Disclosures:

• I have deep discussions with my dogs when no one is around
• I am afraid of caves
Objectives:

• Discuss definitions of acute and chronic urinary retention – common conditions experienced in the emergency room and inpatient setting
• Review epidemiology, risk factors and common conditions causing urinary retention
• Brief review on the physiology and anatomy of micturation
• Develop a common stepwise approach to diagnosis and initial management
• Review common clinic scenarios experienced in the inpatient setting
Definitions:

• AUA – American Urological Association
• ICS – International Continence Society
• UDS – urodynamic testing
• LUTS – lower urinary tract symptoms
• BPH – benign prostatic hypertrophy
• BOO – bladder outlet obstruction
• DU – detrusor underactivity
• POP – pelvic organ prolapse
• **Vignette 1:**
  
  • 69 year old otherwise healthy man – POD#1 following left total knee arthroplasty
    • Foley catheter removed - unable to void for 6 hours

• **Considerations:**
  
  • How to determine significance ?
  • Likely underlying etiology ?
  • Initial management ?
  • Likelihood of resolution ?
  • Need for urological consultation ?
Introduction 1:

• Acute urinary retention (AUR) – one of the most important and common complications of BPH in men
• Also affects women – much less frequently
• Definition – PAINFUL inability to void without incontinence
  • “painful, palpable or percussable bladder, when patient unable to pass urine” – ICS
  • Presentation of pain is key
• AUA – published guidelines on BPH and UDS but not for AUR
Introduction 2:

• Chronic urinary retention
  • AUA definition – non-neurogenic urinary retention with a Post Void Residual volume of > 300 ml
    • Persistent for 6+ months
    • Documented on two separate occasions
• Painless
• Associated with incontinence
Incidence

• Overall incidence – male population – first episode AUR – 2.2-8.5 events per 1000 men per year
• 13:1 male to female ratio
• Men with LUTS – 18-36 events per 1000 men per year
• Age as risk factor:
  • 70 years old – 10% of men have episode of AUR
  • 80 years old – 33% of men have episode of AUR
• Women – 3 events per 100,000 women per year

Economic cost/burden of AUR 1:

• Nationwide Emergency Department Sample – 2006-2009
  • 1.2 millions visits by men for chief complaint of LUTS
  • 45% of which underwent urinary catheterization
  • 2009 – ED management of LUTS - $495 billion dollars
    • BPH does not equal AUR – initiation of treatment for BPH often coincides with clinical event such as AUR
  • Outpatient economic burden - ?????

• Patient morbidity
  • AUR – rated as traumatizing as new diagnosis of stroke or MI
  • Prolonged catheterization – significant deterioration of QOL

• Economic impact of AUR in women – poorly defined due to low incidence
Economic Cost/Burden of AUR 2:

• Appropriate treatment of AUR – results in significant cost saving to the health care system

• 2003-2008 – Medicare/Medicaid patients
  • Every month of 5-alpha reductase therapy decreased overall BPH related costs by 15%/month
  • Reduces rates of AUR and need for prostate surgery by 14%, 11% respectively

• MTOPs trial – demonstrated significant reductions in need for surgery, retention events and bleeding events with dual medical therapy with alpha blockers and 5ARIs
Fig. 1: Distribution of $\alpha_1$-adrenergic receptors in the lower urinary tract and site of action of $\alpha_1$-adrenergic receptor blockers. Selective agents target receptors predominantly localised to the bladder and prostate. Non-selective agents may have more systemic effects.
5 Alpha Reductase Inhibitors

- Dutasteride
- Finasteride

Why 5-alpha reductase inhibitors?

- 5-alpha reductase inhibitors (dutasteride and finasteride) reduce prostate size
  - Mechanism of action:
    - Testosterone → Dihydrotestosterone (DHT)
  - They also lower PSA Levels
    - Therefore, may cause false-negative due to lowered PSA level when there is cancer
    - Hence, screening evaluation includes medication use

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Neuroanatomy of Voiding
• Vignette 2:

• 83 year old woman with dementia – presents to ED with confusion, lethargy, poor oral intake
  • Febrile, WBC 17 on admission
  • Unable to void for urine specimen – catheterized volume 400 cc
  • UA with 40 rbc, 23 wbc, +nitrite, +LE and bacteria
  • PMH: DMII, CVA, CAD, hysterectomy

• Considerations:
  • How to determine significance?
  • Likely underlying etiology?
  • Initial management?
  • Likelihood of resolution?
  • Need for urological consultation?
# Functional Classification of Voiding Dysfunction (Wein)

## Failure to store
- Bladder disorder
  - DO/OAB
  - Poor compliance
- Outlet disorder
  - Iatrogenic – post op
  - Urethral hypermobility
  - ISD

## Failure to empty
- Bladder disorder
  - Neurogenic
  - Myogenic
  - Psychogenic
  - Idiopathic
- Outlet disorder
  - Anatomic – prostate, bladder neck, urethra
  - Functional – dysfunctional voiding, sphincter dyssynergia
Risk factors for AUR

• Age
• History of bothersome LUTS
• History of AUR
• General medical conditions
  • DM
  • Psychiatric illness
  • Neurologic disease
  • CVA
• Urologic abnormalities – BPH, prostate cancer, POP, urethral stricture, prior surgery/radiation, urethral diverticulum, vulvovaginitis
Medications

• Antiarrhythmics
• Anticholinergics
• Antidepressants
• Antihistamines
• Antihypertensives
• Parkinsons medications
• Estrogen/testosterone medications
• Muscle relaxants
• Alpha, beta agonists
• Sedatives – narcotics, benzodiazepenes
Risk factors for Provoked AUR

• Cystitis/infection
• Excessive fluid intake, alcohol ingestion
• Cold exposure
• Traveling/prolonged immobilization
• Constipation
• Instrumentation
• Pain
• General/spinal anesthesia
• Spinal disk disease/compression
• Bladder overdistension
• **Vignette 3:**
  
  • 70 year old man with known metastatic prostate cancer – admitted for hydration while undergoing docetaxel chemotherapy
      • Known metastatic lesions in pelvis, thorax and spine
      • Voiding well prior to admission
      • PSA <0.1
      • Several days of constipation
      • Acute onset retention, tingling/numbness of scrotum
  
  • **Considerations:**
      • How to determine significance?
      • Likely underlying etiology?
      • Initial management?
      • Likelihood of resolution?
      • Need for urological consultation?
Diagnosis 1:

- History
  - Timing/onset of symptoms
  - Pain
- LUTS evaluation – antecedent to AUR event
  - Storage symptoms – frequency, nocturia, urgency, incontinence
    - Stress, urge, mixed incontinence
    - Nocturnal enuresis
    - Overflow incontinence
    - Bladder sensation
  - Voiding/obstructive symptoms – poor/intermittent stream, spraying, dribbling, hesitancy, straining
- *Gross hematuria, urethral pain, dysuria*
- Relevant medical history, medication evaluation
Diagnosis 2:

• Physical exam:
  • bladder percussion, palpation, SP tenderness
  • DRE in male – size, tenderness, nodularity
  • Vaginal exam in female – POP, inflammation, cysts
  • Focused neuro exam (anal and levator tone, genital sensation)
• Diagnostics – Cr/BUN, UA/Ucx, bladder scan vs catheterized PVR
• PSA:
  • acute measurement during AUR – may be falsely elevated due to inflammation
  • Prior level – helpful to estimate prostate size/risk for BPH
  • Grossly elevated – consider possibility of advanced prostate cancer
Further diagnostics?

- **Bladder US** – required if morbid obesity, trauma preclude bedside US or catheterization
  - Can evaluate bladder wall thickness, prostate size, median lobe, distal ureteral dilation

- **Renal US** – only indicated when renal failure is present

- **Pressure flow studies**
  - **AUA LUTS guideline:**
    - **PVR** – “in patients with LUTS as a safety measure to rule out significant urinary retention”
    - **Uroflow** – “initial and ongoing evaluation of male patients with LUTS when abnormality of voiding/emptying is suggested”
    - **Pressure flow studies** – “to determine if urodynamic obstruction is present when invasive, potentially morbid or irreversible treatments are considered”

- **EUA** – PFS reserved for men considering surgery who 1. cannot void > 150 ml or 2. who have a PVR >300 ml or 3. age > 80 years old
Interpreting pressure flow studies:

- Used to distinguish between bladder outlet obstruction vs detrusor underactivity*

- Two values required – Qmax and Pdet at Qmax
  - 1. Bladder outlet obstruction index
    - BOOI = Pdet@Qmax – 2(Qmax)
    - High pressure and poor flow = obstruction
    - 3 groups
      - > 40 obstructed
      - 20-40 equivocal
      - < 20 unobstructed
  - 2. Bladder contractility index – characterizes detrusor strength
    - BCI = Pdet@Qmax + 5(Qmax)
    - Low pressure and low flow = poor contractility
    - 3 groups
      - > 150 – strong
      - 100-150 normal
      - < 100 weak

- Useful method to characterize those who may benefit from surgery

Bladder outlet obstruction index

![Bladder outlet obstruction index diagram](image-url)
Bladder contractility index
• **Vignette 4:**

  • 82 year old woman admitted with shortness of breath
    • CT PE protocol in ED reveals large pulmonary embolus – admitted for initiation of anticoagulation with heparin drip
    • Becomes therapeutic on heparin – develops gross hematuria for 4 hours then subsequently complains of inability to urinate and bladder pain
    • UA on admission demonstrated 25 RBCs, no evidence of infection

  • **Considerations:**
    • How to determine significance ?
    • Likely underlying etiology ?
    • Initial management ?
    • Likelihood of resolution ?
    • Need for urological consultation ?
Immediate Treatment

• 1. Bladder decompression – urethral or SP catheter
• 2. Initiation/continuation of alpha blocker therapy
• 3. Initiation of 5 alpha reductase inhibitor
  • Prostate volume > 40 cc
  • PSA > 1.5 ng/ml
• 4. Remove any provocative factors
1. Bladder decompression

- Exclude trauma/urethral disruption – if suspected perform RUG
  - History of pelvic trauma
  - Blood at meatus
- Standard catheter (16fr) – initial attempt
- Coude – suspect enlarged prostate
- Smaller catheter – suspect stricture
- Trauma/false passage – flex cystoscopy w/ guidewire placement
- SP tube placement – full bladder + Trendelenburg + US guidance to identify bowel loops and reduce bowel injury
  - 2-3% rate of bowel injury 1.8% mortality rate*
  - Caution with distorted pelvic anatomy, prior surgery, obesity, undistended bladder

2. Initial Medical Management

- Alpha blockers – recommended for all male patients with AUR
  - Retention – results in guarded urethral sphincter and increase sympathetic tone
  - Trial without catheter – successful in 60% on alpha blockers vs 40% placebo
    - RR of recurrent retention – 0.7 – tamsulosin, alfuzosin, silodosin
    - Meta-analysis of 13 RCTs – 1.6 risk ratio favoring successful voiding of alpha blocker over placebo
    - Stat significant reduction in future AUR events w/ alpha blocker therapy
    - No head to head trials of alpha blockers against each other, only vs placebo
    - Time to effect variable – 24 hours to 7 days

- Women with AUR – limited data available – some evidence for increased flow rates and decreased PVRs
  - Women with primary bladder neck obstruction
  - Caveat – majority of female AUR cases – due to DU

- 5 alpha reductase inhibitors – no effect on successful void trial but reduce re-catheterization rates and improve progression of BPH in men w/ prostate volume > 40 ml and PSA > 1.5 ng/ml
Trial of void

• Much variability across studies
• No consistent relationship between duration of catheter and success of void trial
• Catheterization > 3 days – no affect on success of void trial – was associated with prolonged hospitalization and increased morbidity
• Decreased success of voiding (80% vs 77%) with catheterization > 5 days
• CONSENSUS – 24-48 hours is minimal time to wait, but 3-5 days seems to be optimal timing for void trial
• CIC – optimal if patient able to perform as allows multiple void trials until patient resumes voiding spontaneously
• Controversy w/ catheters – 19% of healthcare associated infections are UTI with half attributed to catheter use
  • Symptomatic UTI – positive urine culture, pyuria, systemic symptoms – fever, SP pain, dysuria, urgency, hematuria
Post obstructive diuresis

- Typically seen following decompression of long standing/chronic retention, bilateral obstruction or obstruction in solitary kidney
- At risk patients – HTN, volume overload/edema, weight gain
- Excessive polyuria - > 200 ml/hour
- Excessive salt, water excretion – inappropriate diuresis of water due to impaired concentrating ability of kidney – temporary resistance of collecting duct to ADH, impaired Na reabs throughout nephron
- Treatment – careful monitoring of UOP, electrolytes and volume status
  - Replace UOP at 80% with ½ NS until daily total UOP about 3 L
  - Monitor/replace K, Mg as needed
Treatment Algorithms

1. Evaluation

2. Immediate Treatment

3. Management
Evaluation

• **History** – timing, spontaneous vs provoked, storage and voiding symptoms, incontinence, sensation, hematuria/clots, urethral/bladder/pelvis pain, dysuria

• **Physical** – palpable bladder, SP pain, DRE, vaginal exam, neuro exam

• **PVR** – scan vs catheterized

• **Labs** – BUN/Cr, UA/Ucx, eval for prior PSA value

• **Imaging** – RBUS if renal failure

• **Differential** – Functional classification – BOO vs DU vs combination
Immediate Treatment

- **Bladder decompression** – indwelling urethral catheter, CIC, SP
- **Alpha blocker** – initiate therapy in all men and select women
- **5 alpha reductase inhibitor** – initiate therapy in men with prostate volume > 40 ml or baseline PSA > 1.5 ng/ml
- **Acute surgical intervention** – TURP – indicated for prostatic abscess
Management

• Trial without catheter – at 3-5 days following uncomplicated AUR, if CIC being performed evaluate PVRs for resumption of spontaneous voiding

• Urodynamic evaluation
  • Consider for – cannot void > 150 ml, PVR > 300 cc, age > 80 or < 50
  • Perform when considering invasive, potentially morbid or irreversible treatment
  • Calculate BOOI and BCI

• Long term interventions – discuss risks, benefits, alternatives in regard to bladder outlet procedure, indwelling catheter, CIC. Consider Sacral neuromodulation or Percutaneous posterior tibial nerve stimulation for non-obstructive urinary retention
Surgical Intervention

• Indications
  • those who fail to void spontaneously with void trial
  • Bothersome LUTS, failed medical therapy

• Caution regarding TURP in setting of AUR
  • AUR -> TURP = 56% failed postop void trial
  • No AUR -> TURP = 28% failed postop void trial

• Pressure flow studies – may identify patients at risk for failure to void

• Decision to proceed with surgery:
  • 1. patient treatment goals – willingness to incur surgical risk to be catheter free
  • 2. ability to perform CIC
  • 3. satisfaction/dissatisfaction with indwelling catheter
Investigational behavioral and medical therapies for AUR

• Few studies – all with small sample sizes – awaiting reproduction
• Caffeine – increased voided volumes and decreased need for subsequent catheterization
• Hot packs to abdomen – decreased postop retention episodes
• PDE5 inhibitor therapy + alpha blockers = no effect on spontaneous voiding after AUR events
• Combo alpha blocker therapy
• DES, ketoconazole – added to alpha blocker therapy – improved rates of spontaneous voids after AUR
Strategies to Increase Detrusor Contractility

• Medications
  • Acetylcholinesterase inhibitors – prolong effects of Ach
  • Cholinergics – bethanecol, carbachol – mimic Ach effects
    • No proven effect
    • Significant side effects – flushing, sweating, excessive salivation
  • Prostaglandins – shown to improve bladder contractility – only with intravesical instillation

• Sacral nerve stimulation
  • FDA approved for:
    • Non obstructive urinary retention – Fowler’s syndrome, neurogenic bladder from SCI
      • Mechanism – suppression of hyperactive guarding reflex, reduction in sphincteric tone
      • Decreased PVR by 236 ml, improved voided volume 300 ml*
    • Refractory overactive bladder
    • Chronic fecal incontinence

• Posterior tibial nerve stimulation – third line therapy for OAB
  • Mech – nerve fibers from L4-S3 – may work similarly to SNS – not FDA approved ye

Summary

- Initial management of AUR – bladder decompression
- Alpha blocker therapy – initiated in all male patients and select female patients with suspected bladder neck obstruction
- CIC – reasonable alternative to indwelling catheter
- Trial of void – at 3-5 days following initial bladder decompression
URINARY RETENTION TREATMENT ALGORITHM

Acute: Painful inability to void, +/- without incontinence
Chronic: Non-painful, small volume voids, +/- incontinence

History and Physical
Post-Void Residual Blood urea nitrogen/Creatinine
+/- Urinalysis
+/- Prior PSA
+/- Renal ultrasound

Bladder Decompression
- Indwelling urethral catheter
- Intermittent catheterization
- Medical Therapy
  - Alpha-1 blocker: all men and select women
  - 5-alpha reductase inhibitor: consider if prostate >40 mL or baseline PSA >1.5 ng/mL

Trial Without Catheter
- Suggested at 3 to 5 days for uncomplicated retention
- Monitor catheterized post-void residuals

Urodynamic Evaluation
- When invasive, potentially morbid or irreversible treatments are considered
- Consider if cannot void >150 mL, PVR >300 mL, age >80 years, men <50 years

Calculate Bladder Outlet Obstruction Index (Pdet@Qmax – 2*Qmax)
(>40 obstructed, 20 to 40 equivocal, <20 unobstructed)

Calculate Bladder Contractility Index (Pdet@Qmax + 5*Qmax)
(>150 strong, 100 to 150 normal, <100 weak)

Detrusor Failure

Combination Failure

Outlet Obstruction

No Contraction Unsure if Obstructed

Weak Contraction Suspect Obstructed

Strong Contraction Clearly Obstructed

If Satisfied
- No additional intervention

Non-Obstructed Urinary Retention
- Sacral neuromodulation
- Percutaneous posterior tibial nerve stimulation (non-FDA approved)

Indwelling vs CIC

BOO Procedure

NO
Resume Indwelling vs CIC

Passed TWOC?

YES
Treatment Goals Met