

Urinary Incontinence

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URINARY INCONTINENCE - **involuntary urine leakage** of sufficient severity to be health or social problem.

- **always abnormal** (regardless of age*, mobility, mental status).
*aging does not cause urinary incontinence, but age-related changes can predispose to it!
- **highly treatable and often curable**, but still remains largely neglected problem.
- **females** : males = 5 : 1
10-25% of all 25-64 yo women
40% of all > 65 yo women

YOUNG PATIENTS – frequent **NOCTURNAL ENURESIS**. see p. S46 >>

- ½ young and middle-aged women experience urinary incontinence in association with **childbirth**.

ELDERLY PATIENTS

- often **institutionalized** (significant burden to caregivers).
- predisposing **physiologic factors** in aging (alone do not cause incontinence):
 - 1) more prevalent **uninhibited bladder contractions** ± impaired bladder contractility (detrusor hyperactivity with impaired contractility)
 - 2) bladder capacity↓
 - 3) among **women**, **urethral resistance declines** (estrogen effects↓ and weakened periurethral and pelvic muscles), urethral length↓
among **men**, **urethral resistance increases** (prostatic enlargement).
 - 4) ability to postpone voiding↓
 - 5) postvoiding residual volume↑ (but ≤ 50-100 mL).
 - 6) daily ingested fluid is excreted later in night.

COMPLICATIONS

1. **Uncomfortable**
2. **Skin** problems
3. **Falls** (in older patients rushing to bathroom)
4. **Social stigma** → embarrassment, isolation, depression.

Urinary incontinence is commonly important precipitating factor in decision to enter **long-term care facility!**

Sympathetic nerves promote STORAGE (α -adrenoreceptors contract sphincter, β -adrenoreceptors relax bladder).

Parasympathetic nerves promote MICTURITION (relax sphincter and contract detrusor).

A. TRANSIENT (RECENT ONSET) INCONTINENCE

- requires treatment of *underlying cause* only.
- untreated may become persistent!
- uncommon in younger persons but common in **elderly** (should always be considered!).

- Symptomatic UTI** (vs. asymptomatic UTI - does not cause incontinence!) especially in young women - *DYSURIA* and *URGENCY* are so severe that person cannot reach toilet before voiding.
 - sexually active women with persistent dysuria – test for *Chlamydia trachomatis*.
- Atrophic urethritis** in postmenopausal women - leads to epithelial and submucosal thinning → loss of mucosal seal, local irritation → *URGENCY*.
 - treatment - estrogen.
- Alcohol and drugs** (psychoactive drugs, diuretics, anticholinergics) esp. in older persons.
- Psychiatric disorders** (delirium, depression, psychosis).
- Polyuria**.
- Restricted mobility** prevents patient from reaching toilet (H: urinal or bedside commode).
- Impacted stool** (esp. in elderly patients) - *URGE* or *OVERFLOW INCONTINENCE*.
 - mechanism - stimulation of opioid receptors or mechanical bladder-urethra disturbance.
 - typically have associated *fecal incontinence*.
- Postprostatectomy, postpartum**.

TABLE 8-4 Commonly Used Medications That May Affect Continence

Type of Medication	Examples	Potential Effects on Continence
Sedatives/hypnotics	Long-acting benzodiazepines (e.g., diazepam, flurazepam)	Sedation, delirium, immobility
Alcohol		Polyuria, frequency, urgency, sedation, delirium, immobility
Anticholinergics	Dicyclomine, disopyramide, sedating antihistamines	Urinary retention, overflow incontinence, delirium, impaction
Antipsychotics	Thioridazine, haloperidol	Anticholinergic actions, sedation, rigidity, immobility
Tricyclic antidepressants	Amitriptyline, desipramine	Anticholinergic actions, sedation
Antiparkinsonians	Trihexyphenidyl, benztropine mesylate (not L-dopa/selegiline)	Anticholinergic actions, sedation
Narcotic analgesics	Opiates	Urinary retention, fecal impaction, sedation, delirium
α-Adrenergic antagonists	Prazosin, terazosin, doxazosin	Urethral relaxation may precipitate stress incontinence in women
α-Adrenergic agonists	Nasal decongestants	Urinary retention in men
Calcium channel blockers	All dihydropyridines ^a	Urinary retention; nocturnal diuresis due to fluid retention
Potent diuretics	Furosemide, bumetanide	Polyuria, frequency, urgency
Angiotensin-converting enzyme inhibitors	Captopril, enalapril, lisinopril	Drug-induced cough can precipitate stress incontinence in women and in some men with prior prostatectomy
Thiazolidinediones	Rosiglitazone	Nocturnal diuresis due to fluid retention
Cyclooxygenase 2 selective NSAIDs	Rofecoxib, celecoxib	Nocturnal diuresis due to fluid retention
Vincristine		Urinary retention

^a Examples include nifedipine, nicardipine, isradipine, felodipine, nimodipine. *Source:* Adapted from NM Resnick, in *Current Medical Diagnosis and Treatment*, LT Tierney et al (eds), Norwalk, Appleton & Lange, 1993.

B. ESTABLISHED INCONTINENCE

- Detrusor overactivity
- Detrusor underactivity
- Urethral obstruction
- Urethral incompetence

ETIOPATHOPHYSIOLOGY

- lower urinary tract malfunction: see p. 2435 >>

Functional problems in older persons (e.g. environment, mentation, mobility, manual dexterity, medical factors) are often superimposed - may contribute to incontinence but rarely cause it (if so, it is called *FUNCTIONAL INCONTINENCE*)

1. DETRUSOR OVERACTIVITY

→ involuntary bladder contractions.

- leading cause of incontinence in older persons** (prevalence - 31% women ≥ 75 years and 42% men ≥ 75 years).
 - UMN damage** (multiple sclerosis, stroke, Parkinson, Alzheimer) see p. 2590a >>
 - GU causes** (cystitis, bladder stone, bladder tumor)
- clinically – *URGE INCONTINENCE*: abrupt onset of intense urge to urinate → inability to delay voiding → precipitant voiding (leakage volume is moderate ÷ large; vs. stress incontinence – small volume);
 - FREQUENCY* (> 8 voids per 24 hours);
 - NOCTURIA* is common.
- anal sphincter voluntary control is intact.
- may coexist with *impaired contractility* (detrusor hyperactivity with impaired contractility) - urgency, frequency with weak flow rate, significant residual urine, bladder trabeculation.

2. DETRUSOR UNDERACTIVITY

- least common cause of incontinence;

- spinal shock** (acute phase of spinal cord injury)
 - LMN injury, autonomic neuropathy** see p. 2590a >>
 - chronic outlet obstruction** – in men
 - idiopathic** – in women
- patient strains during urination.
 - urinary retention → *OVERFLOW INCONTINENCE* (frequent leakage of small amounts of urine without warning).
 - prolonged urinary retention → **detrusor damage** (detrusor replaced by fibrosis - bladder fails to empty even when primary cause is removed).

N.B. symptoms (urgency, frequency, nocturia) may mimic detrusor overactivity or outlet obstruction (in men)! – treatment is different!

Only **urodynamic testing** (rather than cystoscopy or intravenous urography) differentiates *detrusor underactivity* from *urethral obstruction* in men (such testing is not required in women, in whom obstruction is rare)

3. OUTLET INCOMPETENCE

- most common cause in **younger women** (second most common cause in **older women**):

- neurogenic causes** (radical prostatectomy*, LMN disease, Shy-Drager syndrome).
*stress incontinence is often temporary and resolves within first postoperative year
- GU causes = genuine stress incontinence**:
 - urethral hypermobility** - loss of posterior urethrovesical angle (type 1-2 stress incontinence) - due to pelvic muscle or ligament laxity (e.g. after childbirth) – most common form!!!

- 2) *sphincter incompetence* due to damage (radical prostatectomy, childbirth) – type 3 stress incontinence - rare.
 - 3) *congenital anomalies* (bladder exstrophy, epispadias, vesicovaginal fistula, ectopic ureteral orifices).
- clinically – **STRESS INCONTINENCE** - instantaneous small leakage (without bladder contraction) on stress maneuvers that increase intraabdominal pressure (coughing, laughing, bending, lifting).

4. OUTLET OBSTRUCTION

- second most common cause in men (N.B. most men with obstruction are not incontinent!):
 - a) *suprasacral spinal cord lesion* - **detrusor-sphincter dyssynergia** - rather than relaxing when bladder contracts, outlet contracts (→ severe outlet obstruction with severe trabeculation, diverticula, and "Christmas tree" bladder deformation → hydronephrosis → renal failure).
 - b) *GU causes* - benign prostatic hyperplasia, prostate cancer, urethral stricture, large cystocele [prolapses and kinks urethra on straining].
- can present as **DRIBBLING INCONTINENCE** after voiding.
if secondary **detrusor overactivity** develops → **URGE INCONTINENCE**;
if **detrusor decompensation** supervenes → **OVERFLOW INCONTINENCE**.
- residual volume > 50-100 mL (may be nil in early obstruction!).

SIGNS & SYMPTOMS

- **voiding diary** is very useful (kept by patient or caregiver). also see p. 2431 >>

Five **CLINICAL TYPES** of incontinence:

1. **Urge** incontinence
2. **Stress** incontinence
3. **Overflow** incontinence
4. **Functional** incontinence
5. **Mixed** (urge + stress)

URGENCY is not sensitive / specific for detrusor overactivity, but **PRECIPITANCY** (abrupt sensation that urination is imminent) is.

- imminent urination (in absence of stress maneuver) without warning (**reflex or unconscious incontinence**) - invariably due to **detrusor overactivity**.

URINARY FREQUENCY (> 7 voids/day) - due to voiding habits, overflow incontinence, sensory urgency, stable but poorly compliant bladder, depression, anxiety, excessive urine production.

N.B. incontinent persons may severely restrict fluid intake and thus do not void frequently!

NOCTURIA - nonspecific symptom (e.g. two episodes may be normal for person who sleeps 10 h but not for one who sleeps 4 h):

- 1) **excessive fluid intake** in late evening (younger persons excrete most of their daily ingested fluid before bedtime, whereas many healthy elderly excrete at night)
 - 2) **polyuria**.
 - 3) **bladder dysfunction** - outlet obstruction, small capacity, detrusor overactivity, sensory urgency.
 - 4) peripheral **edema**.
 - 5) **insomnia**.
- if volume of most nightly voids is much smaller than *functional bladder capacity* (largest single voided volume on voiding diary) - either **sleep-related problem** (patient voids because he is awake anyway) or **bladder dysfunction**.

OBSTRUCTIVE AND IRRITATIVE SYMPTOMS

- a) benign prostatic hyperplasia or bladder outlet obstruction
- b) overactive detrusor (may be exacerbated by surgery if prostatic hyperplasia was incorrectly held liable).

DIAGNOSIS

1. **Neurologic exam**.
2. **Digital exam**.
 - *URETHRAL sphincter is evaluated through ANAL sphincter examination* (same innervation – S₂₋₄) - successful sphincter contraction is evidence against cord lesion.
3. **Pelvic examination** on all women.
4. **Cystometry** (assessment of detrusor tone and dynamics) – bladder is being filled through catheter; if contractions start = detrusor overactivity.
5. **Stress testing** (> 90% sensitivity and specificity for *outlet incompetence*): with full bladder (at end of cystometry), patient assumes upright position, spreads legs, relaxes perineal area, and provides single, vigorous cough - immediate leakage that starts and stops with cough (delayed or persistent leakage suggests *detrusor overactivity* triggered by coughing).
6. **Observation of voiding** ± multichannel urodynamic testing (uroflow).
7. **Postvoiding residual volume** (by catheterization or portable ultrasound) – essential in almost all patients because symptoms of overflow incontinence are nonspecific; if > 50-100 mL suggests *bladder weakness* or *outlet obstruction*, but smaller amounts do not exclude either diagnosis.
8. **Cystoscopy**.
9. **Q-tip test** (indirect measure of urethral axis = angle of inclination) – patient in lithotomy position; Q-tip is inserted into urethra; if Q-tip moves > 30° from horizontal = abnormal urethral mobility.

TREATMENT

BALANCED BLADDER (balance between storage and evacuation) - no outlet obstruction, sterile urine, low residual volume (< 100 ml), low voiding pressures.

Pads and special undergarments

- *condom catheters* (for men) may lead to **skin breakdown** and **decreased motivation** to become dry.
- *external collection devices* may be effective in women.

Other essential care

- continued renal function monitoring.
- UTI control - **high fluid intake** (diuresis > 3 L/d), **urine acidification** (e.g. **ASCORBIC ACID***).
- for bedridden patients:
 - 1) early ambulation, frequent position change
 - 2) dietary Ca restriction (to inhibit calculi formation).

*also prevents calculi formation

DETRUSOR OVERACTIVITY (SPASTIC BLADDER – URGE INCONTINENCE)

- **indwelling urethral catheters** are not recommended - they usually exacerbate contractions (if catheter is necessary, small balloon should be used to minimize irritability and consequent leakage around catheter).
- Behavioral therapy** - cornerstone of treatment:
 - bladder retraining regimens**
for example: in patient who is incontinent every 3 h, regimen involves voiding every 2 h during daytime and suppressing urgency in-between; once patient has maintained daytime urinary control for 3 consecutive days, voiding interval can be extended by 1/2 h and process repeated until satisfactory result or continence is achieved.
 - prompted voiding technique**
patient is asked at 2-h intervals about need to void; patient who responds "yes" is escorted to toilet and given positive reinforcement after voiding (negative reinforcement is avoided).
 - Pharmacotherapy** - **BLADDER RELAXANT DRUGS** - can augment behavioral therapy but not replace it (drugs generally do not abolish uninhibited contractions!)
 - Anticholinergics** [detrusor innervation is parasympathetic!]:
N.B. anticholinergics may cause *cognitive decline* in elderly!
 - PROPANTHELINE** (15-30 mg bid)
 - FESOTERODINE** extended release tablet - 4 mg (max 8 mg) administered ×1/d.
 - TOLTERODINE***
 - DARIFENACIN***
 - SOLIFENACIN***

*selective M₃ muscarinic antagonists
 - β₃-adrenergics** [work in detrusor] - **MIRABEGRON** (Myrbetriq®)
 - Smooth muscle relaxants** – **FLAVOXATE**
 - Combination (**smooth muscle relaxant + anticholinergic**):
 - OXYBUTYNIN** (shortest acting but highest incidence of side effects); FDA approved for women > 18 yrs as OTC (for men – only by Rx)
 - DICYCLOMINE**
 - TROSPIMUM** (as effective as oxybutynin but with better tolerability).
 - Ca-channel blockers** – **NIFEDIPINE, DILTIAZEM.**
 - Antidepressants** – **IMIPRAMINE** (25-200 mg/d), **DOXEPIN.**
 - ADH analogs** (for nocturia) – **DESMOPRESSIN.**
 - BOTOX (ONABOTULINUMTOXINA)** – FDA approved for adults who cannot use / do not adequately respond to anticholinergics.
 - in males, detrusor overactivity often coexists with urethral obstruction - **urodynamic testing** should be done before bladder relaxant drugs!
 - drugs with rapid onset of action (e.g. OXYBUTYNIN) can be used *prophylactically* if incontinence occurs at predictable times.
 - some drugs can be applied *intravesically*.
 - all drugs may cause *urinary retention* (intentionally inducing urinary retention and using intermittent catheterization may be reasonable for some patients).
 - Augmentation cystoplasty** increases bladder capacity by incorporating section of *intestine* or *stomach* - reserved for severe cases (e.g. in MS patients).

DETRUSOR UNDERACTIVITY (ATONIC BLADDER – OVERFLOW INCONTINENCE)

Establish immediately drainage (to prevent overdilatation → detrusor muscle damage) - **bladder decompression** (for ≥ 7-14 days):

- intermittent catheterization** (done by patient) – preferable! (less complications, better bladder training)
- continuous catheter drainage** (predisposes men to urethritis, periurethritis, prostatic abscess, and urethral fistula).

Bladder after decompression:

- Bladder function partially restored:**
 - augmented voiding techniques:** double voiding, Credé's maneuver (suprapubic pressure during voiding), Valsalva maneuver.
 - cholinergic agonist (BETHANECHOL)**
 - esp. useful if bladder contracts poorly due to anticholinergic drug that cannot be discontinued.
 - most effective in combination with **α-adrenergic blocker** (e.g. **TERAZOSIN**).
- Acontractile detrusor** – any *medical intervention* is likely to be futile → **intermittent self-catheterization** (± **UTI prophylaxis** with antibiotics).
 - patients with motor difficulties (unable to perform self-catheterization):
 - indwelling urethral catheter** (**UTI prophylaxis** with antibiotics is not useful here) with 6-weekly changes; use clamps to achieve volumes ≈ 300 mL.
 - surgical urinary diversion** (e.g. suprapubic diversion). *see below >>*

N.B. in **lower motoneuron damage** medical therapy is generally ineffective! *see p. 2590a >>*

OUTLET INCOMPETENCE (STRESS INCONTINENCE)

- Nonpharmacologic measures**
 - **pelvic muscle exercises** (e.g. **Kegel's exercises** – strengthen m. pubococcygeus) ± **biofeedback** are often effective! – both women and men!
 - **electrical stimulation** (to strengthen pelvic muscles) is under investigation.
 - treatment of **precipitating conditions** (e.g. coughing, atrophic vaginitis with estrogens), avoiding known **bladder irritants** (caffeine, alcohol)
 - **weight loss** in obese patient.
 - **pessary** insertion, **contraceptive diaphragms** in younger women; **tampons** in older women.
 - toileting and fluid regimen that maintains **bladder volume below leakage threshold**.
- Pharmacotherapy** to increase bladder outlet resistance - **α-agonists** (e.g. sustained-release **PHENYLPROPANOLAMINE**; sustained-release **PSEUDOEPHEDRINE** 120–240 mg daily; **DULOXETINE** 40–60 mg daily*); possible combination with **bladder relaxant drug** (e.g. **IMIPRAMINE**).
 - for menopausal women – **topical estrogen** (N.B. data from large clinical trials suggest that oral estrogen ± progestin actually worsen incontinence).
*not FDA approved for this indication

The antimuscarinic agents (darifenacin, fesoterodine, oxybutynin, solifenacin, tolterodine, and trospium) used commonly for the treatment of stress urinary incontinence have a small benefit. [25] These drugs have strong anticholinergic properties and can cause major side effects, especially in elderly populations. For example, oxybutynin resolved urinary incontinence in 114 of 1000 treated patients, while 63 of 1000 stopped treatment because of side effects. [26]

3. **Surgery** (urinary retention is risk!)

for URETHRAL HYPERMOBILITY:

- a) BLADDER NECK SUSPENSION (ELEVATION) TECHNIQUES:
 - 1) **retropubic urethropexy** (gold standard) – paraurethral-paravesical structures are fixed to pubis:
 - *traditional MMK (Marshall-Marchetti-Krantz) procedure* – fixation to symphysis (complication - osteitis pubis).
 - *Burch colposuspension* (best results!) – fixation to Cooper's ligament; frequently done as additional component of surgery for uterine prolapse.
 - 2) **needle procedures** - paraurethral structures are fixed to anterior abdominal aponeurosis.
- b) PUBOVAGINAL SLING (by use of fascia lata) – complicated procedure, but results very good.

for SPHINCTER INCOMPETENCE - in order of increasing complexity:

For men after radical prostatectomy, wait at least 1 year post-op before electing further surgery (during this time pelvic floor exercises seem to have great benefit)

- a) **injection of urethral bulking agents** (glutaraldehyde cross-linked bovine collagen); endoscopic injection of in submucosa overlying or just distal to urethral sphincter, at four sites circumferentially, until urethra coapts; can be repeated after 4 weeks.
- b) PUBOVAGINAL **slings**, MALE PERINEAL **slings** (urethral cuff and control pump that have to be operated by patient).
- c) **artificial urinary sphincter** implantation - gold standard treatment for men after prostatectomy.

4. **Palliative measures**

- for *men* - condom catheter, penile clamp, penile sheath, self-adhesive sheath.
- some collection devices for *women* are available.

OUTLET OBSTRUCTION

in males:

- a) **α-adrenergic blockers** (**ALFUZOSIN***, **TAMSULOSIN***, **TERAZOSIN**, **PHENOXYBENZAMINE**) – relax **internal** sphincter and improve irritative voiding symptoms (frequency and urgency).

*fewer effects on blood pressure
- b) **BACLOFEN**, **benzodiazepines** reduce tone of striated **external** sphincter.
- c) **5α-reductase inhibitor** (**FINASTERIDE**) - for men with prostatic obstruction.
- d) TURP, external sphincterotomy (in male), bladder neck incision with bilateral prostatotomy, prostatectomy.
- e) urethral stents.

in females:

- a) **large cystocele** → surgery ± outlet suspension procedure (if urethral hypermobility coexists).
- b) **distal urethral stenosis** → dilation + estrogen.

OUTLET OBSTRUCTION WITH DETRUSOR OVERACTIVITY

(e.g. detrusor-sphincter dyssynergia in suprasacral spinal cord damage with spared LMN → see p. 2590a >>)

- 1) **α-blockers** (**TERAZOSIN** 1-2 mg tid or qid) to relax sphincter.
- 2) **anticholinergics** (to promote urinary retention).
- 3) for residual urine - **intermittent self-catheterization** for women, condom catheter for men (or permanent indwelling catheter); discontinue if < 80 mL on 3 consecutive occasions.
- 4) endoscopic **external sphincterotomy**.
- 5) **surgical urinary diversion**.

Vocare®/FineTech Brindley Bladder Control System (FineTech Medical Ltd., England) -

implantable **sacral anterior root stimulator** 1999 FDA-approved for **neurogenic bladder secondary to suprasacral spinal cord injury** - ¹⁾provides urination on demand and ²⁾reduces post-void residual volume.

- **equipment:**
 - 1) extradural electrodes - attached to sacral anterior nerve roots
 - 2) subcutaneously implanted receiver-stimulator
 - 3) external battery-powered controller and transmitter (placed on skin over subcutaneously implanted receiver-stimulator - emits electromagnetic fields).
- **prerequisites:**
 - 1) clinically complete suprasacral spinal cord lesion.
 - 2) intact anterior sacral nerve roots (i.e. intact parasympathetic innervation of bladder)
 - 3) skeletal maturity and neurological stability.
 - 4) patient cannot be adequately managed with intermittent or condom catheterization.
- **implantation** is performed in conjunction with **dorsal rhizotomy** via **S1-S3 laminectomy** (results in areflexic bladder with low intravesicular pressure and high compliance - limiting incontinence and autonomic hyperreflexia); extradural electrodes are implanted during same procedure.
- Vocare® device is **patient-activated** - urethral sphincter and bladder contract and relax.

PERMANENT (SURGICAL) URINARY DIVERSION

- if circumstances prevent satisfactory continuous or intermittent bladder drainage.

Types:

- a) **upper tract diversion** (by ileal or colon conduit).
- b) **suprapubic cystostomy** (predisposes to infection, calculi formation, and, rarely, transitional or squamous cell carcinoma).
- c) **cutaneous vesicostomy** (bladder opened to anterior abdominal wall) with external appliance (no indwelling catheter) - convenient in children.

BIBLIOGRAPHY for ch. “Urology & Nephrology, Gynecology & Obstetrics” → follow this [LINK >>](#)

Viktor's NotesSM for the Neurosurgery Resident
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