Female urinary incontinence

ICS definitions (Abrams 2003)

Stress urinary incontinence. The symptom is the complaint of involuntary leakage on exertion or on sneezing or coughing. The sign is the observation of involuntary urinary loss from the urethra synchronous with exertion, sneezing, or coughing. Urodynamic stress incontinence is noted during urodynamic testing (filling cystometry) and is defined as the involuntary leakage of urine during increases in abdominal pressure in the absence of a detrusor contraction.

Urge urinary incontinence. The symptom is the complaint of an involuntary leakage accompanied by or immediately preceded by urgency. The sign is the observation of involuntary urinary loss from the urethra that is accompanied by or immediately preceded by urgency. Detrusor overactivity incontinence is incontinence related to an involuntary detrusor contraction during urodynamics.

Mixed urinary incontinence. The complaint of an involuntary leakage of urine associated with urgency and also with exertion, effort, sneezing, or coughing. For practical purposes initial management should be directed to the predominant symptom

Classification of urinary incontinence

- Stress urinary incontinence (SUI)
- Urge urinary incontinence (UUI)
- Mixed urinary incontinence
- Other
  - Transient causes (DIAPERS)
  - Urethral diverticulum
  - Vesico-vaginal fistula
  - Ectopic urethrae

Demographics

- Very common
- Prevalence
  - Stress 42 - 55%
  - Urge 7 - 12%
  - Mixed 24 - 44% (Elving, Bortolotti)

Bimodal distribution

- Gradual increase to peak at menopause (~30%)
- Further peak after 70 yrs (30-40%)
- SUI predominates in young/middle-aged women; mixed and OAB in older patients

Whites > Blacks, Hispanics and Asians

Family history

- Mother +/- sister increased RR x3
Stress urinary incontinence

Originally believed that 2 types of stress incontinence based on UDS findings: Genuine stress incontinence (GSI) and intrinsic sphincter deficiency (ISD). However, it is known that many women with urethral hypermobility are not incontinent, implying that a sphincter defect present in all. SUI however may or may not be associated with concomitant bladder base descent, which may be important for subsequent surgical treatment.

Theories of SUI development
(i) Urethral position theory (Kelly, Bonney, Einhorning) – failed transmission of intra-abdominal pressure to the urethra
(ii) Intrinsic sphincter deficiency (McGuire) – poor periurethral support tissues
(iii) Hammock theory (DeLancey) – lax pubococcygeus backplate
(iv) Integral theory (Petros and Ulmstein) – weak pubourethral ligaments
Probably multifactorial, incorporating all features of above. Nowadays all patients considered to have ISD, with varying degrees of urethral hypermobility.

Classification of SUI (Blaivas and Olson 1988)
Based on position of bladder base in relation to the inferior margin of the pubic symphysis (IMPS), and whether or not the BN is open at rest
Type 1 Normal position above IMPS
BN closed at rest
Leakage and descent < 2cm below IMPS
Type 2 Normal position, BN closed, rotational descent (cystourethrocoele)
2b = abnormally low position at rest
Type 3 Previously ISD
Normal position
BN open at rest

Differentiation on the basis of clinical examination, video UDS, Valsalva leak point pressure, and urethral pressure profiling
Urethral hypermobility
Bladder base descent leads to urethra exiting true pelvis. Thus raised intraabdominal pressure unequally transmitted to bladder vs. urethra and leakage occurs
Risk factors for urethral hypermobility
- Pregnancy (esp. prolonged labour)
- Vaginal delivery (esp. instrumental)
- Pelvic surgery
- Obesity
- Chronic cough
- Chronic constipation
- Autonomic neuropathy (DM, MS, Shy-Drager)

Sphincter deficiency without descent (ISD)
Bladder neck already open at rest; thus very low increase in intraabdominal pressure results in urinary leakage
Risk factors for pure ISD
- Neuropath
- Trauma or previous surgery
- Radiation
- Poor oestrogenisation

Evaluation of Stress Urinary Incontinence
History (as above)
- Family history
- Medical history
- Obstetric history
Clinical examination
- Abdominal exam (? retention)
- Abbreviated neurological examination
- Stress test
- Speculum evaluation
- Vaginal grip
  - (Q-tip test)
  - (Bonney test)
  - (Marshall test)
Additional tests
- Urinalysis
- Post-void residual
- Frequency voiding chart
- Pad tests
- Urodynamics
  - Valsalva leak point pressure
  - Urethral pressure profile
  - With ring pessary reduction of prolapse (see POP notes)

Clinical examination
(i) Abbreviated neurological examination
  - Afferent = Perineal sensation, bulbocavernosus (but absent in 30%)
  - Motor = Spreading of toes (S3)
(ii) Stress test
Observation of leakage of urine with valsalva or cough.
Should be performed in supine position; if no leak repeat in standing position
Caution – unstable bladder contraction may be stimulated by cough.
Usually suggested by short time lag between cough and leak

(iii) Speculum examination
Ideally Simms speculum in left lateral position; allows identification of anterior and posterior compartment prolapse

(iv) Vaginal examination
Excludes obvious vaginal, cervical or adnexal masses
Vaginal grip graded by Oxford grading system (Laycock 1992)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No contraction</td>
</tr>
<tr>
<td>1</td>
<td>Flicker</td>
</tr>
<tr>
<td>2</td>
<td>Weak</td>
</tr>
<tr>
<td>3</td>
<td>Moderate (with lift)</td>
</tr>
<tr>
<td>4</td>
<td>Good (with lift)</td>
</tr>
<tr>
<td>5</td>
<td>Strong (wet)</td>
</tr>
</tbody>
</table>

Whilst very limited evidence that vaginal grip predicts outcome of PFMT, NICE expert advice recommends grip test

(NR) Q-tip test
Lubricated ear bud in urethra. Deviation > 30 degrees diagnostic.
Unreliable and adds little to investigation
Not recommended by NICE

(NR) Bonney test
2-finger elevation of periurethral tissue to abolish leak
Very difficult to do without compressing urethra
Not recommended by NICE

(NR) Marshall test
Equivalent to Bonney test except LA and clamp to avoid inadvertent compression of urethra
Impractical and unnecessary
Not recommended by NICE

Additional tests
(i) Urinalysis
(ii) Post-void residual
(iii) Voiding diary
NICE recommends minimum of three days
(iv) Symptom questionnaire
ICIQ-SF questionnaire (Bristol) recommended by EAU
(v) Pad testing
Short-term standardised (1 hr) vs. long-term (1 day)
Short test = 500ml fluid, various exercises, increase in pad weight > 10g equals severe stress incontinence. High false negative rates; better with long-term testing but no relation to outcome of Rx. Not recommended by NICE
(vi) Urodynamics
Studies comparing symptoms with UDS findings have shown that:
Only 10% of women who deny UUI on history demonstrate bladder overactivity on UDS (NPV = 90%). Forms basis for NICE recommendation that UDS not required for straightforward ‘lone’ SUI
Up to 30% of women who deny SUI demonstrate it on UDS
No evidence that pre-op UDS improves Rx outcome for incontinence
Not recommended prior to commencing conservative therapy Nevertheless widely believed to be beneficial prior to surgery Multichannel recommended vs. single channel

Indication for urodynamics
Mixed symptoms (suspicion of OAB) Previous failed incontinence surgery Suspicion of neuropathic bladder or voiding dysfunction

Differentiating ‘lone ISD’ from ISD with hypermobility
Urodynamic valsalva leak point pressure (VLPP) < 60 cm water believed to be diagnostic [60-90 equivocal; > 90 excludes diagnosis]*
Urethral pressure profile (Urethral pressure – detrusor pressure) < 20 cm water
VLPP and UPP controversial. Conflicting evidence that low VLPP or UPP predicts failure following sling/tape procedures. Possibly due to standardisation difficulties. Not currently recommended.
* VLPP should be differentiated from Detrusor LPP (leakage of urine from bladder in absence of abdominal contraction; DLPP > 40 cm water suggests possible UUT dilatation)

NB. No evidence for routine cystoscopy, except in the presence of dipstick haematuria (Cardozo 0/200). No evidence for the routine use of imaging, except USS for the determination of PVR

Management of Stress Urinary Incontinence
Overview
Conservative
Weight loss*
Lifestyle modification (weightlifting, firebreathing, etc.)
PMFT
Biofeedback
Medical
Topical vaginal oestrogen
Duloxetine
Surgical
Periurethral support procedures (Supportive)
Mid-urethral tape
Colposuspension
Autologous sling
Sphincter augmentation (Occlusive)
Bulking agents
Artificial sphincter
* obesity strongly correlates with SUI and OAB

Conservative treatment
(i) Pelvic floor muscle training (Kegel exercises)
   Originally described by Kegel using perineometer
   Up to 50% of women cannot identify pelvic floor muscles
   Proven efficacy for treatment in all women with SUI - subjective cure
   rates ~ 30-40%; objective cure rates ~50%
   Proven effective prophylaxis only in pregnant primips
   8+ contractions tds for 3 months+ recommended by NICE
   No evidence that vaginal cones, biofeedback or electrical stimulation
   better than PFMT alone
   Electrical stimulation (E-Stim; requires vaginal probe) and magnetic
   therapy (Neotonus; EM waves generated by special chair – no vaginal
   probe required) only recommended for women unable to identify and
   adequately contract pelvic floor. No conclusive proof of efficacy (i.e vs.
   sham treatment)

Medical treatment
(ii) Topical vaginal oestrogen
   Improves ‘hammock’ tone and urethral mucosal coaption
   A number of PC-RCTs have shown improvements for topical vaginal
   oestrogen vs. placebo in terms of frequency and SUI episodes. Only
   short-term follow-up however. Response rate ~50%
   Generally well-tolerated. Side-effects vaginal burn, itch, spotting
   Risks of malignancy with long-term oestrogen treatment – (BNF)
   No evidence for systemic oestrogens – may make SUI worse

(iii) Duloxetine (Yentreve; Eli Lilley)
   Serotonin (5-HT) and NA reuptake inhibitor (SNRI)
   Acts chiefly in sacral spinal cord to increase pudendal nerve activity
   Licensed for moderate to severe SUI (? how to classify) in 2 doses,
   20mg bd and 40mg bd.
   Cochrane database review (Mariappan 2006) of efficacy
   Reduced leakage episodes, voiding interval and QOL
   Significant side-effects (nausea, vomiting dizziness, dry mouth,
   constipation) in ~30%; withdrawal in ~10%
   Not recommended as first or second-line treatment by NICE: useful
   alternative in those unfit for surgery

Surgical treatment
Factors to consider before surgery for SUI
   • What is the relative contribution of urethral hypermobility and ISD?
   • Does the patient have impaired detrusor contractility?
   • The need for repair of genital prolapse, hysterectomy or fistula repair.
   • The patient’s life style, age, medical co-morbidities and expectations
Rapid expansion in numbers of surgical procedures for SUI since 1998 entirely due to the evolution of mid-urethral tape surgery at the expense of colposuspension. Generally procedures may be divided into those which provide periurethral support, and those which augment urethral closure. (NB. ? tape vs. tight tape) Evidence in SUI hampered by poorly designed trials with little consistency in terms of patients inclusion, exclusion criteria, and outcome measures.

A. Periurethral support procedures
Typically for patients with urethral hypermobility rather than ISD. Some departments use VLPP > 90cm water as indication for periurethral support procedures, although pubovaginal sling surgery a/w increased morbidity and complications. Divided into suspension vs. backplate procedures:

(i) Suspension procedures
Burch colposuspension, Marshall-Marchetti-Kranz (MMK), Raz suture, Stamey suture, etc.
All designed to attach the periurethral support tissues to fixed structure, preventing descent
Suture procedures a/w poor long-term efficacy of ~30%. Lap colposuspension originally a/w poor long-term results cf. open (60% vs. 93% cure at 3 yrs Burton 1997) but now equivalent.
MMK - BN hitched up to periosteum of pubic symphysis - not recommended due to osteitis pubis
Vagino-obturator shelf repair – vagina anchored to obturator internus fascia – poorer results cf. Burch
Open Burch colposuspension therefore considered gold-standard; long-term efficacy 85-90%.

Burch colposuspension
Requires adequate vaginal length and mobility
Approximation of paravaginal tissues to iliopectineal line (ligament of Cooper). Typically 2-4 sutures on each side – critical not to tie sutures too tightly
Non-absorbable sutures a/w erosion into bladder – use polydioxanone
Approximately 85% objective cure rate (Janis metaanalysis)

Complications of colposuspension:

General surgical complications

- Haematuria
- De-novo instability 30%
- Retention 10% (half spontaneously resolve)
- Vaginal prolapse 20% (majority asymptomatic)
- Post-colposuspension syndrome 10% (leg/groin pain)

(ii) Backplate procedures

Designed to re-create firm support tissue behind posterior urethra, thus preventing descent and allowing closure of urethra with raised intra-abdominal pressure (remember Abrams hosepipe analogy)

May be slings or tapes, biological or synthetic. Typically for women with ‘simple’ SUI without a history of previous surgery, synthetic tapes first line.

Classification of TVT

- Type 1: Macroporous monofilament > 75um (polypropylene)
- Type 2: Microporous monofilament < 10 um (expanded PTFE)
- Type 3: Macroporous multifilament
- Type 4: Submicron porous (silicon)

Synthetic tapes

Macroporous (>75um allowing ingress of fibroblasts, collagen and BV; prolene mesh), microporous (<10um; gore-tex); or submicron (<1um; silastic)

**Macroporous ‘bottom-up’ mesh a/w best efficacy with lowest complication rates – recommended by NICE**

Long-term follow-up of TVT recently described by Nilson et al

- 90% objective cure
- 77% subjective cure
- 20% subjective improvement

Long-term results of top-down and TOT awaited

Complications

- Failure 10%
- Acute/chronic retention 5-10%
- Urinary tract infection 5%
- Perforation 5%
Overactive bladder  5%
Severe voiding dysfunction  2%
Haemorrhage/haematoma  1%
Erosion  1%
Wound infection  1%

* Many patients taught ISC before TVT. If AUR develops options are
threefold: immediate loosening of tape in theatre; ISC or IDC. Even
without immediate revision, majority of patients settle spontaneously.<10% ultimately require tape division. Interestingly 30% remain dry
Outcomes similar in young vs. old women except for slightly higher
rates of de-novo bladder overactivity in the elderly population

**All eroded material must be excised an tissue coverage performed
Complications specific to TOT include leg pain (inadvertent insertion
through adductor longus tendon) and higher rates of vaginal fornix
perforation. TOT – obturator canal lies in upper outer corner of
obturator foramen

B. Augmentation of urethral closure
Usually reserved for patients suspected of having intrinsic sphincter
deficiency. VLLP < 60 cm water.

(i) Periurethral bulking agents
Typically for Type III SUI (no descent; lone ISD)
More effective than no treatment/placebo but inferior to surgery (autologous
sling): fewer complications however
Little difference between collagen, carbo-coated zirconium beads, hyaluronic
acid/dextran co-polymer (Deflux), silicone (polydimethylsiloxane, aka
macroplastique)
Autologous fat no better than placebo PTFE microparticles a/w migration
Collagen a/w hypersensitivity reactions
Problems (NICE)
Repeat injections required to acheive efficacy
Efficacy diminishes over time
Not as effective as sling
Complications common but transient: include AUR and denovo bladder
overactivity

(ii) Pubovaginal slings
Indications
SUI with significant ISD component
Sacral neurogenic bladder (spina bifida)
Erosion, fistula or tissue loss
Failed mid-urethral tape
Ongoing requirement for ISC
Poor bladder compliance considered a contraindication – risk hydrenephrosis
Different degrees of ‘tightness’ for different patients
Four different types:
   Autograft
       Autologous rectus fascia, fascia lata
Autografts almost never a/w erosion
Rectus fascia better cf fascia lata – no requirement for repositioning and no leg symptoms

Allograft
Cadaveric dura mater, cadaveric fascia lata, acellular dermis
No difference between substances
Sterilisation by solvents, freeze-drying or radiation
No
Risk of HIV 1 in 8 million
Risk of CJD 1 in 3.5 million

Xenograft
Porcine small bowel submucosa, bovine pericardium
Porcine small bowel mucosa a/w reduced immunological response

Synthetics
Autologous material better cf. cadaveric material and prior to TVT was considered gold standard.

Surgical technique
6-8cm of rectus fascia harvested
Space of Retzius entered
Vaginal incision at bladder neck
Suture passer top down
Siting of autograft at bladder neck and proximal urethra
Suture with vicryl to endopelvic fascia on either side
NB. ‘tight’ closure may be acheived by crossover technique

Complications
Urinary retention* 20-40%
Abdominal pain up to 100% (resolves with suture hydrolysis)
Erosion Very rare
Failure Rare (early technical; late 2’ prolapse)
* Transection if within 6 weeks; if urethra hypersuspended complete removal required

Very high cure rates can be expected (93% at 22 months McGuire; 98% for revisions)

(iii) Artificial urinary sphincter
Indicated for Type 3 SUI
High subjective cure rates > 90% (Kowalcyzk 2000) but significant erosion rates 7-29%
Therefore only recommended for previous failed SUI surgery
Which technique is best?
TVT better than colposuspension (Novara 2007)
TVT just better than fascial sling (Novara 2007)
TVT = TOT (Freeman 2008)
TOT outside in better than inside out
Fascial sling better than colposuspension (Albo 2007)

Revision surgery
Many centres would place 2nd tape
Equivalent efficacy and complication rate to primary procedure
Others recommend Burch or Fascial Sling
Albo (NEJM) 2007 (n=655) showed autologous fascial sling more effective than Burch, but a/w higher risk of side-effects and revision for voiding dysfunction
**Overactive bladder (OAB) and urge urinary incontinence**

Overactive bladder is a symptom profile characterised by urinary frequency, nocturia and urgency with or without urge urinary incontinence.

**Evaluation**

**History**
- Fluid intake
- Caffeine
- Smoking
- Diabetes

**Examination**
- Exclude demonstrable stress incontinence
- Exclude palpable bladder

**Voiding diary**

**Post-micturition residual**

**Urinalysis**
- Non-visible haematuria in the absence of UTI/menstruation mandates investigation

**Urinary cytology (?)**

**Urodynamics**

**Management**

(i) **Conservative**

- Caffeine withdrawal
- Bladder retraining (6 week course)
  - More effect than control in RCTs
  - As effective as oxybutynin but with lower relapse and fewer SE
  - Anticholinergic plus retraining = reduced freq. but equal incontinence episodes
- Prompted and timed voiding reduce incontinence in cognitively impaired

(ii) **Pharmacological**

- **Topical oestrogen therapy**

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**Intravaginal oestrogens** are recommended for the treatment of OAB (overactive bladder) symptoms in post-menopausal women with vaginal atrophy (NICE 2006).

**Vagifem Vaginal Tablets (or Orthoestren Intervaginal cream):** Insert one tablet (or applicator full) daily for two weeks, then reduce to one tablet (or applicator full) twice weekly.

At one year oestrogen pessaries reduces urinary incontinence by half (20% to 10%) and frequency by three quarters (40% to 10%)

**Anticholinergics**

- Vast amount of data
- Cochrane review (Herbison 2003) included 32 RCTs, conclusively proving anticholinergics decrease frequency and urgency, increasing mean bladder functional capacity.
Overall efficacy 50-75%
Very little difference between formulations in terms of efficacy – differences promulgated by drug companies often have no ‘real world advantage’. Solifenacin may have better efficacy in urge incontinence (Star trial Chapple)
Effects in elderly (BBB) can be profound
NICE recommend non-proprietary immediate release (IR) oxybutynin first line (>60 yrs 2.5mb bd; otherwise 5mg bd up to qds)
If poorly tolerated then tolterodine, solifenacin, darifenacin, trospium, or transdermal oxybutynin. Tolterodine reserved for troublesome side-effects; trospium for CNS side-effects, and solifenacin for treatment failures – some rationality for this.
Propiverine, flavoxate, propantheline and imiprimine not recommended by NICE

Contraindications
Myasthenia gravis
Narrow-angle glaucoma
Toxic megacolon
Bowel obstruction

Half-lifes
Tolterodine 2-4 hrs
Oxybutynin 2-3 hrs
Tolterodine XL 8.5 hrs
Oxybuynin XL 13 hrs
Trospium 20 hrs
Solifenacin 40 hrs

Desmopressin
Highly effective in reducing nocturia and ‘nocturnal bother’ in adults, with sustained long-term responses
No evidence for its use in reducing daytime incontinence
Oral and intranasal preparations equally effective but neither licensed in UK for this use
Side effects
Headache, nausea and daytime urinary frequency
Mild hyponatraemia in ~10% - may be more common in elderly (post-Rx monitoring for 3 days recommended if given to over 60s)

Intravesical Botulinum toxin
Binds to pre-synaptic nerve terminals, leading to inhibition of ACh release and failed neuromuscular transmission
Specifically stops endovesicles fusing with plasma membrane by cleaving cytosolic translocation SNARE proteins
Botulinum toxin A only recommended (short duration of response with botulinum toxin B
2 preparations in botulinum toxin A in UK (BOTOX - Allergan, Dysport - Ipsen). Different dosages – not interchangeable.
Typically 10IU/ml BoTox 20-30 injections of 1 ml (fan-shaped distribution 5 columns x 4-6 trigone-sparing) into detrusor. Usually 200 IU for IDO and 300 IU for NDO. Evidence (Dmochowski metaanalysis 2007)

<table>
<thead>
<tr>
<th></th>
<th>Improvement</th>
<th>Continence</th>
<th>ISC</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDO</td>
<td>60-100%</td>
<td>34-100%</td>
<td>0-75%</td>
<td>Mean 6/12</td>
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<td>21 studies</td>
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<td>1 x RCT</td>
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<tr>
<td>NDO</td>
<td>66-100%</td>
<td>57-87%</td>
<td>0-69%</td>
<td>Mean 6/12</td>
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<tr>
<td>21 Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 x RCT</td>
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</tbody>
</table>

Problems
- Infection, bleeding, dysuria, AUR, incomplete emptying
- Requirement for repeat treatment

Surgical treatment
Sacral nerve neuromodulation (Sacral nerve stimulation)
Medtronic® InterStim Sacral Nerve Stimulation (SNS) System™, Minnesota, USA
Permanent stimulation of S3 nerve root (dorsal division – usually unilateral only) thought to inhibit reflex detrusor contraction – mechanism unknown (? gating theory)
S3 stimulation
- Motor: dorsiflexion great toe, contraction levator ani
- Sensory: Pulling sensation in rectum, scrotum, vagina

Initial percutaneous nerve evaluation (PNE) for a few days with external stimulator, followed by implantable SNS in those who respond

Around two-thirds of patients have sustained response (both incontinence episodes and frequency-urgency) for at least 3 years (similar efficacy in those with Fowler’s syndrome)
However definitions of response vary making it difficult to determine true efficacy. Conventionally at least 50% improvement in symptoms considered success.
Complications common
- Pain at implant site
- Leg pain
- Infection
- Urinary retention
- Bowel function disturbance

Revision in one third (lead migration, malfunction)
Removal in 10%

Cost can be prohibitive: Hardware costs £8400; Battery change at ~ 5-7 years costs £5300. NICE estimated £25,000 per QALY
Currently NICE only recommend for patients with NDO or IDO, not non-obstructive voiding dysfunction.
NB. S3 foramen located 1cm below and lateral to posterior sacral prominence (PSP). PSP located 4 fingers breadth above tip of coccyx.

Augmentation cystoplasty
- Typically ileal segment (25cm, 25cm from ileocaecal valve), occasionally ileocaecal or sigmoid
- No RCTs – case series report cure/improvement in 50-75%
- Side effects common however
  - Recurrent UTI 35%
  - Voiding dysfunction /ISC 30%
  - Increased bowel frequency 20%
  - Metabolic acidosis 15%
  - Calculus formation 15%
  - Incontinence 10-12%
  - Perforation <1%
  - Malignancy <1%

Mucus production (30-40g per day)

Detrusor myomectomy
- Excision of muscle to leave mucosa as a wide-necked diverticulum
- No pure studies in idiopathic DO; all ‘contaminated with neurogenic DO patients
- From limited case series, improvement expected in >75%
- Requirement for ISC in approximately one third

Urinary diversion
- Uncommonly performed for idiopathic DO
- Typically ileal conduit UD; occasionally pouch, rectal bladder
- SE due to urinary diversion + ~50% vesical infection/pyocystis

Incontinence in the Elderly (DIAPPERS)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Detriment/confusional state</td>
<td>Results from almost any underlying illness or medication; incontinence is secondary and abates once the cause of confusion has been corrected</td>
</tr>
<tr>
<td>Infection—urinary (only asymptomatic)</td>
<td>Causes incontinence, but the more common asymptomatic bacteriuria does not</td>
</tr>
<tr>
<td>Atrophic</td>
<td>Characterized by vaginal erosions, telangiectasia, petechiae, and friability; may cause or contribute to incontinence. Now controversial but may be worth a 3- to 6-month trial of estrogen, especially local (if not contraindicated by breast or uterine cancer)</td>
</tr>
<tr>
<td>Postinfectious</td>
<td>Includes many prescribed and nonprescribed agents; because incontinence can be caused by diverse mechanisms (see Table 71-2)</td>
</tr>
<tr>
<td>Excess urine output</td>
<td>Results from large fluid intake, diuretic agents (including theophylline, caffeinated beverages, and alcohol), and metabolic disorders (e.g., hyperglycemia or hypercalcemia). Nocturnal incontinence also may result from mobilization of peripheral edema (e.g., congestive heart failure, venous insufficiency)</td>
</tr>
<tr>
<td>Restricted mobility</td>
<td>Often results from overlooked, correctable conditions such as arthritis, pain, postprandial hypotension, or fear of falling</td>
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<tr>
<td>Stool impaction</td>
<td>May cause both fecal and urinary incontinence that remit with disimpaction</td>
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<tr>
<td>Type of Medication</td>
<td>Examples</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------------------------------------------</td>
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<tr>
<td>Sedatives-hypnotics</td>
<td>Long-acting benzodiazepines (e.g., diazepam, flurazepam)</td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
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<tr>
<td>Anticholinergics</td>
<td>Dicyclomine, disopyramide, antihistamines (sedating ones only, e.g., diphenhydramine [Benadryl])</td>
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<tr>
<td>Antipsychotics</td>
<td>Thoridazine, haloperidol</td>
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<tr>
<td>Antidepressants</td>
<td>Amitriptyline, desipramine, non selective serotonin reuptake inhibitors</td>
</tr>
<tr>
<td>Anti-parkinsonians</td>
<td>Trihexyphenidyl, benztrapine mesylate (not L-dopa or selegiline)</td>
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<tr>
<td>Narcotic analgesics</td>
<td>Opiates</td>
</tr>
<tr>
<td>α-Adrenergic antagonists</td>
<td>Prazosin, terazosin, doxazosin</td>
</tr>
<tr>
<td>µ-Adrenergic agonists</td>
<td>Nasal decongestants</td>
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<tr>
<td>Calcium channel blockers</td>
<td>All dihydropyridines</td>
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<tr>
<td>Potent diuretics</td>
<td>Furosemide, bumetanide (not thiazides)</td>
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<tr>
<td>NSAIDs</td>
<td>Indomethacin, cycloxygenase-2 inhibitors</td>
</tr>
<tr>
<td>Thiazoid diuretics</td>
<td>Rosiglitazone, proglitazone</td>
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<tr>
<td>Parkinson’s agents (some)</td>
<td>Pramipexole, ropinore amantadine</td>
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<tr>
<td>Angiotensin-converting enzyme inhibitors</td>
<td>Captopril, enalapril, lisinopril</td>
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<tr>
<td>Vincristine</td>
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Appendix

Mechanism of continence in women
4 factors contribute to female continence:
- Bladder compliance
- Efficient urethral sphincter
- Efficient urethral support
- Adequate urethral mucosal coaption

3 components of urethral support in women (from true pelvis to perineum)
- Suburethral ‘hammock’ of connective tissue
  - Allows efficient transfer of raised intraabdominal pressure
- Endopelvic fascia (condensations of which termed ligaments)
  - Arcus tendineus facia pelvis
- Levator ani musculature
  - Particularly pubourethralis
  - Intrinsic tone re-inforces pelvic ligaments