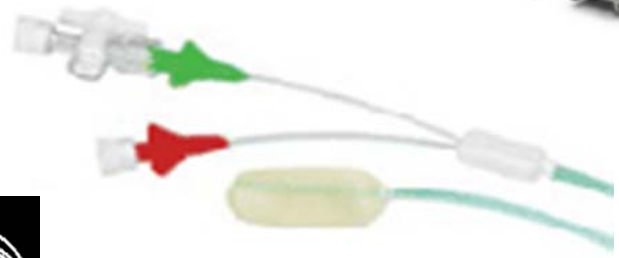
- Studies are performed by our trained nursing staff in conjunction with an APRN and a radiology technician
- Physician interprets study

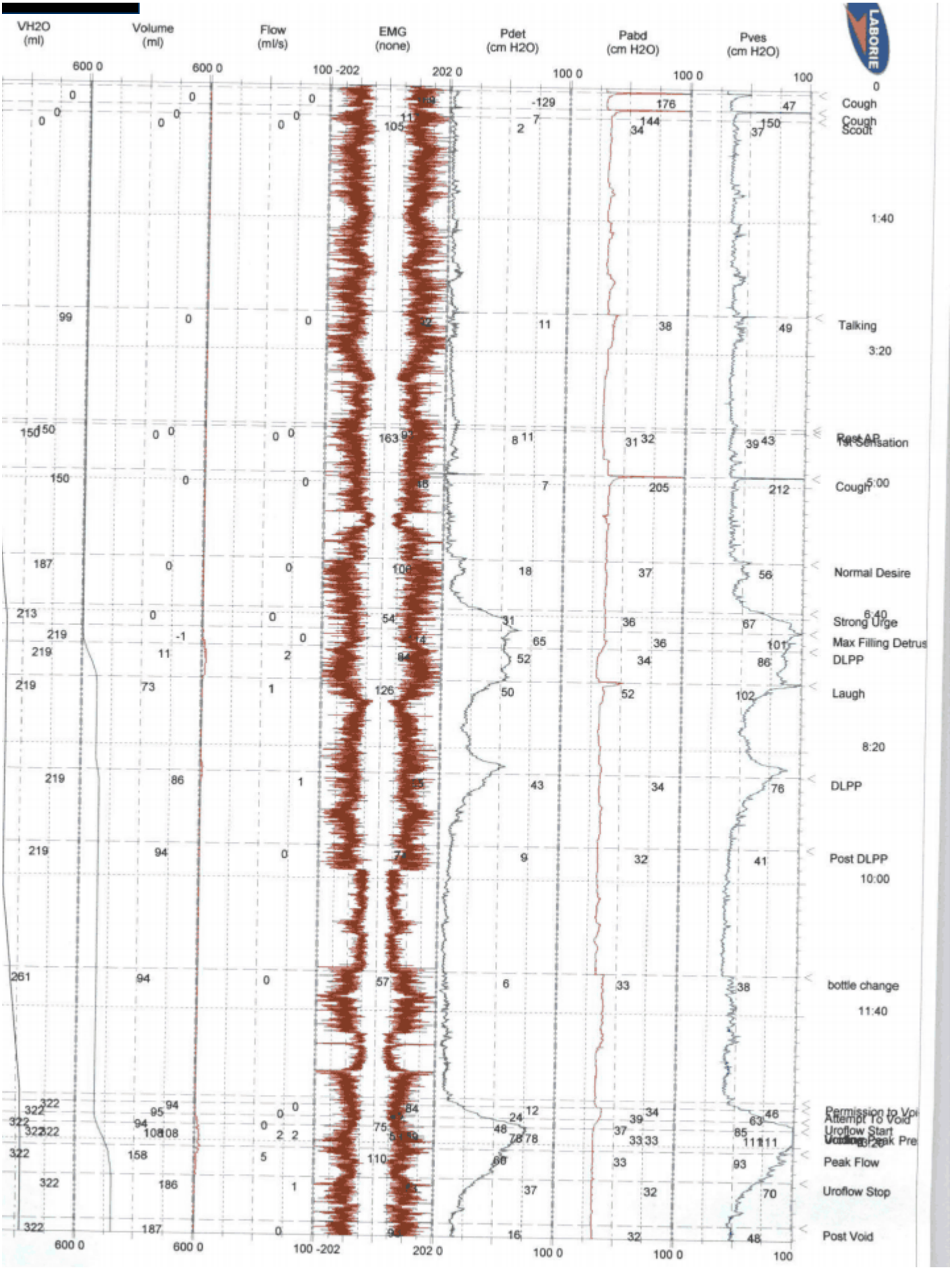
Pre-Procedure Preparation

- Nurse visit/education
  - Explanation of procedure
  - Review of allergies and current medications
    - Anticholenergic medications are held for 7 days
  - Review of risk factors
    - Pregnancy, mobility, joint replacement, immunocompromised, voiding status
  - Patient consent
  - Urine culture
    - 7 days prior to testing, preferably a catheterized specimen
  - Pregnancy test
- Prophylactic Antibiotic Coverage
  - Based on current AUA Best Practice Statements on: Antimicrobial Prophylaxis for Urologic Surgery and Antimicrobial Prophylaxis for Joint Replacement

Urodynamic Procedure

- Time out/Consent
- Non-intubated Uroflow
- Patient positioning
- Catheterized PVR
- Bladder catheter
- Rectal catheter
- EMG leads




VH2O (ml)
Volume (ml)
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EMG (none)
Pdet (cm H2O)
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600 0
600 0
100 -202
202 0
100 0
100 0
100
Cough
Cough
Scout
1:40
Talking
3:20
Rest AB
1st Sensation
Cough
5:00
Normal Desire
6:40
Strong Urge
Max Filling Detrus
DLPP
Laugh
8:20
DLPP
Post DLPP
10:00
bottle change
11:40
Permission to Vo
Attempt To Void
Uroflow Start
Peak Pre
Peak Flow
Uroflow Stop
Post Void

Urodynamic Tests and Nomenclature

- **Uroflowmetry** – measurement of the rate of urine flow over time
- **Post-void residual** (PVR) - volume of urine left in the bladder at the completion of micturition.
- **Cystometry** (CMG) – measurement of the pressure/volume relationship of the bladder during bladder filling. (bladder sensation, compliance, capacity and detrusor overactivity)
- **Electomyography** (EMG) – measurement of striated sphincteric muscles of the perineum to evaluate for abnormal muscle function associated with LUTS and dysfunction
- **Pressure flow studies** (PFS) – measures relationship between pressure in the bladder and urine flow rate during bladder emptying
- **Videourodynamics** (VUDS) – addition of imaging during cystometry and/or pressure flow studies
- **Abdominal leak point pressure** (ALPP) or **Valsalva leak point pressure** (VLPP) - pressure at which urine leakage occurs due to increased abdominal pressure in the absence of a detrusor contraction.
- **Urethral pressure profile** – continuous measurement of the fluid pressure needed to just open a closed urethra
- **Maximum urethral closure pressure** (MUCP) – maximum difference between urethral pressure and intravesical pressure

Post-Procedure Instructions

- Please take your antibiotic today as prescribed
- Drink 8 to 10 eight ounce glasses of fluid over the next 2 days. Water is best. This will help prevent a urinary tract infection and soothe irritation.
- You may have irritation when you empty your bladder over the next 24 hours. This is normal. If the pain lasts longer than 24 hours please call the office.
- If you have a fever of 100.0 degrees or higher please contact the office
- You may pass a few drops of blood when you empty your bladder. If you pass clots or the bleeding increases please contact the office.
- Call the office for any questions or concerns you may have regarding your recent urodynamics procedure
- Your next scheduled appointment is:

Objective #4
Review the 2012 AUA Adult UDS Guidelines

- 2012 AUA Adult Urodynamic Guidelines
  - SUI and Pelvic Organ Prolapse
  - OAB, MUI, UI
  - NGB
  - LUTS

UDS Guideline Evidence Strength

- The guideline recommendations are based on Grade B (moderate) to Grade C (low) evidence strength.
- In the absence of sufficient evidence, additional information is provided as Clinical Principles and Expert Opinion.

Stress Urinary Incontinence and Pelvic Organ Prolapse (POP)

Case

- 46 y/o G3P3 female with a 2 year history of urinary incontinence related to activity and occasionally to urgency. She also complains of a vaginal bulge
- PMH/PSH: none
- Meds: none
- PE: stage II POP with urethral hypermobility, no CST

Urodynamics for SUI

- Multichannel UDS may be used in select patients and for complicated patients
- Assess urethral function with intravesical catheter
- Poor urethral function suggested by low CLPP, VLPP or MUCP may predict less optimal outcomes with some types of therapy
- UDS may be used to guide invasive treatment decisions, choice of surgery and postoperative voiding dysfunction according to our guidelines.
- Fluoroscopy may improve diagnoses of SUI and help assess for bladder outlet obstruction and degree of prolapse.

Stess Urinary Incontinence and Pelvic Organ Prolapse (POP)

- UDS finding: involuntary leakage of urine during filling cystometry associated with increased intra-abdominal pressure in the absence of detrusor contraction.
- Pelvic organ prolapse: descent of pelvic organs
- Occult SUI: SUI observed after reduction of high grade prolapse

No Leak During SUI Testing

- Repeat SUI testing should be performed with the urethral catheter removed in patients suspected of having SUI who do not have SUI with the urethral catheter in place
  - Over 50% of women with symptoms of SUI who do not leak with the urethral catheter in place will leak when the urethral catheter is removed
  - One study found 35% of men with post prostatectomy incontinence did not leak until the urethral catheter was removed
  - Replacement of a new sterile urethral catheter should be replaced to finish the study and to assess the pressure flow study during voiding

Maniam P et al, J Urol 2002; 167:2080
Huckabay C et al, Neurourol Urodyn 2005; 24: 622

Testing for Patients with POP

- Patients with high grade prolapse may report no symptoms of SUI
  - Stress testing should be performed with the prolapse reduced to evaluate for occult SUI if the presence of SUI would change the surgical plan

Testing for Patients with POP

- UDS may be used with the prolapse reduced to assess for occult SUI and detrusor dysfunction
- Determine if elevated PVR or retention is related to outlet obstruction from prolapse, detrusor hypoactivity or both

When UDS May Not Be Needed

- UDS is optional prior to surgery for SUI in uncomplicated patients
  - Uncomplicated patient: Symptoms and signs of SUI without prior GU surgery, neurological history or symptoms, no other health concerns, no pelvic organ prolapse, no other voiding symptoms
  - SUI on physical exam may provide adequate urethral assessment

Overactive Bladder, Urge Incontinence, Mixed Incontinence

Case

- 60 y/o female with a 5+ year history of urgency and frequency of urination. Denies urinary incontinence. Nocturia 3-5 times per night
- PMH/PSH: diabetes, TAH/BSO
- PE: obese, vaginal atrophy, good support
- Meds: metformin

Overactive Bladder, Urge Incontinence, Mixed Incontinence

- Detrusor overactivity: diagnosed by UDS when involuntary detrusor contraction occurs during the cystometry filling phase
  - DO is not required to make the diagnosis of OAB.
  - UDS may not diagnose DO in patients with OAB and UI
    - History, physical examination, voiding diaries, PVR are equal parts in the overall assessment of symptoms

Urodynamics for OAB, UI and MUI

- In uncomplicated patients consider conservative treatment options and medical therapy first

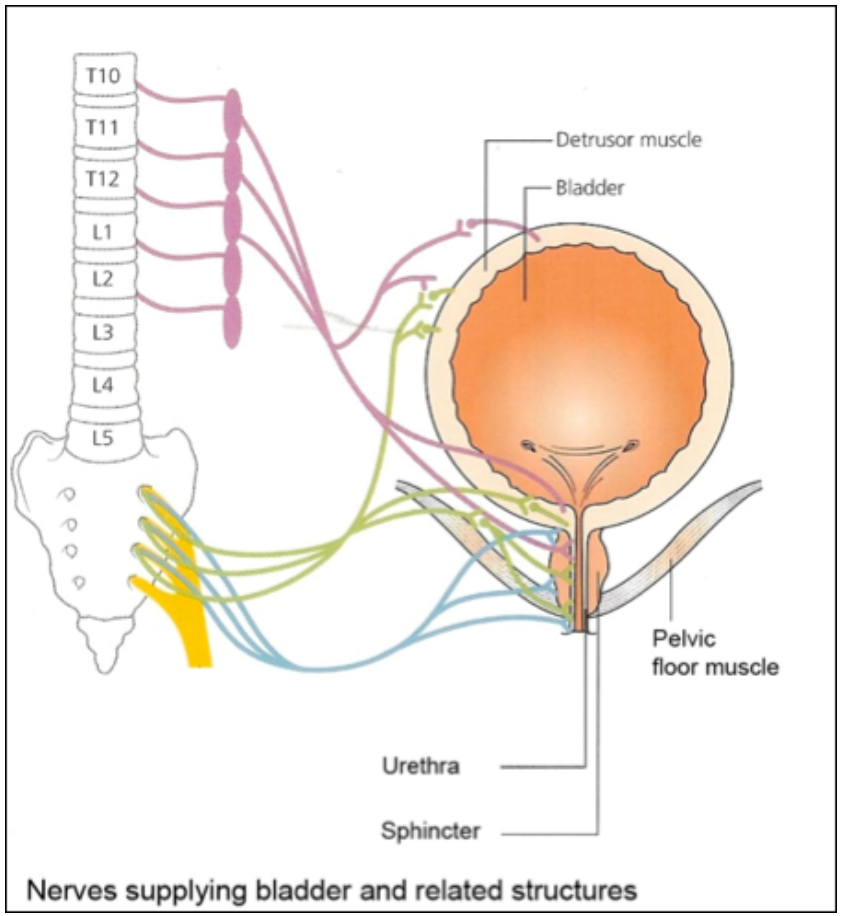
Urodynamics for OAB, UI and MUI

- Consider multichannel UDS to determine compliance, detrusor overactivity or other abnormalities prior to invasive treatment and if conservative treatment has failed
  - Does the patient have DO: involuntary rise in detrusor pressure during filling which may cause leaking
  - Does the patient have impaired compliance which may compromise the upper tract. If so, treatment should be given to lower storage pressure.
  - Does the patient have increased filling sensation: filling sensation at low volumes without detrusor contraction

Refractory OAB and UI After Bladder Outlet Procedure

- Differential diagnosis: obstruction, urethral injury, bladder injury, urethral erosion.
- Comprehensive assessment, cystoscopy should be performed
- Consider pressure flow study for patients who develop refractory urgency after bladder outlet procedure to r/o bladder outlet obstruction.
  - Elevated detrusor voiding pressure with low flow may suggest obstruction
  - Elevated PVR with altered voiding symptoms after an anti-incontinence procedure strongly imply obstruction and UDS may not be needed prior to intervention (urethrolysis).

Neurogenic Bladder



Nerves supplying bladder and related structures

Case

- 24 y/o male with C6-7 SCI initially had urinary retention, now on ISC but has urinary incontinence between cathing.
- PMH/PSH: anxiety/depression,cervical spine surgery
- Meds: Zoloft, oxybutinin
- PE: wheelchair, quadriplegic

Tools for Neurogenic Bladder Assessment

- Patients with a neurogenic bladder may have bladder dysfunction early in the disease process or not until the disease has progressed
- PVR is useful to assess bladder and outlet dysfunction at initial assessment and follow up
- Risks of elevated PVR: UTI, urosepsis, upper tract deterioration, stone disease

Complex Cystometry for Neurogenic Bladder

- A CMG should be performed in patients with *relevant* neurological conditions *(SCI, MMC and others at risk for upper tract impairment)* with or without symptoms. CMG should be performed at the initial assessment and at follow up when appropriate.
  - CMG will assess for compliance, DO, areflexia, hyporeflexia to help guide management.
  - CMG provides diagnostic, therapeutic and prognostic information for patient is MMC and SCI

Complex Cystometry for Neurogenic Bladder

- CMG may be used to assess patients with other neurological diseases who have symptoms of LUTS
  - The benefit of CMG results in protection of renal function in patients with MS, Parkinson's, and CVA is less clear.
  - CMG can accurately diagnose detrusor dysfunction in this population
  - Consider CMG testing in these patients when their symptoms do not respond to medications or when voiding dysfunction or incomplete emptying occur because of disease progression or treatment.

Pressure Flow Studies for Neurogenic Bladder

- PFS should be performed in patients with MMC or SCI with or without symptoms
- PFS should be performed in patients with MS, PD, CVA or other neurologic diseases who have elevated PVR or urinary symptoms
- PFS can distinguish between bladder outlet obstruction and detrusor hypo/acontractility.
- PFS can help guide treatment options and monitor treatment outcomes

Videourodynamics for Neurogenic Bladder

- Consider VUDS in patients with MMC or SCI
- Consider VUDS in patients with other neurologic diseases with elevated PVR or urinary symptoms
- VUDS has been found to improve diagnostic evaluation of patients with neurogenic bladder
- VUDS is helpful to locate sites of obstruction, grade of vesicoureteral reflux, anatomical abnormalities (diverticula, bladder stones, bladder neck obstruction, detrusor bladder neck dyssynergia).

EMG for Neurogenic Bladder

- Perform EMG with CMG +/- PFS in patients with relevant neurologic diseases at risk for NGB or in patients with other neurologic diseases with elevated PVR or urinary symptoms
- EMG measures signals from external urethral sphincter, external anal sphincter and pelvic floor muscles to determine if perineal contractions are coordinated or uncoordinated with detrusor contractions
- EMG is helpful in assessing for DSD
  - Involuntary contraction of the external sphincter during detrusor contraction
  - EMG with fluoroscopy, CMG and PFS to obtain the most accurate diagnosis

Lower urinary Tract Symptoms

"I swear I'll give up smoking, drinking, gluttony,
even my fat-back bacon if only you will let me pee."

Case

- 72 y/o male with a 10+year history of urinary urgency, frequency, recently developed urgency incontinence, incomplete emptying and weakened urinary stream
- PMH/PSH: HTN, BPH, appendectomy
- Meds: atenolol, flomax, proscar
- PE: prostate 50g

PVR testing for LUTS

- Consider PVR testing at initial assessment and during follow up to rule out retention
  - PVR testing is a nonspecific test, it cannot differentiate between BOO or detrusor hypocontractility
  - In some patients an elevated PVR may be harmful.
    - Identify patients with high PVR to reduce risk of upper tract injury, infection and further bladder dysfunction
    - PVR evaluation may facilitate treatment selection and help to monitor treatment outcome

Uroflow for LUTS

- Consider uroflow testing in male patients at initial and follow up evaluation who have LUTS suggesting voiding/emptying dysfunction
- Uroflow gives objective and quantitative measurements and should correlate with the patient's symptoms
- However, uroflow is unable to determine BOO from detrusor hypocontractility. Uroflow findings can be influenced by artifact and multiple uroflows for the same patient can have a large variability.

Complex CMG for LUTS

- Consider CMG for patients with LUTS to determine if bladder filling or bladder storage dysfunction is present prior to invasive treatment
  - The presence of DO or impaired compliance on CMG may help with the decision for invasive treatment

Pressure Flow Study for LUTS in Men

- PFS should be performed in men with LUTS prior to invasive treatment to determine if obstruction is present.
- Voiding PFS is the standard for diagnosis of BOO in men
- The panel suggests a better outcome from surgery for BPH if PFS suggests a diagnosis of BOO
  - It can be recommended that PFS become part of the evaluation of LUTS in men
  - It may not always be necessary to diagnose BOO before moving forward with surgery

Pressure Flow Study for LUTS in Women

- Consider PFS in women when it is important to evaluate for obstruction
- Results should always be correlated to the patient's symptoms and other diagnostic tests.
- BOO in women has not been well established, This is an area for current and future research.

VUDS in LUTS

- Consider VUDS in patients with LUTS to locate the area of obstruction
  - Primary bladder neck obstruction: failure of the bladder neck to open during a voluntary detrusor contraction.
    - High detrusor pressure associated with low flow with radiological evidence of bladder neck obstruction with relaxation of urethral sphincter muscle and no evidence of distal obstruction
  - Dysfunctional voiding

Conclusion

- UDS is a complex and dynamic test that aids in directing patient treatment
- It is not without risk
- It is the best tool available to us to determine bladder dysfunction

Resources

Winters JC, Dmochowski, RR, Goldman HB et al: American Urologic Association/Society of Urodynamics, Female Pelvic Medicine and Urogenital Reconstruction Guideline: Adult Urodynamics. 2012.

Abrams, P, Cardozo L, Fall M et al: Standardisation of Terminology of Lower Urinary Tract Function: Report from the Standardisation Sub-Committee of the International Continence Society. Neurourol Urodyn 2002; 21:167-178.

Maniam P and Goldman HB: Removal of transurethral catheter during urodynamics may unmask stress urinary incontinence. J Urol 2002; 167: 2080.

Huckabay C, Twiss C Berger A et al: A urodynamic protocol to optimally assess men with post0prostatectomy incontinence. Neurourol Urodyn 2005; 24: 622.

Questions?

UDS Guideline Review for SUI and Pelvic Organ Prolapse

- Assess urethral function when diagnosing SUI
- Assess PVR when considering invasive treatment for SUI
- Consider UDS in patients with symptoms and physical findings of SUI who are considering invasive treatment
  - Repeat stress testing with urethral catheter removed in patients suspected of having SUI who do not demonstrate SUI with UDS catheter in place
  - Reduce high grade prolapse in patients when preforming stress testing during UDS to assess for occult SUI and detrusor dysfunction

UDS Guideline Review for OAB, UI, and MUI

- Consider UDS when it is important to determine if altered compliance, DO or other UDS abnormalities are present in patients with UI when considering invasive treatment
- Consider pressure flow studies in patients with UI after bladder outlet procedures to assess for bladder outlet obstruction
- Absence of DO on a single UDS study does not exclude it as a cause of the patient's symptoms

UDS Guideline Review for Neurogenic Bladder

- Perform PVR during initial assessment and as part of follow up in patients with SCI and MMC
- Perform CMG during initial assessment and as part of follow-up in patients with relevant neurogenic conditions with or without symptoms
  - Consider CMG evaluation in patients with other neurogenic diseases with LUTS
- Perform pressure flow testing during initial assessment and as part of follow-up in patients with relevant neurogenic conditions with or without symptoms, in patients with other neurogenic disease with elevated PVR or in patients with persistent symptoms.
- Consider fluoroscopy at time of UDS in patients with relevant neurogenic conditions at risk for neurogenic bladder, in patients with other neurogenic disease with elevated PVR or in patients with urinary symptoms.
- Perform EMG in combination with CMG with or without PFS in patients with relevant neurogenic conditions at risk for neurogenic bladder, in patients with other neurogenic disease with elevated PVR or in patients with urinary symptoms.

UDS Guideline Review for Lower Urinary Tract Symptoms (LUTS)

- Consider PVR in patients with LUTS to rule out significant urinary retention initially and at follow up
- Consider uroflow in the initial and ongoing evaluation of male patients with LUTS when abnormality of voiding and emptying is suggested
- Consider CMG when it is important to determine if DO or other abnormalities of the bladder filling/storage are present in patients with LUTS, particularly before invasive treatment
- Perform PFS in men when it is important to determine if urodynamic obstruction is present in men with LUTS, particularly before invasive treatment
- Consider PFS in women when it is important to determine if obstruction is present
- Consider fluoroscopy with UDS in properly selected patients to localize the level of obstruction, particularly for primary bladder neck obstruction