Investigation

Investigation

The diagnosis is made on imaging (ultrasound, computed tomography [CT], magnetic resonance imaging [MRI] or cystogram) or through direct vision at cystoscopy (Figure 83.7). Bladder outlet obstruction should be confirmed with urody - namics if suspected. Investigation

Investigation should aim to identify predisposing or exacerbat - - ing factors for urinary incontinence, as well as any features that may have a detrimental outcome on treatment (e.g. BMI). The following investigations are recommended: 1 Urinalysis – to identify UTI. - 2 Flow rate and postvoid residual measurement – to identify voiding dysfunction or urinary retention. 3 Three-day bladder diary – to assess daytime and night - time frequency episodes, polyuria (the production of >2.8 litres of urine in 24 hours in adults), nocturnal polyuria (>20–33% of urine production occurs at night), functional capacity (based on voided volumes) and inconti - nence episode frequency . The following in vestigations should be considered if con - servative and pharmacological measures have failed to improve symptoms, if there is suspicion of underlying anatomical or neurological pathology based on the history and examination or in cases of recurrent urinar y incontinence after previous surgery . 1 CT urogram or MRI will identify an ectopic ureter or ure - terovaginal or vesicovaginal fistula (VVF). MRI should be performed if there is suspicion of a urethral diverticulum. 2 Cystourethroscopy in cases where fistula or iatrogenic bladder or urethral pathology is suspected (e.g. following previous incontinence surgery). 3 Urodynamics/video urodynamics – this test is used to assess the pressure–volume relationship of the bladder during the storage and voiding phases of the micturition cycle. In the investigation of urinary incontinence, uro - dynamics is recommended in the following situations: /uni25CF MUI (SUI with UUI or overactive bladder symptoms); /uni25CF suspicion of voiding dysfunction or neurological LUT dysfunction; /uni25CF previous failed anti-incontinence surgery; /uni25CF prior to invasive treatment. Urodynamics (filling and voiding cystometry) Urodynamic investigation is used to measure the detrusor pres - sure during filling and voiding. The detrusor pressure cannot be measured directly and so it is derived from subtracting the intra-abdominal pressure from the intravesical pressure (Figure 83.12). /uni25CF Technique . A 6Fr or 8Fr transurethral pressure- measuring catheter is inserted into the bladder to measure the intravesical pressure (p), and another is inserted into ves the rectum (or vagina) to measure the intra-abdominal pressure (p). The detrusor pressure (p) can then be abd det derived by subtracting intra-abdominal pressure from intravesical pressure. /uni25CF Storage phase . The bladder is filled with saline through the transurethral catheter at a steady rate (usually 50 /uni00A0 mL/min in non-neurogenic patients) and the following observations are recorded: cystometric capacity , compliance of the bladder (the relationship between the change in bladder volume and the change in detrusor pressure), bladder sensations and the presence of phasic rises in detrusor pressure (detrusor overactivity) (Figure 83.13). Any incontinence associated with phasic rises in detrusor pressure represents UUI. Stress tests (e.g. cough) are also performed throughout the filling phase and any leakage associated with increases in intra-abdominal pressure, in the absence of an increase in detrusor pressure, represents SUI. /uni25CF Voiding phase . When the patient has

reached a strong desire to pass urine, bladder filling is stopped and the pa tient is asked to void. During voiding, a high detrusor pres sure with corresponding low flow rate represents bladder outlet obstruction (Figure 83.14). Several nomograms to identify bladder outlet obstruction based on pressure–flow criteria exist for men and women. Jerry G Blaivas , b. 1943, American urologist. Carl A Olsson , contemporary , American urologist, with Jerry G Blavias described the radiographic classification of stress urinary incontinence in 1988. /uni25CF Video urodynamics . The addition of fluoroscopic im - aging enables the diagnosis of VUR and anatomical ab - normalities (bladder or urethral diverticula or fistulae) and can classify the type of SUI (Table 83.6). In this case, the bladder is filled with radiographic contrast. /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF - /uni25CF -

500 375 250 125 Millilitres 0 75 O 2 50 cmH 25 0 72 O 48 2 24 cmH 0 69 O 2 46 23 cmH 0 Figure 83.12 Urodynamic trace showing normal bladder storage and voiding. The red line represents intra-abdominal pressure (blue line intravesical pressure (p). The subtracted pressure – the detrusor pressure (ves no rise in p , which represents a normal bladder storage phase. abd, intra-abdominal; det, detrusor; MCC, maximum cystometric capacity; det p1, pressure 1; p2, pressure 2; ves, intravesical. 345 348 p det det -2 p1 ves 44 p2 abd 45 p) and the abd p) – is shown by the orange line. During /f_i lling, there is det TABLE 83.6 Blaivas–Olsson classi /f_i cation of stress urinary incontinence. Type At rest On stress Rotational descent, 0 Bladder neck closed bladder neck open, but no Situated above the leak demonstrated superior margin of the pubic symphysis I Descent less than 2 /uni00A0 cm, Bladder neck closed bladder neck open and Situated above the leak seen. No cystocele inferior margin of the pubic symphysis IIA Descent more than 2 /uni00A0 cm, Bladder neck closed bladder neck open and Situated above the leak seen. Cystocele seen inferior margin of the pubic symphysis IIB May or may not be further Bladder neck closed descent, but bladder neck Situated below the opens and leak seen inferior margin of the pubic symphysis 3 Obvious gravitational Bladder neck and incontinence in the proximal urethra open at absence of signi /f_i cant rest (in the absence of a mobility detrusor contraction) Positions at rest and on stress refer to the bladder neck and proximal urethra.

Cg Cg 500 375 250 125 72 19 0 75 50 25 12 4 0 72 48 36 35 24 0 69 46 32 23 23 0 Figure 83.13 Urodynamic trace showing detrusor overactivity (phasic rises in intravesical pressure [a corresponding rise in intra-abdominal pressure [p]). abd, intra-abdominal; Cg, cough; det, detrusor; dlp, detrusor leak point; do, detrusor abd overactivity; MCC, maximum cystometric capacity; p1, pressure 1; p2, pressure 2; ves, intravesical. MCC Values 348 Millilitres O 2 cmH -3 47 O 2 cmH 49 O 2 cmH mL/s 0 Figure 83.14 Urodynamic trace showing bladder outlet obstruction (very high intravesical pressure [low /f_l ow rate represented by the lowest trace). abd, intra-abdominal; det, detrusor; MCC, maximum cystometric capacity; p1, pressure 1; p2, pressure 2; ves, intravesical. Cg do MCC 232 234 214 194 137 p det 59 det 23 9 3 -1 90 p1 ves 49 40 32 31 p2 abd 32 31 30 29 26 p] and detrusor pressure [p] without ves det Values 348 p det det 5 p1 ves p2 53 abd 0 p] and detrusor pressure [p] with the ves det

Conservative The recommended initial treatment for urinary incontinence consists of lifestyle interventions (weight loss, fluid modifi cation, smoking cessation, treat constipation), behavioural therapy (timed voiding and bladder training) and pelvic floor muscle training. Pharmacological therapy Pharmacotherapy with antimuscarinics and β -agonists is the 3 mainstay of management. Antimuscarinics should be used with caution in the elderly or in those who take multiple medi

cations with antimuscarinic activity owing to the association with dementia with long-term use. The aim of pharmacological treatment of SUI is to increase the urethral closure pressure by increasing smooth and stria muscle tone. Duloxetine, a selective serotonin and noradrena line reuptake inhibitor, has been shown to increase sphincteric muscle activity and therefore improve urinary incontinence. However, pharmacological trea tment for SUI is less commonly used than for OAB because of high discontinuation rates and reports of serious adverse events, such as mental health disor ders and suicide, with duloxetine. Invasive treatment of stress urinary incontinence in women Several surgical options for the treatment of SUI are available, and the choice of therapy depends upon the pathophysiology of the incontinence (relative degree of hypermobility and intrinsic sphincter deficiency) and individual patient prefer ences. Intraurethral injection therapy The least invasive surgical option for the treatment of SUI is the injection of bulking agent into the urethral submucosa to improve the urethral closure mechanism and hence restore continence. This is particularly beneficial for those with a greater degree of intrinsic sphincter deficiency (type 3 SUI) rather than those with predominant hypermobility . The procedure can be performed as an outpatient and involves injecting bulking agent into di ff erent aspects of the urethra, at the level of the bladder neck or mid-urethra, order to obtain visual urethral coaptation (Figure 83.15 Although less invasive than other surgical treatments, suc cess rates are generally lower, with patient-reported improve ment rates of approximately 60% in the short term; repeat injections are often required. Synthetic mid-urethral sling The synthetic mid-urethral sling has been the most commonly performed surgical procedure for SUI over the past three decades. Its less invasive nature compared with the autologous sling and retropubic suspension procedures in addition to its relative ease of insertion have contributed to its popularity . Synthetic slings are made of type 1 macroporous polypropylene Anders Retzius , 1796–1860, Swedish anatomist. - - ted - mesh and can be inserted through the retropubic or transob - - turator routes. A 1-cm incision in the anterior vaginal wall at the level of the mid-urethra is made, and the paraurethral space is dissected bilaterally to the pubic bone. With an empty blad - der, the sling is placed through the retropubic space, exiting on the lower abdominal wall appr oximately 2–3 /uni00A0 cm lateral to the midline bilaterally . Cystoscopy should be performed after sling placement to ensur e that the mesh has not perforated the - bladder or urethra. The sling is placed without tension. The transobturator sling is placed in a similar manner, but the sling is placed through the obturator foramen, exiting in the groin crease at the level of the clitoris. Success rates are high with an almost 90% cure rate at 17-year follow-up, and e ffi cacy is similar between retropu - bic and transobturator slings. Howev er, increasing concerns about serious long-term mesh-related complications (erosion; chronic pelvic, groin, perineal and vaginal pain; sexual dys - function) ha ve led surgeons in many countries to abandon the use of these devices. Retropubic suspension procedures in). Colposuspension aims to restore the bladder neck and proxi - - mal urethra to their normal intra-abdominal position, thereby - allowing equal pressure transmission to the bladder and prox - imal urethra at times of raised intra-abdominal pressure, and so impro ve SUI by augmenting the urethral closure pressure. It is recommended for those with demonstrable hypermobility and concomitant cystocele. The procedur e is traditionally performed through a Pfannenstiel incision, although minimally invasive approaches (laparoscopic, robot assisted) have been described in recent years in an attempt to reduce morbidity . The procedur e involves dissection of the retropubic space (space of Retzius), the relatively avascular space between the pubic symphysis and

Figure 83.15 Urethral mucosal coaptation following intraurethral injection of bulking agent. The urethral mucosa can be seen to be bulging at the site of bulking agent injection, thereby occluding

the urethral lumen.

bladder. The vaginal fascia at the level of the bladder neck and proximal urethra is exposed bilaterally and two to four non absorbable sutures are placed 2–3 /uni00A0 cm lateral to the bladder neck (proximal suture) and proximal urethra (distal suture) on each side. T hese sutures are then attached to the iliopectineal ligament (Cooper’s ligament) and the knots tied gently in order to achieve elevation without tension (Figure 83.16). Cystoscopy should be performed following the procedure to ensure that the sutures have not been passed through the bladder. The Burch colposuspension has good long-term e ffi cacy with cure rates of 70–90% at 5-year follow-up. Howe ver, risks of posterior pelvic organ prolapse are higher than with sling procedures. Autologous fascial sling The autologous pubovaginal sling aims to improve SUI by adding strength to the mid-urethral posterior supporting ‘hammock’. It is an e ff ective and durable treatment for SUI and can be inserted ‘tension-free’, similar to the synthetic mid-urethral sling, or can be inserted under tension in order to provide a compressive e ff ect on the urethra for those with intrinsic sphincter deficiency . As this sling is not a foreign body , there is very low risk of urethral erosion. Most commonly , a strip of rectus fascia (8 /uni00A0×/uni00A0 2 /uni00A0 cm) is har vested through a small Pfannenstiel incision, although if this cannot be used then fascia lata can be harvested from the leg using a fascial stripper. The sling is then attached to a 0 polydioxanone (PDS) suture on each side (Figure 83.17 passed into the retr opubic space in a similar manner to the synthetic mid-urethral sling. In patients with a greater degree of intrinsic sphincter deficiency the sling can be inserted under a greater degree of tension. Sir Astley Paston Cooper , 1768–1841, surgeon, Guy’s Hospital, London, UK, described the ligament that runs on the pectineal line of the pubic bone in 1804. John C Burch , 1900–1977, gynaecologist, V anderbilt University , Nashville, TN, USA. - Success rates of 75% at 10-year follow-up are reported. The pubovaginal sling is a suitable option for those who have failed previous SUI surgery , irradiated patients or those with urethral fibrosis from previous urethral pathology (e.g. urethral diverticulum, fistula, mesh erosion). However, there is a higher risk of voiding dysfunction requiring CISC with this technique, as well as new onset OAB symptoms. Artificial urinary sphincter - The artificial urinary sphincter (AUS) is considered for women with severe recurrent SUI due to intrinsic sphincter deficiency that has failed to improve after previous surgical intervention. This three-piece device consists of a cu ff that is) and placed around the urethra at the level of the bladder neck, a pressure-regulating balloon placed in the extraperitoneal space and a control pump placed in the labia majora (Figure 83.18). Recent advances in minimally invasive surgery have reduced the morbidity associated with the traditional open approach,

Figure 83.16 Burch colposuspension showing the suture position from the vaginal fascia (arrow) to the iliopectineal (Cooper’s) ligament (star). Figure 83.17 Autologous rectus fascial sling harvested and attached to non-absorbable sutures (‘sling on a string’). Cuff Pressure regulating reservoir Control pump Figure 83.18 The AMS 800 Arti /f_i cial Urinary Sphincter.

and safety in randomised trials. Evidence of e ffi cacy is limited to case series from specialist centres. One of the largest series of 376 AUS implantations reported a cure rate of 85.6% at a mean of 9.6 years of follo w-up, but this was at the expense of a 10-year revision rate of 30%. /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Invasive treatment of stress urinary incontinence in men Post-prostatectomy incontinence is the commonest cause of SUI in men. Several factors may contribute

(Table 83.7 Pharmacological treatment with duloxetine has a limited role; the mainstay of treatment is surgical, with the male sub urethral sling or the AUS. The male transobturator suburethral sling is recommended for men with mild to moderate SUI and those w ho have not had prior radiotherapy . In cases of severe SUI or recurrent SUI or in those who have had prior radiotherap y , the AUS is the gold standard treatment. The male sling repositions the bulb of the urethra in a retrourethral position, providing additional support to the existing sphincter without causing obstruction. The AUS is occlusive. Both approaches require a midline perineal incision through the bulbospongiosus muscle. For placement of the male suburethral sling, a helical trocar is used to pass the polypropylene mesh through the obturator foramina bilaterally . Placement of the AUS requires circumfer ential mobilisation of the proximal bulbar urethra for insertion of the cu ff , and a separate inguinal incision for insertion of the pressure-regulating balloon into the extraperitoneal space (Figure 83.19). The control pump is connected and inserted into a subdartos pouch in the scrotum through this inguinal incision. T he transobturator suburethral sling has reported cure rates of 66% at 3-year follow-up whereas the AUS has long term satisfaction rates of 80–90%. Reoperation with the AUS is r equired in 26% in the long term for infection, erosion or mechanical failur e. Invasive treatment of overactive bladder and urgency urinary incontinence If pharmacological therapy for idiopathic or neurogenic OAB fails, intravesical injection of BTX-A and sacral nerve stimu lation (SNS) have demonstrated high e ffi cacy in randomised). - trials. For those who prefer a less invasive alternative, percuta - neous tibial nerve stimulation (PTNS) may be useful. Failure to respond to these minimally invasive treatments often leads to surgical treatment with augmentation enterocystoplasty or urinary diversion for end-stage incontinence. Intravesical injection of botulinum toxin A BTX-A is a neurotoxin produced by the anaerobic bacterium - Clostridium botulinum . There are seven subtypes (A–G) and type A is most clinically useful because of its longer duration of action. It is thought to have both a ff erent and e ff erent mech - anisms of action. The procedure is performed under local anaesthesia with a flexible cystoscope. Risks include UTI and voiding dysfunction requiring CISC in approximately 10%. Furthermore, symp - egen - toms typically return after around 6 months owing to r - eration of new nerve terminals, so the treatment needs to be repeated at regular intervals. High-quality randomised trials have demonstrated the e ffi - thic OAB and neurogenic detru - cacy of BTX-A for both idiopa sor overactivity , with success rates of approximately 60–90%. Sacral nerve stimulation This treatment involves implantation of an electrical pulse generator to stimulate the S3 sacral nerve root, thereby - improving OAB symptoms. The mechanism of action is not

TABLE 83.7 Factors contributing to post-prostatectomy incontinence. Patient factors Surgical factors BMI Fibrosis Age Urethral stricture Prostate size Technique of prostatectomy (non-nerve-sparing) Membranous urethra length Pre-existing LUTS Laxity of posterior support Previous TURP Neurovascular bundle damage Previous radiotherapy Devascularisation BMI, body mass index; LUTS, lower urinary tract symptom; TURP , transurethral resection of the prostate. Figure 83.19 Perineal approach demonstrating exposure of the corpus spongiosum.

completely understood but it is thought that a ff erent stimu lation modulates reflex pathways involved in the micturition cycle. The procedure is typically performed in two stages. The first, known as the ‘first stage tined lead’, involves insertion of a lead with f our electrodes percutaneously , under fluoro scopic guidance, to the S3 foramen via a posterior approach. Electrical cur rent is then applied to achieve stimulation of the sacral nerve, and correct lead

placement is identified by the typical motor responses of plantarflexion of the g reat toe and inward movement of the intergluteal fold due to contraction of the levator ani (anal reflex). This lead is then kept in place for approximately 2 weeks; if clinical e ffi cacy (based on at least 50% improvement in bladder diary parameters) has been achieved then the second stage involves insertion of a perma nent implant (Figure 83.20). E ffi cacy rates of 70–80% have been reported with this technique for both idiopathic OAB and NLUTD, and there is no significant di ff erence in terms of e ffi cacy between BTX-A and SNS. Complications include lead migration, device infec tion and implant site pain. Percutaneous tibial nerve stimulation PTNS is a minimally invasive form of peripheral neuromod ulation that is recommended for patients who are unsuitable is thought to improve symptoms of idiopathic OAB through stimulation of the sacral plexus S2–4, indirectly via the tibial nerve. Success rates are lower than those reported for BTX-A and SNS (approximately 50%), and patients require weekly treatment sessions over 12 weeks. However, there are no signif - icant side e ff ects related to this treatment. Augmentation enterocystoplasty Augmentation enterocystoplasty is reserved for those with high-pressure detrusor overactivity , poor compliance and reduced bladder capacity who have failed to respond to the above treatments. It is recommended for patients with both idiopathic and neurogenic bladder dysfunction. The aim is to create a low-pressure reservoir with increased functional capacity , thereby preserving renal function. The procedure can be performed through a Pfannenstiel or lower midline abdominal incision with an extraperitoneal approach to mobilise the bladder from the peritoneum. The bladder is then bivalved in the coronal plane to a point 1 /uni00A0 cm anterior to the ureteric orifices bilaterally . Although several gastrointestinal segments have been used, ileocystoplasty is the most common. A 25-cm segment of ileum is isolated, opened along its antimesenteric border and attached to the bivalved bladder, thereby increasing the bladder capac - ity (Figure 83.21). A suprapubic catheter is placed, and the patient undergoes a cystogram 3 weeks after surgery to ensure that the enterocystoplasty segment has completely healed prior to catheter removal. Augmentation cystoplasty is an e ff ective option with conti - nence and satisfaction rates of over 90%, as well as considerable improvements in urodynamic parameters (detrusor overactiv - ity , compliance, maximum detrusor pressure). Howev er, this is a major surgical undertaking with risks of UTI, need for - CISC, metabolic disturbances, mucus and stone formation, spontaneous perforation and possibly a small long-term risk of malignancy . - - - -

Figure 83.20 Radiograph demonstrating correct lead placement of the tined lead in the S3 foramen and the implant in the buttock. Figure 83.21

Augmentation ileocystoplasty. One of the ureteric ori

/f_i ces can be seen with the interureteric bar (arrow).

In those with so-called ‘end-stage’ incontinence that has failed to respond to the above measures, urinary diversion remains a last resort to improve quality of life. Ileal conduit urinary diversion, with or without cystectomy , is most commonly performed. When performed for benign indications, overall revision rates approach 40% (incisional or parastomal hernia, stomal complications, ureteroileal anastomosis revision or secondary cystectomy for refractory pyocystis). Summary box 83.3 Urinary incontinence /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Urinary incontinence should be classi /f_i ed as UUI, SUI or MUI Initial management for urinary incontinence of any type is with behavioural modi /f_i cation, bladder training and pelvic /f_l oor muscle training OAB and UUI can be managed in a stepwise manner with pharmacotherapy, intravesical BTX-A, SNS or augmentation enterocystoplasty SUI in women is initially managed with bulking agents, mid- urethral slings (synthetic or autologous) or colposuspension SUI in men is managed with the suburethral sling or AUS Urinary diversion is a last-resort option for those with end- stage urinary incontinence Suprapontine lesion • History : predominantly storage problems • Ultrasound • Urodynamics Spinal (infrapontine–suprasacral) lesion • History : both storage and voiding problems • Ultrasound • Urodynamics dyssynergia Sacral/infrasacral lesion • History : predominantly voiding symptoms • Ultrasound • Urodynamics acontractile detrusor Figure 83.22 Characteristic lower urinary tract disorders arising from neurological disease. (Reproduced with permission Fowler CJ, Kessler TM. Lower urinary tract dysfunction in the neurological patient: clinical assessment and management. 14 (7): 720–32.)

Investigation

Plain radiograph of the bladder, renal tract ultrasound or CT will confirm the diagnosis and provide an estimation of size to aid treatment planning (Figure 83.28). Investigation

Initial investigation is with urinalysis (a dipstick test checks for the presence of red cells, white cells and nitrites), urine - microscopy , culture and sensitivity , flow rate assessment and measurement of postvoid residual volume. In those with rUTI, renal tract ultrasound to exclude anatomical pathology should be performed; cystoscopy is reserved for those with atypical symptoms, haematuria or other features that raise suspicion of underlying pathology (e.g. bladder cancer, stones, urinary tract fistula). Current methods of microbiological UTI diagnosis are based on the identification of a ‘significant’ pure growth 3 of a known uropathogen in the urine. A cut-o ff of ≥ 10 colony-forming units/mL is commonly used to diagnose acute uncomplicated cystitis in women, but it is becoming increasingly clear that patients can develop symptoms of UTI with much lower concentrations of urinary bacteria; the Pseudo - minimum concentration required to cause UTI or rUTI has not yet been defined. - Investigation

Urine Urine should be cultured and examined cytologically for malignant cells. An increasing number of urinary biomarkers based on panels of epigenetic markers are being studied, but none has been shown to surpass the accuracy of cystoscopy and so are not routinely used. Cross-sectional imaging: CT urography and MRI of the bladder CT urogram is the gold standard evaluation for upper tract disease (including hydronephrosis) and assessment of nodal metastases (Figure 83.35). MRI of the bladder can be useful in staging of the primary tumour. Imaging should ideally be performed prior to transurethral resection of the bladder tumour (TURBT) as false-positive T3 disease can be diagnosed if cross-sectional imaging is carried out too soon after TURBT . CT of the chest should be performed in confirmed bladder cancer cases for complete staging. Cystourethroscopy Flexible cystourethroscopy under local anaesthetic is the main stay of diagnosis and should always be performed on patients with haematuria (Figure 83.36). The diagnostic accuracy of conventional ‘white’ light cystoscopy has been improved optical enhancement techniques such as narrow-band imaging (NBI) and photodynamic ‘blue’ light cystoscopy (PDD), which relies on the photosensitiser hexaminolevulinate. These tech niques are recommended in patients with a high suspicion of cancer and negative initial findings, or in those with positive cytology but negative ‘white’ light cystoscopy . Investigation

Retrograde cystogram or CT cystogram confirms the diag nosis and identifies whether the injury is intraperitoneal or extraperitoneal (Figure 83.38). Postdrainage views should be obtained as a small amount of contrast extravasation may be missed with a full bladder. With intraperitoneal perforation, contrast is seen to outline loops of bo wel.

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