Guidelines on Urinary Incontinence

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1. INTRODUCTION

Urinary incontinence (UI) is an extremely common complaint in every part of the world. It causes a great deal of distress and embarrassment, as well as significant costs, to both individuals and societies. Estimates of prevalence vary according to the definition of incontinence and the population studied. However, there is universal agreement about the importance of the problem in terms of human suffering and economic cost.

1.1 Aim

These Guidelines from the European Association of Urology (EAU) Working Panel on Urinary Incontinence are written by urologists primarily for urologists, though we recognise that they are likely to be referred to by other professional groups. They aim to provide sensible and practical evidence-based guidance on the clinical problem of UI rather than an exhaustive narrative review. Such a review is already available from the International Consultation on Incontinence [1], and so the EAU Guidelines do not describe the causation, basic science, epidemiology and psychology of UI. The focus of these Guidelines is entirely on assessment and treatment reflecting clinical practice. The Guidelines also do not consider patients with UI caused by neurological disease, or in children, as this is covered by complementary EAU Guidelines [2, 3].

The EAU Panel knew that they would find little evidence for some issues and a lot of evidence for others. This difference, to some extent, reflects the greater funding available for industry-sponsored trials of drugs, the results of which are required for licensing in Europe and the USA. The less stringent regulatory requirements for the introduction of new devices or surgical techniques means that there are far fewer high-quality studies regarding these interventions. Although the lack of high-quality evidence means that judgements about the worth of interventions are prone to bias, the Panel took the view that clinicians still require some guidance concerning clinical practice. In these circumstances, we have summarised the available evidence and made recommendations based on expert opinion, with uncertainty reflected by a lower grade of recommendation.

The elderly

The panel decided to include a separate but complimentary set of recommendations referring to the elderly population within each section. Older people with UI deserve special consideration for a number of reasons. Physiological changes with natural ageing mean that all types of UI become more common with increasing age. Urinary incontinence commonly co-exists with other comorbid conditions, reduced mobility, and impaired cognition and may require specific interventions, such as assisted toileting.

For the elderly person expectations of assessment and treatment may need to be modified to fit in with specific circumstances, needs, and preferences, while taking into account any loss of capacity for consent. When the urologist is dealing with a frail elderly patient with urinary incontinence, collaboration with other healthcare professionals such as elderly care physicians is recommended.

*1.1.1 **Use in different healthcare settings and by healthcare professionals***

The Panel recognises that a patient's first point of contact may not always be a urologist, and that the healthcare professional delivering specific treatments such as physiotherapy, may also not be a urologist. For this reason, some healthcare professionals may find that the Guidelines do not explain a particular topic in enough detail for their needs, e.g. delivery modalities for pelvic floor muscle training (PFMT).

1.2 Publication history

The 2012 edition of these Guidelines was completely rewritten using new methodology and based on new searches up to July 2011 and those carried out for ICUD and NICE (2006) documents.

The 2013 edition was updated with searches to September 2012 and included a new appendix on non obstetric fistula derived from the ICUD 2013, but the contained evidence has not yet been assessed according to the EAU methodology (see Appendix A available online at www.uroweb.org). In the 2014 edition additional searches were done for patient reported outcome measures (PROMS), urethral diverticulum, containment, prolapse reduction stress test, anticholinergic load, and mirabegron. In this 2015 edition searches were done on the 'Assessment and Diagnosis' chapter and on the subject of mirabegron in the 'Drug Treatment' chapter (Table 1).

A quick reference guide, presenting the main findings of the Urinary Incontinence Guidelines, is also available, as well as two scientific publications in the journal of the EAU, European Urology [4, 5]. All texts can be viewed and downloaded for personal use at the society website:
http://www.uroweb.org/guidelines/online-guidelines/.

This document was peer-reviewed prior to publication.

1.3 Panel composition

The EAU Urinary Incontinence Panel consists of a multidisciplinary group of experts, including urologists, a gynaecologist and a physiotherapist.

2. METHODS

References used in this text are graded according to their Level of Evidence (LE) and Guidelines are given a Grade of Recommendation (GR). In this 2015 EAU Guidelines compilation, all standard information on LE and GR has been taken out of the individual Guidelines topics for the sake of brevity. The methodology section (see the introduction chapter of the complete book) outlines the LE and GR criteria which are used throughout the Guidelines, according to a classification system modified from the Oxford Centre for Evidence-based Medicine Levels of Evidence.

This 2015 version has been updated and re-formatted according to the EAU template for non-oncology Guidelines, so that all Guidelines follow a similar format.

The current Guidelines provide:

- A clear pathway (algorithm) for common clinical problems. This can provide the basis for thinking through a patient's management and also for planning and designing clinical services.
- A brief but authoritative summary of the current state of evidence on clinical topics, complete with references to the original sources.
- Clear guidance on what to do or not to do, in most clinical circumstances. This should be particularly helpful in those areas of practice for which there is little or no high-quality evidence.

2.1 PICO questions

The 'PICO' framework was used to develop a series of clinical questions that would provide the basis of presentation of the guidelines [6, 7]. There are four elements to each clinical question:

- Population (P)
- Intervention (I)
- Comparison (C)
- Outcome (O)

The wording of each PICO is important because it informs the subsequent literature research. For each search, the EAU Panel listed every possible wording variation.

In these Guidelines, the four traditional domains of urological practice are presented as separate chapters, namely assessment and diagnosis, conservative management, drug therapy and surgical treatments.

In this third edition of these new EAU Guidelines for Urinary Incontinence, the Panel has focused largely on the management of a 'standard' patient. The Panel has referred in places to patients with 'complicated incontinence', by which we mean patients with associated morbidity, a history of previous pelvic surgery, surgery for UI, radiotherapy and women with associated genitourinary prolapse. This third edition does not review the prevention of UI, and the management of fistula (available online at the society website). These issues will be fully addressed using our standard methodology in future editions.

2.2 Search strategies

A number of significant narrative reviews, systematic reviews and guidance documents have been produced within the last few years. The Panel agreed that the literature searches carried out by these reviews would be accepted as valid. Thus, for each PICO question, a search was carried out with a start date that was the same as the cut-off date for the search associated with the most recent systematic review for the PICO topic. This pragmatic selection approach, while being a compromise and open to criticism, made the task of searching the literature for such a large subject area possible within the available resources. For each section, the latest cut-off date for the relevant search is indicated. Thus, for each PICO, a subsequent literature search was carried out (confined to Medline and Embase and to English language articles), which produced an initial list of abstracts. The abstracts were each assessed by two Panel members, who selected the studies relevant to the PICO question, and the full text for these were retrieved (Table 1).

Table 1: Initial list of abstracts	
Chapter	*Latest 'cut-off' date for search*
Assessment and diagnosis	- PROMS & Questionnaires: 30 April 2014 - Urinalysis and urinary tract infection: 1 May 2014 - Post-voiding residual volume: 12 May 2014 - Pad testing: 29 September 2014 - Urodynamics: 7 May 2014 - Imaging: 12 May 2014
Conservative therapy	28 June 2012 - Containment: 10 July 2013
Drug therapy	28 June 2012 - Anticholinergic load: 29 April 2013 - Mirabegron: 25 April 2014
Surgical therapy	9 July 2012 - POP & OAB: 29 April 2013 - Prolapse reduction stress test: 16 May 2013 - Urethral diverticulum: 7 May 2013

Each PICO was then assigned to a Panel member, who read the papers and extracted the evidence for incorporation into standardised evidence tables. From 2012 onwards we have used a purpose designed web based application in which original papers are downloaded and appraised online according to a standardised format which is based on Scottish Intercollegiate Guidelines Network (SIGN) documents. The web application is progressively populated with evidence appraisals which can be displayed in tabular format showing summaries of data quality as well as summaries of outcomes.

The existing evidence from previous systematic reviews and new evidence were then discussed for each PICO in turn at a Panel meeting generating consensus conclusions. To help standardise the approach, modified process forms (data extraction and considered judgment) from SIGN were used.

The quality of evidence for each PICO is commented on in the text, aiming to synthesise the important clinical messages from the available literature and is presented as a series of levels of evidence summaries in the EAU format as described in the Introduction chapter of the complete Guidelines book.

From the evidence summaries, the Panel then produced a series of action-based recommendations, again graded according to EAU standards. These grades aim to make it clear what the clinician should or should not do in clinical practice, not merely to comment on what they might do.

The Panel has tried to avoid extensive narrative text. Instead, algorithms are presented for both initial and specialised management of men and women with non-neurogenic UI. Each decision node of these algorithms is clearly linked back to the relevant evidence and recommendations.

It must be emphasised that clinical guidelines present the best evidence available to the Panel at the time of writing. There remains a need for ongoing re-evaluation of the current guidelines by the Panel. However, adherence to guideline recommendations will not necessarily result in the best outcomes for patients. Guidelines can never replace clinical expertise when making treatment decisions for individual patients; they aim to focus decisions by addressing key clinical questions, and provide a strong basis for management decisions. Clinical decisions must also take into account the patient's personal values, preferences and specific circumstances.

2.3 Terminology

Evidence summaries provide a succinct summary of what the currently available evidence tells us about an individual clinical question. They are presented according to the levels of evidence used by the EAU.

Recommendations have been deliberately written as 'action-based' sentences. The following words or phrases are used consistently throughout the Guidelines, as follows:

- **Consider** an action. This word is used when there is not enough evidence to say whether the action causes benefit or risk to the patient. However, in the opinion of the Panel, the action may be justified in some circumstances. Action is optional.
- **Offer** an action. This word is used when there is good evidence to suggest that the action is effective, or that, in the opinion of the Panel, it is the best action. Action is advisable.

- **Carry out (perform)** an action. **Do** something. This phrase is used when there is strong evidence that this is the only best action in a certain clinical situation. Action is mandatory.
- **Do not** perform (i.e. avoid) an action. This phrase is used when there is high-level evidence that the action is either ineffective or is harmful to the patient. Action is contraindicated.

3. DIAGNOSTIC EVALUATION

3.1 History and physical examination

Taking a careful clinical history is fundamental to the clinical process. Despite the lack of formal evidence, there is universal agreement that taking a history should be the first step in the assessment of anyone with UI. The history should include details of the type, timing and severity of UI, associated voiding and other urinary symptoms. The history should allow UI to be categorised into stress urinary incontinence (SUI), urgency urinary incontinence (UUI) or mixed urinary incontinence (MUI). It should also identify patients who need rapid referral to an appropriate specialist. These include patients with associated pain, haematuria, a history of recurrent urinary tract infection (UTI), pelvic surgery (particularly prostate surgery) or radiotherapy, constant leakage suggesting a fistula, voiding difficulty or suspected neurological disease. In women, an obstetric and gynaecological history may help to understand the underlying cause and identify factors that may impact on treatment decisions. The patient should also be asked about other ill health and for the details of current medications, as these may impact on symptoms of UI.

Similarly, there is little evidence that carrying out a clinical examination improves care, but wide consensus suggests that it remains an essential part of assessment of people with UI. It should include abdominal examination, to detect an enlarged bladder or other abdominal mass, and perineal and digital examination of the rectum (prostate) and/or vagina. Examination of the perineum in women includes an assessment of oestrogen status and a careful assessment of any associated pelvic organ prolapse (POP). A cough test may reveal SUI if the bladder is sufficiently full and pelvic floor contraction together with urethral mobility can be assessed digitally.

3.2 Patient questionnaires

This section includes symptom scores, symptom questionnaires, scales, indexes, PROMs and health-related quality of life (HRQoL) measures. The latter include generic or condition specific.

Questionnaires should have been validated for the language in which they are being used, and, if used for outcome evaluation, must have been shown to be sensitive to change. The methodology for questionnaire development was reviewed in the 5th International Consultation on Incontinence in 2012 [8].

*3.2.1 **Questions***

- In patients with UI, can the use of Questionnaires/PROMS differentiate between stress, urgency and mixed incontinence, and does this differentiation impact on QoL after treatment?
- In adults with UI, does assessment using either urinary symptom or QoL questionnaires improve treatment outcome for UI?
- In adults with UI, does assessment of the patient perspective (concerns or expectations) improve patient outcomes, regarding either urinary symptoms or QoL, compared to no patient-reported assessment?

*3.2.2 **Evidence***

Although many studies have investigated the validity and reliability of urinary symptom questionnaires and PROMs, most have taken place in adults without UI. This limits the extent to which results and conclusions from these studies can be applied in adults with UI. Some questionnaires (QUID, 3IQ) have potential to discriminate UI types in women [9, 10]. In men ICIQ-UI-SF score does not differentiate UI types [11].

Some are responsive to change and may be used to measure outcomes, though evidence on their sensitivity is inconsistent [12-14].

No evidence was found to indicate whether use of QoL or condition specific questionnaires have an impact on outcome of treatment.

The table shows a summary of the ICUD review 2012 with recent additions. Criteria on which questionnaires are assessed include validity, reliability and resposiveness to change.

	Category A (all 3 criteria fulfilled)*	Category B (2 criteria fulfilled)*	Category C (only 1 criterion fulfilled)*
Symptom measures and health related QOL measures	ICIQ-UI Short Form, ICIQFLUTS,ICIQ-MLUTS IIQ and IIQ-7, I-QOL (ICIQ-Uqol), ISS, KHQ, LIS (?-interview), N-QoL, OAB-q SF, OAB-q (ICIQ-OABqol), PFDI and PFDI-20, PFIQ and PFIQ-7, PRAFAB, UISS;	Contilife, EPIQ, LUTS tool IOQ,YIPS;	ABSST ISI, ISQ, UIHI, UIQ
Measure of patient satisfaction (patient's measure of treatment satisfaction)	BSW, OAB-S, OABSAT-q, TBS	PPQ	EPI, GPI, PSQ
Goal attainment scales		SAGA	
Screening tools (used to identify patients with UI)	B-SAQ, OAB-SS, OABV8, OAB-V3, QUID	ISQ, USP	3IQ, CLSS, MESA, PUF
patient symptom scale			
Assessment of symptom bother and overall bother	PPBC, UDI or UDI-6, LUSQ, PGI-I and PGI-S;	PFBQ, SSI and SII	PMSES, POSQ, UI-4
Assessment of the impact of urgency	IUSS, U-IIQ, UU Scale, U-UDI	PPIUS, SUIQ, UPScore, UPScale, UQ, USIQ-QOL, USIQ-S, USS	
Questionnaires to assess sexual function and urinary symptoms		FSFI, ICIQ-VS, PISQ, SQoL-F	SFQ
Treatment adherence measures		MASRI	

** Criteria on which questionnaires are assessed include validity, reliability and resposiveness to change.*

3IQ = Three Incontinence Questions Questionnaire ABSST = Actionable Bladder Symptom Screening Tool B-SAQ = Bladder Self-Assessment Questionnaire BSW = Benefit, Satisfaction with treatment and Willingness CLSS = Core Lower Urinary Tract Symptom Score Contlife® = Quality of Life Assessment Questionnaire Concerning Urinary Incontinence EPIQ = Epidemiology of Prolapse and Incontinence Questionnaire FSFI = Female Sexual Function Index ICIQ = International Consultation on Incontinence Modular Questionnaire ICIQ-FLUTS = ICIQ-Female Lower Urinary Tract Symptoms ICIQ-MLUTS = ICIQ-Male Lower Urinary Tract Symptoms ICIQ-VS = International Consultation on Incontinence Questionnaire – Vaginal Symptoms IIQ (IIQ-7) = Incontinence Impact Questionnaire (short form) IOQ = Incontinence Outcome Questionnaire I-QOL (ICIQ-Uqol) = Urinary Incontinence-Specific Quality of Life Instrument ISI = Incontinence Severity Index ISQ = Incontinence Stress Index ISS = Incontinence Symptom Severity Index IUSS = Indevus Urgency Severity KHQ = King's Health Questionnaire LIS = Leicester Impact Scale LUSQ = Leicester Urinary Symptom Questionnaire LUTS Tool = Lower Urinary Tract Symptoms Tool MASRI = Medication Adherence Self-Report Inventory MESA = Medial Epidemiological and Social Aspects of Aging Questionnaire N-QoL = Nocturia Quality of Life Questionnaires OAB-q (ICIQ-OABqol) = Overactive Bladder Questionnaire OAB-S = Overactive Bladder Satisfaction measure OAB-SAT-q = OAB Satisfaction questionnaire OAB-SS = Overactive Bladder Symptom Score OAB-v3 = OAB short form OAB-v8 = OAB Awareness Tool	PFBQ = Pelvic Floor Bother Questionnaire PFDI (PFDI-20) = Pelvic Floor Distress Inventory (short form) PFIQ (PFIQ-7) = Pelvic Floor Impact Questionnaire (short form) PRAFAB = Protection, Amount, Frequency, Adjustment, Body image) PGI-I and PGI-S = Patient Global Impression of Severity and Improvement PISQ = Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire PMSES = Broome Pelvic Muscle Exercise Self-Efficacy Scale POSQ = Primary OAB Symptom Questionnaire PPBC = Patient Perception of Bladder Condition PPIUS = Patient's Perception of Intensity of Urgency Scale PPQ = Patient Preparation Questionnaire PUF = patient symptom scale (Pelvic Pain, Urgency and Frequency) QUID = Questionnaire for Urinary Incontinence Diagnosis SAGA = Self-Assessment Goal Achievement Questionnaire SQoL-F = Sexual Quality of Life - Female SSI and SII = Symptom Severity Index and Symptom Impact Index for Stress Incontinence in women SUIQ = Stress/Urge Incontinence Questionnaire TBS = Treatment Benefit Scale UDI (UDI-6) = Urogenital Distress Inventory (-6) UI-4 = Urinary Incontinence -4 Questionnaire UIHI = Urinary Incontinence Handicap Inventory U-IIQ = Urge Incontinence Impact Questionnaire UIQ = Urinary Incontinence Questionnaire UISS = Urinary Incontinence Severity Score UPScale = Urgency Perception Scale UPScore = Urgency Perception Score UQ = Urgency Questionnaire USIQ-QOL = Urgency Severity & Intensity Questionnaire: Symptom Severity USIQ-S = Urgency Severity & Intensity Questionnaire: Quality of Life USP = Urinary Symptom Profile USS = Urinary Sensation Scale

To date, there is no one questionnaire that fulfills all requirements for assessment of people with UI. The clinician must evaluate the tools that exist to use alone or in combination for assessment, and monitoring of treatment outcome [15].

The questionnaires can be found on the following internet resource sites: www.iciq.net, www.proqolid.org, www.mapi-institute.com, www.pfizerpatientreportedoutcomes.com, www.ncbi.nlm.nih.gov.

Evidence summary	**LE**
Validated condition specific symptom scores assist in the screening for, and categorisation of UI.	3
Validated symptom scores measure the severity of UI.	3
Both condition specific and general health status questionnaires measure current health status, and change following treatment.	3

Recommendation	GR
Use a validated and appropriate questionnaire when standardised assessment is required	B*

** Recommendation based on expert opinion.*

3.3 Voiding diaries

Measurement of the frequency and severity of LUTS is an important step in the evaluation and management of lower urinary tract dysfunction, including UI. Voiding diaries are a semi-objective method of quantifying symptoms, such as frequency of urinary incontinence episodes. They also quantify urodynamic variables, such as voided volume and 24-hour or nocturnal total urine volume. Voiding diaries are also known as micturition time charts, frequency/volume charts and bladder diaries.

Discrepancy between diary recordings and the patient rating of symptoms, e.g. frequency or UI, can be useful in patient counselling. In addition, voided volume measurement can be used to support diagnoses, such as overactive bladder (OAB) or polyuria. Diaries can also be used to monitor treatment response and are widely used in clinical trials. In patients with severe UI, a voiding diary is unlikely to accurately report 24 hour urine output and so voided volume may be lower than total bladder capacity.

3.3.1 Questions

- In adults with UI, what are the reliability, diagnostic accuracy and predictive value of a voiding diary compared to patient history or symptom score?

3.3.2 Evidence

Two recent articles have suggested a consensus has been reached in the terminology used in voiding diaries [16, 17]:

- **Micturition time charts** record only the times of micturitions for a minimum of 24 continuous hours.
- **Frequency volume charts** record voided volumes and times of micturitions for a minimum of 24 hours.
- **Voiding diaries** include information on incontinence episodes, pad usage, fluid intake, degree of urgency and degree of UI.

Several studies have compared patients' preference for, and the accuracy of, electronic and paper voiding diaries in voiding dysfunction [18-22]. Several studies have compared shorter (3 or 5 days) and longer diary durations (7 days) [23-28].

Two studies have demonstrated the reproducibility of voiding diaries in both men and women [23, 28]. Further studies have demonstrated variability of diary data within a 24-hour period and compared voided volumes recorded in diaries with those recorded on uroflowmetry [29, 30]. Other studies have investigated the correlation between data obtained from voiding diaries and standard symptom evaluation [31-34].

Evidence summary	LE
Voiding diaries of 3-7 days duration are a reliable tool for the objective measurement of mean voided volume, daytime and night-time frequency and incontinence episode frequency.	2b
Voiding diaries are sensitive to change and are a reliable measure of outcome.	2b

Recommendations	GR
Ask patients with urinary incontinence to complete a voiding diary to evaluate co-existing storage and voiding dysfunction.	A
Use a diary duration of between 3 and 7 days.	B

3.4 Urinalysis and urinary tract infection

Reagent strip ('dipstick') urinalysis may indicate urinary tract infection (UTI), proteinuria, haematuria or glycosuria requiring further assessment. Refer to the Urological Infections Guideline for diagnosis and treatment of UTI [35].

3.4.1 Questions

- In adults with UI, what is the diagnostic accuracy of urinalysis to detect UTI?
- In adults with UI does treatment of UTI or asymptomatic bacteriuria cure or improve UI compared to no treatment?

3.4.2 ***Evidence***

Urinalysis negative for nitrite and leucocyte esterase has high specificity to exclude UTI in people with UI [36] and despite lower sensitivity should be included, with urine culture when necessary, in the evaluation of all patients with UI. Urinary incontinence may occur during symptomatic UTI [37] and existing UI may worsen during UTI [38]. The rate and severity of UI was unchanged after eradication of asymptomatic bacteriuria in nursing home residents [39].

Evidence summary	**LE**
Urinalysis negative for nitrite and leucocyte esterase reliably excludes UTI.	1
UI may be a symptom during UTI.	3
The presence of a symptomatic UTI worsens symptoms of UI.	3
Elderly nursing home patients with UI do not benefit from treatment of asymptomatic bacteriuria.	2

Recommendations	**GR**
Do urinalysis as a part of the initial assessment of a patient with urinary incontinence.	A*
If a symptomatic urinary tract infection is present with urinary incontinence, reassess the patient after treatment.	A*
Do not routinely treat asymptomatic bacteriuria in elderly patients to improve urinary incontinence.	B

** Recommendation based on expert opinion.*

3.5 Post-voiding residual volume

Post-voiding residual (PVR) volume is the amount of urine that remains in the bladder after voiding. It indicates poor voiding efficiency, which may result from a number of contributing factors. It is important because it may worsen symptoms and, more rarely, may be associated with UTI, upper urinary tract dilatation and renal insufficiency. Both bladder outlet obstruction and detrusor underactivity contribute to the development of PVR. Post-voiding residual can be measured by catheterisation or ultrasound (US). The prevalence of PVR is uncertain, partly because of the lack of a standard definition of an abnormal PVR volume.

3.5.1 ***Question***

In adults with UI, what is the value of measuring PVR?

3.5.2 ***Evidence***

Most studies investigating PVR have not included patients with UI. Although some studies have included women with UI and men and women with LUTS, they have also included children and adults with neurogenic UI. In general, the data on PVR can be applied with caution to adults with non-neurogenic UI. The results of studies investigating the best method of measuring PVR [40-45] have led to the consensus that US measurement of PVR is better than catheterisation.

In peri- and postmenopausal women without significant LUTS or pelvic organ symptoms, 95% of women had a PVR < 100 mL [46]. In women with UUI, a PVR > 100 mL was found in 10% of cases [47]. Other research has found that a high PVR is associated with POP, voiding symptoms and an absence of SUI [46, 48-50].

In women with SUI, the mean PVR was 39 mL measured by catheterisation and 63 mL measured by US, with 16% of women having a PVR > 100 mL [47].

Evidence summary	**LE**
Lower urinary tract symptoms coexisting with UI are associated with a higher rate of post-voiding residual compared to asymptomatic subjects.	2

Recommendations	**GR**
Use ultrasound to measure post-voiding residual.	A
Measure post-voiding residual in patients with urinary incontinence who have voiding symptoms.	B
Measure post-voiding residual when assessing patients with complicated urinary incontinence.	C
Post-voiding residual should be monitored in patients receiving treatments that may cause or worsen voiding dysfunction.	B

3.6 Urodynamics

Urodynamic testing is widely used as an adjunct to clinical diagnosis, in the belief that it may help to provide or confirm diagnosis, predict treatment outcome, or facilitate discussion during a consultation. For all these

reasons, urodynamics is often performed prior to invasive treatment for UI. These Guidelines will focus on invasive tests, including multichannel cystometry, ambulatory monitoring and video-urodynamics, and different tests of urethral function, such as urethral pressure profilometry, Valsalva leak point pressure estimation and retrograde urethral resistance measurement.

3.6.1 ***Question***

In adults with UI, what is the diagnostic accuracy and predictive value of uroflowmetry, i.e. the measurement of maximum urinary flow rate (Q_{max}), and urodynamic testing?

3.6.2 ***Evidence***

3.6.2.1 Variability

In common with most physiological tests there is variability in urodynamics results. Numerous small studies of multichannel cystometry have been done over many years in differing populations. Whilst in healthy women the same session repeatability has been shown to be poor [51], in those with incontinence it may be acceptable [52]. Measurement of urethral closure pressure (MUCP) correlates poorly with incontinence severity [53] and there is conflicting evidence about its reproducibility [54, 55]. One method of recording MUCP cannot be compared meaningfully to another [56].

Abdominal or Valsalva leak point pressures may correlate to incontinence severity [57] but the tests are not standardised and there is no evidence about reproducibility.

No studies on the reliability of ambulatory monitoring were found.

3.6.2.2 Diagnostic accuracy

The diagnostic accuracy of urodynamics is assessed in terms of its correlation with clinical diagnosis and incontinence severity. The problem is that clinical diagnosis and urodynamic findings often do not correlate [58, 59], and normal healthy people may have urodynamic abnormalities.

The diagnostic accuracy of urethral pressure profilmetry [53] and 'Urethral Retro resistance' is generally poor [60]. Urethral reflectometry may have greater diagnostic accuracy but its clinical role remains unclear [61].

Ambulatory urodynamics may detect unexpected physiological variance from normal more often than conventional cystometry, but the clinical relevance of this is uncertain [62, 63].

3.6.2.3 Does urodynamics influence the outcome of conservative therapy

A recent Cochrane review of seven RCTs showed that use of urodynamic tests increased the likelihood of prescribing drugs or avoiding surgery However, there was no evidence that this influence on decision making altered the clinical outcome of treatment [64]. Subanalysis of an RCT comparing fesoterodine to placebo [65] and another dose finding study of botulinum toxin [66] showed no predictive value for treatment response, by the urodynamic diagnosis of DO.

3.6.2.4. Does urodynamics influence the outcome of surgery for stress urinary incontinence?

Post-hoc analysis of surgical RCTs has shown the risk of failure of SUI surgery is higher in women who have worse leakage or urodynamically demonstrable SUI [67].

A high quality RCT (n= 630) compared office evaluation alone to office evaluation and urodynamics in women with clinical demonstrable SUI about to undergo surgery for SUI. Whilst urodynamics changed the clinical diagnosis in 56% of women [68]) there was no difference in levels of UI or any secondary outcome at 12 months' follow-up after surgery [69]. Another similar study was closed with only 59 women [70] after finding no difference in outcome. It was then redesigned to randomise only women (N=109) in whom urodynamic findings were contradictory, to immediate surgery or treatment tailored to urodynamic findings. In this trial, performing immediate surgery irrespective of the result of urodynamics did not result in inferior outcomes [71].

In observational studies there is no consistent correlation between the result of urethral function tests and subsequent success or failure of SUI surgery.

3.6.2.5 Does urodynamics help to predict complications of surgery?

There have been no RCTs designed to answer this question.

The presence of pre-operative DO has consistently been associated with development of postoperative UUI.

Whilst post-hoc analysis of an RCT comparing the autologous fascial sling to Burch colposuspension showed inferior outcomes for women who suffered pre-operative urgency [72]. Pre-operative urodynamics failed to predict this outcome [73].

Whilst low pre-operative flow rate has been shown to correlate with post operative voiding dysfucntion [74, 75], post hoc analysis of two high quality surgical trials showed that no pre-operative urodynamic parameter had the ability to predict post operative voiding dysfunction [76, 77].

3.6.2.6 Does urodynamics influence the outcome of surgery for detrusor-overactivity?

No studies were found on the relationship between urodynamic testing and subsequent surgical outcome for DO. However, most studies reporting surgical outcomes for DO have included only patients with urodynamically proven DO or DO incontinence.

3.6.2.7 Does urodynamics influence the outcome of treatment for post-prostatectomy urinary incontinence in men?

There are no RCTs examining the clinical usefulness of urodynamics in post-prostatectomy UI. Whilst urodynamics will distinguish causes of incontinence, its ability to predict outcome of surgery for incontinence for these men is uncertain [78, 79].

Evidence summary	**LE**
Most urodynamic parameters show variability within the same session and over time, and this limits their clinical usefulness.	3
Different techniques of measuring urethral function may have good test-retest reliability, but do not consistently correlate to other urodynamic tests or to the severity of UI.	3
There is limited evidence that ambulatory urodynamics is more sensitive than conventional urodynamics for diagnosing SUI or DO.	2
There may be inconsistency between history and urodynamic results.	3
Preliminary urodynamics can influence the choice of treatment for UI, but does not affect the outcome of conservative therapy or drug therapy for SUI.	1a
Preliminary urodynamics in women with uncomplicated, clinically demonstrable SUI does not improve the outcome of surgery for SUI.	1b
There is no evidence that urodynamic tests of urethral function predict outcome of surgery for SUI in women.	3
There is consistent low-level evidence that pre-operative DO is associated with poorer outcomes of mid-urethral sling surgery in women.	3
There is no evidence that urodynamics predicts the outcomes of treatment for post prostatectomy incontinence in men.	4

Recommendations	**GR**
(NB: Concerning only neurologically intact adults with urinary incontinence)	
Clinicians carrying out urodynamics in patients with urinary incontinence should: • Ensure that the test replicates the patient's symptoms. • Interpret results in the context of the clinical problem. • Check recordings for quality control. • Remember there may be physiological variability within the same individual.	C
Advise patients that the results of urodynamics may be useful in discussing treatment options, although there is limited evidence that performing urodynamics will predict the outcome of treatment for urinary incontinence.	C
Do not routinely carry out urodynamics when offering conservative treatment for urinary incontinence.	B
Perform urodynamics if the findings may change the choice of invasive treatment.	B
Do not use urethral pressure profilometry or leak point pressure to grade severity of incontinence or predict the outcome of treatment.	C
Urodynamic practitioners should adhere to the standards laid out in the ICS document "Good Urodynamic Practice" [80].	C

3.7 Pad testing

Measurement of urine loss using an absorbent pad worn over a set period of time or during a protocol of physical exercise can be used to quantify the presence and severity of UI, and of response to treatment.

3.7.1 ***Question***

- In adults with UI, what is the reliability, diagnostic accuracy and predictive value of pad testing?
- In adults with UI is one type of pad test better than another?

3.7.2 ***Evidence***

The clinical usefulness of pad tests for people with UI has been assessed in two systematic reviews [81, 82]. A 1-hour pad test using a standardised exercise protocol and a diagnostic threshold of 1.4 g shows good specificity but lower sensitivity for symptoms of SUI and MUI. A 24-hour pad test using a threshold of 4.4 g is more reproducible but is difficult to standardise with variation according to activity level [83]. Pad test with a specific short graded exercise protocol also has diagnostic value but a negative test should be repeated or the degree of provocation increased [84]. The usefulness of pad tests in quantifying severity and predicting outcome of treatment is uncertain [81, 85] although early post-operative testing may predict future continence in men after prostatectomy [86]. Pad test is responsive to change following successful treatment [87]. There is no evidence that one type of pad test is superior to another.

Evidence summary	**LE**
A pad test can diagnose UI accurately.	2
Standardisation of bladder volume and degree of provocation improves reproducibility.	2
24 hours is sufficient duration for home-based testing balancing diagnostic accuracy and adherence.	2
Change in leaked urine volume on pad tests can be used to measure treatment outcome.	2

Recommendations	**GR**
Have a standardised duration and activity protocol for pad test.	B
Use a pad test when quantification of urinary incontinence is required.	C
Use repeat pad test after treatment if an objective outcome measure is required.	C

3.8 Imaging

Imaging improves our understanding of the anatomical and functional abnormalities that may cause UI. In clinical research, imaging is used to understand the relationship between conditions of the central nervous system (CNS) or of the lower urinary tract (LUT) and UI, and to investigate the relationship between lower urinary tract and pelvic floor imaging and treatment outcome.

Ultrasound (US) and magnetic resonance imaging (MRI) have replaced X-ray imaging. Ultrasound is preferred to MRI because of its ability to produce three-dimensional and four-dimensional (dynamic) images at lower cost and wider availability. Studies on LUT imaging in patients with UI often include an evaluation of surgical outcomes, making design and conduct of these trials challenging.

3.8.1 ***Questions***

In adults with UI:

- What is the reliability and accuracy of imaging in the diagnosis of UI?
- Do the results of imaging influence the choice of treatment for UI?
- Do the results of imaging, help predict outcome of treatment for UI?
- Do the results of imaging help evaluate outcome of treatments for UI?

3.8.2 ***Evidence***

Many studies have evaluated the imaging of bladder neck mobility by US and MRI, and concluded that UI cannot be identified by a particular pattern of urethrovesical movements [88]. In addition, the generalised increase in urethral mobility after childbirth does not appear to be associated with de novo SUI [89].

There is a general consensus that MRI provides good global pelvic floor assessment, including POP, defecatory function and integrity of the pelvic floor support [90]. However, there is a large variation in MRI interpretation between observers [91] and little evidence to support its clinical usefulness in the management of UI.

Studies have assessed the use of imaging to assess the mechanism of mid-urethral sling insertion for SUI. One study suggested that mid-urethral sling placement decreased mobility of the mid-urethra but not mobility of the bladder neck [92]. In addition, the position of mid-urethral slings with respect to the pubis has been associated with the cure of UI [93].

Several imaging studies have investigated the relationship between sphincter volume and function in women [94] and between sphincter volume and surgery outcome in men and women [95, 96]. In patients undergoing

radical prostatectomy, longer membranous urethra before and after surgery was associated with higher rate of continence [97]. However, no imaging test has been shown to predict the outcome of treatment for UI. Imaging of the pelvic floor can identify levator ani detachment and hiatus size, although there is little evidence of a relationship to clinical benefit after treatment of treating UI.

Detrusor wall thickness
As overactive bladder syndrome (OAB) has been linked to detrusor overactivity, it has been hypothesised that frequent detrusor contractions may increase detrusor/bladder wall thickness (DWT/BWT). However, there is no evidence if BWT/DWT imaging improves management OAB in real life practice. No consensus exists as to the relation between OAB and increased BWT/DWT [98-102].

Evidence summary	LE
Imaging can reliably be used to measure bladder neck and urethral mobility, although there is no evidence of clinical benefit for patients with UI.	2b
There is no consistent evidence that bladder (detrusor) wall thickness measurement is useful in the management of UI.	3

Recommendation	GR
Do not routinely carry out imaging of the upper or lower urinary tract as part of the assessment of urinary incontinence.	A

4. DISEASE MANAGEMENT

4.1 Conservative management

In clinical practice, it is a convention that non-surgical therapies are tried first because they usually carry the least risk of harm. They are often used in combination which makes it difficult to determine which components are effective. Containment devices play an important role, especially for individuals who prefer to avoid the risks of interventional treatments, or in whom active treatment is impossible for any reason.

*4.1.1 **Simple clinical interventions***

4.1.1.1 Underlying disease/cognitive impairment

Urinary incontinence, especially in the elderly, can be worsened or caused by underlying diseases, especially conditions that cause polyuria, nocturia, increased abdominal pressure or CNS disturbances. These conditions include:

- cardiac failure [103]
- chronic renal failure
- diabetes [103, 104]
- chronic obstructive pulmonary disease [105]
- neurological disease including stroke and multiple sclerosis
- general cognitive impairment
- sleep disturbances, e.g. sleep apnoea
- obesity.

It is possible that correction of the underlying disease may reduce the severity of urinary symptoms. However, this is often difficult to assess as patients often suffer from more than one condition. In addition, interventions may be combined and individualised, making it impossible to decide which alteration in an underlying disease has affected a patient's UI.

4.1.1.1.1 Question

In adults with UI, does correcting an underlying disease or cognitive impairment improve UI compared to no correction of underlying disease?

4.1.1.1.2 Evidence

One study showed no correlation between earlier intensive treatment of type 1 diabetes mellitus and the prevalence of UI in later life versus conventional treatment [106].

Evidence summary	LE
Improved diabetic control does not improve UI.	3

4.1.1.2 Adjustment of medication

Although UI is listed as an adverse effect of many drugs in drug compendia, this mainly results from uncontrolled individual patient reports and post-marketing surveillance. Few controlled studies have used the occurrence of UI as a primary outcome or were powered to assess the occurrence of statistically significant UI or worsening rates against placebo. In most cases, it is therefore not possible to be sure that a drug causes UI.

In patients with existing UI, particularly the elderly, it may be difficult or impossible to distinguish between the effects of medication, comorbidity or ageing on UI.

Although changing drug regimens for underlying disease may be considered as a possible early intervention for UI, there is very little evidence of benefit [58]. There is also a risk that stopping or altering medication may result in more harm than benefit.

4.1.1.2.1 Question

In adults with UI, does adjustment of medication improve UI compared to no change in treatment?

4.1.1.2.2 Evidence

Oestrogenic drugs including conjugated equine oestrogens, oestradiol, tibolone and raloxifene, are used as hormone replacement therapy (HRT) for women with natural or therapeutic menopause. Studies of HRT with nonurogenital primary outcomes have looked for change in urinary continence in secondary analyses. Large trials using conjugated equine oestrogens showed a higher rate of development or worsening of UI compared to placebo [107-110]. In a single RCT use of raloxifene was not associated with development or worsening of UI [111]. Three small RCTs using oral oestriol or oestradiol as HRT for vulvovaginal atrophy suggested that UI symptoms were improved although the evidence was unclear [58, 112, 113].

Evidence summary	LE
There is very little evidence that alteration of medication can cure or improve sumptoms of urinary incontinence.	3
Systemic hormone replacement therapy using conjugate equine estrogens in previously continent women increases the risk of developing UI and worsens pre-existing UI.	1a

Recommendations	GR
Take a drug history from all patients with urinary incontinence.	A
For women taking oral conjugated equine oestrogen as hormone replacement therapy who develop or worsen UI, suggest discussion of alternative hormone replacement therapies with the relevant clinician.	A
Advise women who are taking systemic oestradiol who suffer from UI, that stopping the oestradiol is unlikely to improve their incontinence.	A
Review any new medication associated with the development or worsening of urinary incontinence.	C

4.1.1.3 Constipation

Several studies have shown strong associations between constipation, UI and OAB. Constipation can be improved by behavioural, physical and medical treatments.

4.1.1.3.1 Question

Does treatment for constipation improve UI?

4.1.1.3.2 Evidence

One RCT found that a multimodal intervention in elderly patients, involving assisted toileting, fluid intake, etc, reduced the occurrence of UI and constipation, while behavioural therapy appeared to improve both [114].
An observational study comparing women with UI and women with pelvic organ prolapse (POP) to controls found that a history of constipation was associated with both prolapse and UI [115]. Two, large, cross-sectional population-based studies [116, 117] and two longitudinal studies [118, 119] showed that constipation was a risk factor for LUTS.

In conclusion, constipation appears to be associated with UI. However, there is no evidence to show whether or not treating constipation improves UI, although both constipation and UI appear to be improved by certain behavioural interventions.

Evidence summary	LE
There is a consistent association between a history of constipation and the development of UI and pelvic organ prolapse.	3
There is no evidence that treatment of constipation improves UI.	4
Multimodal behavioural therapy improves both constipation and UI in the elderly.	1b

Recommendation	GR
Adults with urinary incontinence who also suffer from constipation should be given advice about bowel management in line with good medical practice.	C

4.1.1.4 Containment

Containment is important for people with UI when active treatment does not cure the problem, or when it is not available or not possible. Some individuals may prefer to choose containment rather than undergo active treatment with its associated risks. This includes the use of absorbent pads, urinary catheters, external collection devices and penile clamps for men; and intravaginal devices for women. Studies of catheter use are not specific to patients with non-neurogenic UI. Detailed literature summaries can be found in the current ICUD monograph [1] and in European Association of Urological Nurses guidance documents [120-122]. A useful resource for health care professionals and patients can be found at:
http://www.continenceproductadvisor.org/.org

4.1.1.4.1 Question

For adults with UI, is one type of containment device better than another?

4.1.1.4.2 Evidence

One RCT involving elderly women in care comparing management with pads to indwelling urethral catheter found no difference in dependency level or skin integrity score at six months [123]. Use of an external sheath was compared with indwelling catheterisation over 30 days in an RCT involving elderly men resident in hospital [124]. There were no differences in bacteriuria or symptomatic UTI but the sheath was more comfortable. A short-term crossover RCT in men with UI found that disease specific QoL was better when using an external sheath and more men preferred it, compared to pads [125].

4.1.1.4.3 Question

For men or women with UI is one type of pad better than another?

4.1.1.4.4 Evidence

A systematic review of six RCTs comparing different types of pads found that pads filled with superabsorbent material were better than standard pads, whilst evidence that disposable pads were better than washable pads was inconsistent [126]. For men with light UI a randomised crossover trial found that a leaf-shaped type of pad was preferred to rectangular pads [127]. A series of three crossover RCTs examined performance of different pad designs for differing populations [128]. For women with light UI, disposable insert pads were most effective. In adults with moderate/severe incontinence, disposable pull-up pants were more effective for women, whilst for men disposable diapers were more effective during the day and washable diapers at night.

4.1.1.4.5 Question

For men or women with UI is one type of catheter or external collection device better than another?

4.1.1.4.6 Evidence

A Cochrane review summarised three RCTs comparing different types of long-term indwelling catheters and found no evidence that one catheter material or type of catheter was superior to another [129]. A systematic review of non-randomised studies found no differences in any UTI outcome or for upper urinary tract changes between use of suprapubic or urethral catheter drainage, but patients with suprapubic catheters were less likely to have urethral complications [130]. For people using intermittent catheterisation, a Cochrane review found no evidence that one type of catheter or regimen of catheterisation was better than another [131]. A Cochrane review summarising five trials comparing washout policies in adults with indwelling urinary catheters found inconsistent evidence of benefit [132].

A further Cochrane review summarising eight trials testing whether antibiotic prophylaxis was beneficial for adults using intermittent or indwelling catheterisation found it reduced incidence of symptomatic UTI but possible harms were not assessed [133].

A randomised crossover study comparing six different brands of sheath devices found that men preferred sheaths [134].

4.1.1.4.7 Question
For men and women with UI are external pressure devices more effective than standard treatment and is one device better than another?

4.1.1.4.8 Evidence
A crossover RCT in men with post-prostatectomy incontinence found a hinge-type penile clamp to be more effective than circular clamps for control of UI and was preferred by participants although it reduced penile blood flow [135].

A Cochrane review summarised seven trials comparing mechanical devices in women with UI finding limited evidence that SUI was reduced by intravaginal devices, no evidence on the effectiveness of intraurethral devices and that there was no difference in control of UI between intravaginal and intraurethral devices [136]. There was no difference in outcome at 12 months in women with SUI between vaginal pessary alone; PFMT alone; and vaginal pessary + PFMT though vaginal pessary was inferior to PFMT at three months for bother from UI.

Evidence summary	**LE**
Pads with greater absorbency are more effective.	1b
Hinge-type penile clamps control SUI in men.	2a
Vaginal devices control SUI in women.	2a
Vaginal devices are no better than PFMT for women with SUI.	2a
A sheath-type external collection device for men is better than pads for improvement in incontinence related QoL.	2a

Recommendations	**GR**
Ensure that adults with UI and/or their carers are informed regarding available treatment options before deciding on containment alone.	A*
Suggest use of disposable insert pads for women and men with light urinary incontinence.	A*
In collaboration with other healthcare professionals with expertise in UI help adults with moderate/severe urinary incontinence to select the individually best containment regimen considering pads, external devices and catheters, and balancing benefits and harms.	A*
Choice of pad from the wide variety of different absorbent materials and designs available should be made with consideration of the individual patient's circumstance, degree of incontinence and preference.	B

** Based on expert opinion.*

*4.1.2 **Lifestyle interventions***
Examples of lifestyle factors that may be associated with incontinence include obesity, smoking, level of physical activity and diet. Modification of these factors may improve UI.

4.1.2.1 Caffeine reduction
Many drinks contain caffeine, particularly tea, coffee and cola. Anecdotal evidence of urinary symptoms being aggravated by excessive caffeine intake has focused attention on whether caffeine reduction may improve UI. However, a cross-sectional population survey found no statistical association between caffeine intake and UI [137]. Lack of knowledge about caffeine content of different drinks has made the role of caffeine reduction in alleviating UI difficult to assess.

4.1.2.1.1 Question
In adults with UI, does caffeine reduction improve UI or QoL compared to no caffeine reduction?

4.1.2.1.2 Evidence
Four studies were found on the effect of caffeine reduction on UI [138-141]. They were of moderate quality and the results were inconsistent. The studies were mainly in women, so results can only be cautiously generalised

to men [139, 140]. One RCT showed that reducing caffeine intake as an adjunct to behavioural therapy resulted in reduced urgency but not reduced UI compared to behavioural therapy alone [139]. Another RCT found that reducing caffeine had no benefit for UI [140]. A further interventional study in the elderly showed borderline significance for the benefit of reducing caffeine intake on UI [141]. In a large prospective cohort study there was no evidence that caffeine reduction reduced the risk of progression of UI over 2 years [142].

Evidence summary	LE
Reduction of caffeine intake does not improve UI.	2
Reduction in caffeine intake may improve symptoms of urgency and frequency.	2

4.1.2.2 Physical exercise

Regular physical activity may strengthen the pelvic floor musculature and possibly decrease the risk of developing UI, especially SUI. However, it is also possible that heavy physical exercise may aggravate UI.

4.1.2.2.1 Question

Does physical exercise cause, improve or exacerbate UI in adults?

4.1.2.2.2 Evidence

The association between exercise and UI is unclear. Four studies [137, 143-145] in differing populations concluded that strenuous physical exercise increases the risk of SUI during periods of physical activity. There is also consistent evidence that physically active females and elite athletes experience higher levels of SUI than control populations [146-151]. On the other hand, the presence of UI may prevent women from taking exercise [152]. There is no evidence that strenuous exercise predisposes athletes to the development of SUI later in life [153]. Lower levels of UI have been observed in cohorts of women who undertake moderate exercise, but it remains unclear whether taking exercise can prevent development of UI [154, 155].

The elderly

Three RCTs in the elderly confirmed that exercise, as a component of a multidimensional regime including PFMT and weight loss, was effective in improving UI in women. It is not clear which component of such a scheme is most important [114, 156, 157].

Evidence summary	LE
Female athletes may experience UI during intense physical activity but not during common activities.	3
Strenuous physical activity does not predispose to UI for women later in life.	3
Moderate exercise is associated with lower rates of UI in middle-aged or older women.	2b

4.1.2.3 Fluid intake

Modification of fluid intake, particularly restriction, is a strategy commonly used by people with UI to relieve symptoms. Advice on fluid intake given by healthcare professionals should be based on 24-hour fluid intake and urine output measurements. Form a general health point of view it should be advised that fluid intake should be sufficient to avoid thirst and that low or high 24-hour urine output should be investigated.

4.1.2.3.1 Question

In adults with UI, what is the effect of modifying fluid intake compared to not modifying fluid intake on symptoms and QoL?

4.1.2.3.2 Evidence

The few RCTs [140, 158, 159] provide inconsistent evidence. In most studies, the instructions for fluid intake were individualised and it is difficult to assess participant adherence to protocol. All available studies were in women.

A recent RCT [159] showed that a reduction in fluid intake by 25% improved symptoms in patients with OAB but not UI. Personalised fluid advice compared to generic advice made no difference to continence outcomes in people receiving antimuscarinics for OAB, according to an RCT comparing drug therapy alone to drug therapy with behavioural advice [160].

Evidence summary	LE
There is conflicting evidence on whether fluid modification changes symptoms of UI and QoL.	2

4.1.2.4 Obesity and weight loss

Obesity has been identified as a risk factor for UI in many epidemiological studies [137, 161]. There is evidence that the prevalence of both UUI and SUI increases proportionately with rising body mass index. The proportion of patients who undergo surgery for incontinence who are overweight or obese is higher than that of the general population.

4.1.2.4.1 Question

In adults with UI, does weight loss lead to an improvement in symptoms of UI or QoL?

4.1.2.4.2 Evidence

All the available evidence relates to women. The prevalence of UI in overweight individuals is well established [137, 161]. Obesity appears to confer a four-fold increased risk of UI [162].

Two systematic reviews plus 1 large RCT concluded that weight loss was beneficial in improving symptoms of UI [163-165]. Five further RCTs reported a similar beneficial effect on incontinence following surgical weight reduction programmes [166-170].

Two large studies in women with diabetes, for whom weight loss was the main lifestyle intervention showed UI did not improve but there was a lower subsequent incidence of UI among those who lost weight [166, 171]. There have been other cohort studies and case-control studies suggesting similar effects, including surgery for the morbidly obese [106, 165, 172-177]. For example, in a longitudinal cohort study, a weight loss of 5-10% was associated with a significant reduction in UI measured by pad test [178].

Evidence summary	**LE**
Obesity is a risk factor for UI in women.	1b
Weight loss (> 5%) in obese women improves UI.	1b
Weight loss in obese adults with diabetes mellitus reduces the risk of developing UI.	1b

4.1.2.5 Smoking

Smoking cessation is now a generalised public health measure. Smoking, especially if > 20 cigarettes per day, is considered to intensify UI.

4.1.2.5.1 Question

In adults with UI, does smoking cessation improve patient outcomes regarding either urinary symptoms or QoL compared to continued smoking?

4.1.2.5.2 Evidence

The effect of smoking cessation on UI was described as uncertain in a Cochrane review [164].

Evidence summary	**LE**
There is no evidence that smoking cessation will improve the symptoms of UI.	4

4.1.2.6 Recommendations for lifestyle interventions

Recommendations	**GR**
Encourage obese women suffering from any urinary incontinence to lose weight (> 5%).	A
Advise adults with urinary incontinence that reducing caffeine intake may improve symptoms of urgency and frequency but not incontinence.	B
Patients with abnormally high or abnormally low fluid intake should be advised to modify their fluid intake appropriately.	C
Counsel female athletes experiencing urinary incontinence with intense physical activity that it will not predispose to urinary incontinence in later life.	C
Patients with urinary incontinence who smoke should be given smoking cessation advice in line with good medical practice.	A

4.1.3 ***Behavioural and Physical therapies***

Terminology relating to behavioural and physical therapies remains confusing because of the wide variety of ways in which treatment regimes and combinations of treatments have been delivered in different studies [179]. The terms are used here to encompass all those treatments which require a form of self-motivated personal

retraining by the patient and also includes those techniques which are used to augment this effect.

Approaches include bladder training (BT) and pelvic floor muscle training (PFMT), but terms such as bladder drill, bladder discipline and bladder re-education and behaviour modification are also used. Almost always in clinical practice, these will be introduced as part of a package of care including lifestyle changes, patient education and possibly some cognitive therapy as well. The extent to which individual therapists motivate, supervise and monitor these interventions is likely to vary but it is recognised that these influences are important components of the whole treatment package.

4.1.3.1 Bladder Training

Patients may be asked to void according to a fixed voiding schedule. Alternatively, patients may be encouraged to follow a schedule established by their own bladder diary/voiding chart (habit training). 'Timed voiding' is voiding initiated by the patient, while 'prompted voiding' is voiding initiated by the caregiver. Timed and habit voiding are recommended to patients who can void independently. Bladder training can be offered to any patient with any form of UI, as a first-line therapy for at least a short period of time. The ideal form or intensity of a BT programme for UI is unclear. It is also unclear whether or not BT can prevent the development of UI.

4.1.3.1.1 Questions

In adults with UI:

- Is BT better than no treatment for cure or improvement of UI?
- Is BT better than other conservative treatments for cure or improvement of UI?
- Does BT as an adjunct to other conservative treatments cure or improve UI?
- Are the benefits of BT durable in the longer term?
- Are there any patient groups for whom BT is more effective?

4.1.3.1.2 Evidence

There have been three systematic reviews on the effect of BT compared to standard care [58, 164, 180] confirming that BT is more effective than no treatment in improving UI. The addition of BT to anticholinergic therapy seems to confer no addional effect apart from the reduction of frequency and nocturia.

BT alone is inferior to a high-intensity programme of PFMT to improve SUI in elderly women [181]. Bladder training is better than intravaginal pessaries to control SUI, although the improvement may only be short-term.

Whatever the method of training used, any benefit of BT on UI is likely to be of short duration unless the BT programme is practised repeatedly. No adverse events have been reported with BT. Biofeedback combined with BT increased continence rates and improved MUI in two RCTs [180].

Evidence summary	**LE**
Behavioural interventions are effective for improvement of UI in women.	1b
The effectiveness of bladder training diminishes after the treatment has ceased.	2
The comparative benefit of bladder training and drugs for the improvement of UUI remains uncertain.	2
The combination of bladder training with antimuscarinic drugs does not result in greater improvement of UI but may have other benefits.	1b
Bladder training is better than pessary alone.	1b

For recommendations see section 4.1.3.5.

4.1.3.2 Pelvic floor muscle training (PFMT)

Pelvic floor muscle training is used to improve function of the pelvic floor, improving urethral stability. There is some evidence that improving pelvic floor function may inhibit bladder contraction in patients with OAB [182].

PFMT may be used to prevent UI, e.g. in childbearing women before birth, in men about to undergo radical prostatectomy, or as part of a planned recovery programme after childbirth or surgery. Most often, PFMT is used to treat existing UI, and may be augmented with biofeedback (using visual, tactile or auditory stimuli), surface electrical stimulation or vaginal cones.

4.1.3.2.1 Question

In adult men and women suffering from UI, does treatment with PFMT (given either alone or augmented with biofeedback, electrical stimulation or vaginal cones) improve or cure UI or improve QoL, compared to no treatment, sham treatment or other conservative treatments, e.g. bladder training, electrical stimulation or vaginal cones?

4.1.3.2.2 Evidence

In a recent UK Health Technology Appraisal (HTA), the role of PFMT in the care of women with SUI was analysed in direct comparisons of treatments and a mixed treatment comparison model, which compared different 'packages' of care [164]. This extensive meta-analysis reviewed data from 37 interventions and 68 direct comparisons, while the mixed treatment comparisons examined combinations of 14 different types of intervention from 55 separate trials. The mixed treatment comparison used both indirect and direct comparisons and may provide more accurate estimates of effect. Where relevant, the Technology Appraisal has influenced the evidence and recommendations in these Guidelines. The Agency for Healthcare Research and Quality (AHRQ) review of nonsurgical treatment of UI in adult women also included indirect comparison methods as well as conventional meta-analysis [180].

4.1.3.2.3 Efficacy of PFMT in SUI, UUI and MUI in women

This question has been addressed by several systematic reviews [164, 180, 183], all report inconsistency between studies because of poor reporting of technique and different outcome measures. Meta-analysis showed that PFMT was effective for cure or improvement of incontinence, and improvement in QoL. The effect applies in women with SUI, UUI and MUI though the effect in MUI is lower than in women with pure SUI. A Cochrane review comparing different approaches to delivery of PFMT(21 RCTs) concluded that increased intensity of delivery of the therapy improves response and that there is no consistent difference between group therapy and individualised treatment sessions [184]. No other consistent differences between techniques were found.

With regard to the durability of PFMT, another RCT reported 15-year follow-up outcomes of an earlier RCT, showing that long-term adherence to treatment was poor and half of patients had progressed to surgery [185].

Numerous systematic reviews have addressed the question of whether the effects of PFMT and BT are additive [164, 180, 186]. These reviews are confounded by differences in patient selection and have arrived at conflicting conclusions leaving uncertainty about the extent to which one treatment may augment the other. Similarly, there remains uncertainty about the additional value of biofeedback with systematic reviews reaching differing conclusions [180, 186].

Comparison of PFMT to other treatments was extensively reviewed by both AHRQ and the 2010 UK HTA [164, 180], which considered additional non-randomised data as part of a mixed treatment comparison. The UK HTA resulted in a number of different findings from those based solely on direct comparisons. In conclusion, the HTA, using a revised methodology, supported the general principle that greater efficacy was achieved by adding together different types of treatment and by increasing intensity.

4.1.3.2.4 PFMT in the elderly

The effect of PFMT in women with SUI does not seem to decrease with increased age: in trials with older women with SUI it appeared both primary and secondary outcome measures were comparable to those in trials focused on younger women [156, 181, 187].

4.1.3.2.5 PFMT and Radical prostatectomy

A Cochrane review concluded that there was no benefit at 12 months post-surgery for men who received postoperative PFMT for the treatment of post-prostatectomy urinary incontinence (PPI) and that the benefits of conservative treatment of PPI remain uncertain [188]. There have been further RCTs which leave uncertainty about whether or not PFMT leads to earlier recovery of continence [189-193]. Two additional RCTs have shown that written instructions alone offer similar levels of improvement to supervised PFMT [194, 195]. One RCT found that PFMT was helpful in men who had been incontinent for at least one year after prostatectomy, and who had had no previous therapy [196].

Evidence summary	LE
PFMT for Women with UI	
PFMT is better than no treatment for improving UI and QoL in women with SUI and MUI.	1
Higher-intensity, supervised treatment regimes, and the addition of biofeedback, confer greater benefit in women receiving PFMT.	1
Short-term benefits of intensive PFMT are not maintained at 15-year follow-up.	2
PFMT for post-prostatectomy UI	**LE**
PFMT does not cure UI in men post-prostatectomy.	1b
There is conflicting evidence as to whether PFMT speeds the recovery of continence following radical prostatectomy.	1b
There is conflicting evidence on whether the addition of bladder training, electrical stimulation or biofeedback increases the effectiveness of PFMT alone.	2
There is no evidence that pre-operative PFMT prevents UI following radical prostatectomy though it may lead to earlier recovery of continence.	2

For recommendations see section 4.1.3.5.

4.1.3.3 Prompted voiding

The term prompted voiding implies that carers, rather than the patient, initiate the decision to void and this applies largely to an assisted care setting.

Prompted voiding is the giving of positive reinforcement for requesting toileting assistance, either spontaneously or following verbal prompts from a caregiver. Two systematic reviews (9 RCTs) [197, 198]. Confirmed a positive effect on continence outcomes of prompted voiding in comparison to standard care [198].

Timed voiding is defined as fixed, pre-determined, time intervals between toileting, applicable for those withor without cognitive impairment. A Cochrane review of timed voiding reviewed two RCTs finding inconsistent improvement in continence compared with standard care in cognitively impaired adults [199].

Evidence summary	LE
Prompted voiding, either alone or as part of a behavioural modification programme, improves continence in elderly, care-dependent people.	1b

For recommendations see section 4.1.3.5.

4.1.3.3.1 Electrical stimulation

The details and methods of delivery of electrical stimulation vary considerably.

Electrical stimulation (ES) can also be combined with other forms of conservative therapy, e.g. PFMT and biofeedback. Electrical stimulation is often used to assist women who cannot initiate contractions to identify their pelvic floor muscles. Electrical stimulation is also used in patients with OAB and UUI, for detrusor inhibition. It has been suggested that ES probably targets the pelvic floor directly in SUI and the detrusor muscle or pelvic floor muscle or afferent innervation in UUI.

4.1.3.3.2 Question

In adults with UI, does treatment with ES improve or cure symptoms of UI or QoL compared to no treatment or sham treatment?

4.1.3.3.3 Evidence

Most evidence on ES refers to women with SUI. The topic has been included in two health technology appraisals [164, 180] and three systematic reviews [58, 200, 201].

The reviews include analysis of 15 trials and use different comparison methods, but conflict in their assessment of whether ES is more effective than sham stimulation and whether ES adds to the benefit of PFMT alone. Studies were considered to be of generally low quality, with a variety of stimulation parameters, treatment regimens and outcome parameters.

A systematic review reported two RCTs in which ES had been compared to oxybutynin in patients with UUI, showing similar efficacy [202].

A Cochrane review of ES in men with UI (6 RCTs) concluded that, in the short-term, there was limited evidence

of ES augmenting effectiveness of PFMT and there was better improvement of incontinence than with sham stimulation [203].

Electromagnetic stimulation has been promoted as an alternative to electrical stimulation but no evidence of effectiveness was found [204].

Evidence summary	LE
In adults with UI, there is inconsistent evidence whether ES is effective in improving UI compared to sham treatment or adds any benefit to PFMT.	1
The comparative benefit of electrical stimulation and antimuscarinic drugs, for improvement of patients with UUI, remains uncertain.	1

For recommendations see section 4.1.3.5.

4.1.3.4 Posterior tibial nerve stimulation

Electrical stimulation of the posterior tibial nerve (PTNS) delivers electrical stimuli to the sacral micturition centre via the S2-S4 sacral nerve plexus. Stimulation is done percutaneously with a fine, 34-G, needle, inserted just above the medial aspect of the ankle (P-PTNS). Transcutaneous stimulation is also available (T-PTNS). Treatment cycles typically consist of 12 weekly treatments of 30 minutes.

4.1.3.4.1 Question

In adults suffering from UUI, what is the clinical effectiveness of PTNS compared to sham treatment or alternative treatment such as antimuscarinic drugs?

4.1.3.4.2 Evidence

P-PTNS

The reviewed studies included two RCTs of PTNS against sham treatment [205, 206] and one comparing PTNS to tolterodine in patients with UUI [207] The results of studies of PTNS in women with refractory UUI are consistent. Considered together, these results suggest that PTNS improves UUI in women who have had no benefit from antimuscarinic therapy or who are not able to tolerate these drugs. However, there is no evidence that PTNS cures UUI in women. In addition, PTNS is no more effective than tolterodine for improvement of UUI in women. In men there is insufficient evidence to make a conclusion about efficacy.

In patients who initially respond to PTNS, the improvement is maintained in some patients at 2 years with continued treatment (approximately monthly) [208].

T-PTNS

A small RCT compared transcutaneous PTNS plus standard treatment (PFMT and BT) with PFMT and BT alone in older women [209]. Women in the T-TPNS group were more likely to achieve Improvement at the end of therapy.

Evidence summary	LE
P-PTNS appears effective for improvement of UUI, in women who have had no benefit from antimuscarinic medication.	2b
P-PTNS is no more effective than tolterodine for improvement of UUI in women.	1b
No serious adverse events have been reported for P-PTNS in UUI.	3
There is limited evidence for effectiveness of T-PTNS.	2a

4.1.3.5 *Recommendations for behavioural and physical therapies*

Recommendations	GR
Offer supervised intensive PFMT, lasting at least 3 months, as a first-line therapy to women with stress urinary incontinence or mixed urinary incontinence.	A
PFMT programmes should be as intensive as possible.	A
Offer PFMT to elderly women with urinary incontinence.	B
Consider using biofeedback as an adjunct in women with stress urinary incontinence.	A
Offer instruction on PFMT to men undergoing radical prostatectomy to speed recovery of incontinence.	B
Offer bladder training as a first-line therapy to adults with urgency urinary incontinence or mixed urinary incontinence.	A
Us a trial of prompted voiding for adults with incontinence, who are cognitively impaired.	A
Do not offer electrical stimulation with surface electrodes (skin, vaginal, anal) alone for the treatment of stress urinary incontinence.	A
Consider offering electrical stimulation as an adjunct to behavioural therapy in patients with urgency Urinary incontinence.	B
Do not offer magnetic stimulation for the treatment of incontinence or overactive bladder in adult women.	B
Do not offer PTNS to women or men who are seeking a cure for urgency urinary incontinence.	A
Offer, if available, P-PTNS as an option for improvement of urgency urinary incontinence in women who have not benefitted from antimuscarinic medication.	B
Support other healthcare professionals in use of rehabilitation programmes including prompted voiding for care of elderly care-dependent people with urinary incontinence.	A

PFMT = pelvic floor muscle training; P-PTNS = percutaneous posterior tibial nerve stimulation; T-PTNS = transcutaneous posterior tibial nerve stimulation.

4.1.4 ***Conservative therapy in mixed urinary incontinence***

About one-third of women with UI have mixed urinary incontinence (MUI) with symptoms of both stress UI (SUI) and urgency UI (UUI), and this becomes more common with increasing age. In terms of evidence base, many studies include patients with MUI, but it is rare for these studies to provide a separate analysis of patients with MUI.

4.1.4.1 *Question*

In adults with MUI, is the outcome of conservative therapy different to that obtained with the same treatment in patients with either pure SUI or pure UUI?

4.1.4.2 *Evidence*

No specific systematic reviews were found that addressed the above question. However, a Cochrane report on pelvic floor muscle training (PFMT) [183] concluded that training was less likely to result in a cure in patients with MUI than in patients with pure SUI, though it is not clear from the report how this conclusion was reached.

A small RCT (n = 71) compared delivery of PFMT, with or without an instructive audiotape. It showed equal efficacy for different types of UI [210].

Following a RCT of PFMT, a review of 88 women available for follow-up at 5 years found that outcomes were less satisfactory in women with MUI than in women with pure SUI [211].

Evidence summary	LE
Pelvic floor muscle training appears less effective for MUI than for SUI alone.	2
Electrical stimulation is equally effective for MUI and SUI.	1b

4.1.4.3 *Recommendations conservative therapy in mixed urinary incontinence*

Recommendations	GR
Treat the most bothersome symptom first in patients with mixed urinary incontinence.	C
Warn patients with mixed urinary incontinence that the chance of success of pelvic floor muscle training is lower than for stress urinary incontinence alone.	B

4.2 Pharmacological management

4.2.1 ***Antimuscarinic drugs***

Antimuscarinic (anticholinergic) drugs are currently the mainstay of treatment for UUI. They differ in their pharmacological profiles, e.g. muscarinic receptor affinity and other modes of action, in their pharmacokinetic properties, e.g. lipid solubility and half-life, and in their formulation.

The evaluation of cure or improvement of UI is made harder by the lack of a standard definition of improvement and the failure to use cure as a primary outcome. In general, systematic reviews note that the overall treatment effect of drugs is usually small but larger than placebo. Dry mouth is the commonest side effect, though constipation, blurred vision, fatigue and cognitive dysfunction may occur.

The immediate release (IR) formulation of oxybutynin is the prototype drug in the treatment of UUI. Oxybutynin IR provides maximum dosage flexibility, including an off-label 'on-demand' use. Immediate-release drugs have a greater risk of side effects than extended release (ER) formulations because of differing pharmacokinetics. A transdermal delivery system (TDS) and gel developed for oxybutynin gives a further alternative formulation.

4.2.1.1 Question

In adults with UUI, are antimuscarinic drugs better than placebo for improvement or cure of UUI and for the risk of adverse effects?

4.2.1.2 Evidence

Five systematic reviews of individual antimuscarinic drugs versus placebo were reviewed for this section [180, 212-215] as well as studies published since these reviews up until September 2013. Most studies included patients with a mean age of 55-60 years. Both female and male subjects were included in different studies but results cannot be generalised across sexes. Only short-term rates for improvement or cure of UUI are reported. The evidence reviewed was consistent, indicating that ER and IR formulations of antimuscarinics offer clinically significant short-term cure and improvement rates for UUI compared to placebo.

Cure of UI was deemed to be the most important outcome measure. Risk of adverse events was best represented by withdrawal from a trial because of adverse events although this does not reflects real life practice. Table 4 shows a summary of the findings from the most recent systematic review [180]. In summary, every drug where cure of UI was available shows superiority compared to placebo in achieving UI, but the absolute size of effect is small.

Table 4. Summary of cure rates and discontinuation rates of antimuscarinic drugs from RCTs which reported these outcomes [180]

Drug	No. of Studies	Patients	Relative risk (95% CI) (of curing UI)	Number needed to treat (95% CI) (to achieve one cure of UI)
Cure of incontinence				
Fesoterodine	2	2465	1.3 (1.1-1.5)	8 (5-17)
Oxybutynin (includes IR)	4	992	1.7 (1.3-2.1)	9 (6-16)
Propiverine (includes IR)	2	691	1.4 (1.2-1.7)	6 (4-12)
Solifenacin	5	6304	1.5 (1.4-1.6)	9 (6-17)
Tolterodine (includes IR)	4	3404	1.2 (1.1-1.4)	12 (8-25)
Trospium (includes IR)	4	2677	1.7 (1.5-2.0)	9 (7-12)
Discontinuation due to adverse events				
			Relative Risk (95% CI) (of discontinuation)	**NNT (95% CI) (of one discontinuation)**
Darifenacin	7	3138	1.2 (0.8-1.8)	
Fesoterodine	4	4433	2.0 (1.3-3.1)	33 (18-102)
Oxybutynin (includes IR)	5	1483	1.7 (1.1-2.5)	16 (8-86)
Propiverine (includes IR)	2	1401	2.6 (1.4-5)	29 (16-27)
Solifenacin	7	9080	1.3 (1.1-1.7)	78 (39-823)
Tolterodine (includes IR)	10	4466	1.0 (0.6-1.7)	
Trospium (includes IR)	6	3936	1.5 (1.1-1.9)	56 (30-228)

Darifenacin
The cure rates for darifenacin were not included in the AHRQ review. Continence rates were 29-33% for darifenacin compared to 17-18% for placebo [180].

Transcutaneous oxybutynin
Transdermal oxybutynin has shown a significant improvement in the number of incontinence episodes and micturitions per day versus placebo and other oral formulations but incontinence was not reported as an outcome [180].

Oxybutynin topical gel was superior to placebo for improvement of UUI with a higher proportion of participants being cured [180].

Evidence summary	LE
All formulations of Fesoterodine, Oxybutynin, Propiverine, Solifenacin, Tolterodine, Darifenacin and Trospium, provide a significantly better rate of cure or improvement of UUI compared to placebo.	1a
All formulations of Fesoterodine, Oxybutynin, Propiverine, Solifenacin, Tolterodine, Darifenacin and Trospium, result in higher rates of dry mouth compared to placebo.	1b

*4.2.2 **Comparison of antimuscarinic agents***
Head-to-head comparison trials of the efficacy and side effects of different antimuscarinic agents are of interest for decision making in real life practice.

4.2.2.1 Question
In adults with UUI, does one type of antimuscarinic drug result in a greater likelihood of cure or improvement in UUI, and/or a greater improvement in QoL, and/or a lesser likelihood of adverse effects compared to an alternative antimuscarinic drug?

4.2.2.2 Evidence
There are over 40 RCTs and five systematic reviews [180, 202, 212, 214, 216]. Nearly all the primary studies were industry sponsored. Upward dose titration is often included in the protocol for the experimental arm, but not for the comparator arm.

In general, these studies have been designed for regulatory approval. They have short treatment durations (12 weeks) and a primary outcome of a change in OAB symptoms rather than a cure of, or an improvement in, UUI, which were generally analysed as secondary outcomes. The clinical utility of these trials in real life practice in questionable. Most trials were of low or moderate quality [214].

The 2012 AHRQ review included a specific section addressing comparisons of antimuscarinic drugs (Table 5).

Table 5: Comparison of antimuscarinic drugs as reviewed in the 2012 AHRQ review [180]

Experimental drug versus standard drug	No. of studies	Patients	Relative risk (95% CI) of curing UI
Efficacy			
Fesoterodine vs. tolterodine ER (continence)	2	3312	1.1 (1.04-1.16)
Oxybutynin ER vs. tolterodine ER (improvement)	3	947	1.11 (0.94-1.31)
Solifenacin vs. tolterodine ER	1	1177	1.2 (1.08-1.34)
Trospium vs. oxybutynin	1	357	1.1 (1.04-1.16)
Discontinuation due to adverse events			
			RR – 95% CI of discontinuation
Solifenacin vs. tolterodine ER	3	2755	1.28 (0.86-1.91)
Trospium vs. oxybutynin	2	2015	0.75 (0.52 -1.1)
Fesoterodine vs. tolterodine	4	4440	1.54 (1.21-1.97)

No antimuscarinic agent improved QoL more than another agent [214]. Dry mouth is the most prevalent adverse effect. Good evidence indicates that, in general, higher doses of any drug are likely to be associated

with higher rates of adverse events. Also, ER formulations of short-acting drugs, and longer-acting drugs are generally associated with lower rates of dry mouth than IR preparations [214, 216]. Oxybutynin IR showed higher rates of dry mouth than tolterodine IR and trospium IR, but lower rates of dry mouth than darifenacin, 15 mg daily [214, 216]. Overall, oxybutynin ER has higher rates of dry mouth than tolterodine ER, although the incidence of moderate or severe dry mouth were similar. Transdermal oxybutynin had a lower rate of dry mouth than oxybutynin IR and tolterodine ER, but had an overall higher rate of withdrawal due to an adverse skin reaction [214]. Solifenacin, 10 mg daily, had higher rates of dry mouth than tolterodine ER [214]. Fesoterodine, 8 mg daily, had a higher rate of dry mouth than tolterodine, 4 mg daily [217, 218]. In general, similar discontinuation rates were observed, irrespective of differences in the occurrence of dry mouth.*

**Doses have been given where the evidence relates to a specific dose level typically from trials with a dose escalation element.*

Evidence summary	**LE**
There is no consistent evidence that one antimuscarinic drug is superior to an alternative antimuscarinic drug for cure or improvement of UUI.	1a
The ER formulation of oxybutynin is superior to the ER and IR formulations of tolterodine for improvement of UUI.	1b
Solifenacin is more effective than tolterodine IR for improvement of UUI.	1b
Fesoterodine, 8 mg daily, is more effective than tolterodine ER, 4 mg daily, for cure and improvement of UUI, but with a higher risk of side effects.	1b
ER formulations and once-daily antimuscarinic drugs are generally associated with lower rates of dry mouth than IR preparations, although trial discontinuation rates are similar.	1b
Transdermal oxybutynin (patch) is associated with lower rates of dry mouth than oral antimuscarinic drugs, but has a high rate of withdrawal due to skin reaction.	1b
Oxybutynin IR or ER shows higher rates of dry mouth than the equivalent formulation of tolterodine.	1a
There is no evidence that any particular antimuscarinic agent is superior to another for improvement in QoL.	1a

*4.2.3 **Antimuscarinic drugs versus non-drug treatment***

The choice of drug versus non-drug treatment of UUI is an important question.

4.2.3.1 Question

In adults with UUI, does one type of antimuscarinic drug result in a greater likelihood of cure or improvement in UUI and/or greater improvement in QoL, and/or lesser likelihood of adverse effects compared to an alternative non-drug treatment?

4.2.3.2 Evidence

More than 100 RCTs and high-quality reviews are available [202, 214, 215, 219-221]. Most of these studies were independent.

The US HTA [202] found that trials were of low- or moderate-quality. The main focus of the review was to compare the different drugs used to treat UUI. In one study, multicomponent behavioural modification produced significantly greater reductions in incontinence episodes compared to oxybutynin and higher patient satisfaction for behavioural versus drug treatment. One RCT showed a substantial benefit for sacral neuromodulation compared with medical therapy [222]. In men with storage LUTS, no difference in efficacy was found between oxybutynin and behavioural therapy [223]. The combination of BT and solifenacin in women with OAB conferred no additional benefit in terms of continence [224].

Two small RCTs [225, 226], reported a similar improvement in subjective parameters with either transcutaneous electrical nerve stimulation or T-PTNS. However, only oxybutynin treated patients showed significant improvements in objective urodynamic parameters (bladder capacity). The oxybutynin-treated group had more side effects. One study compared tolterodine ER to transvaginal/anal electrical stimulation without differences in UI outcomes [227]. One small RCT found that the addition of P-PTNS to tolterodine ER improved UI and QoL [228].

Evidence summary	LE
There is no consistent evidence to show superiority of drug therapy over behavioural therapy for treatment of UUI.	1b
Behavioural treatment has higher patient satisfaction than drug treatment.	1b
There is no consistent evidence to show superiority of drug therapy over PFMT for treatment of UUI.	1b

4.2.3.3 Recommendations for antimuscarinic drugs

Recommendations	GR
Offer IR or ER formulations of antimuscarinic drugs for adults with urgency urinary incontinence.	A
If IR formulations of antimuscarinic drugs are unsuccessful for adults with urgency urinary incontinence, offer ER formulations or longer-acting antimuscarinic agents.	A
Consider using transdermal oxybutynin if oral antimuscarinic agents cannot be tolerated due to dry mouth.	B
Offer and encourage early review (of efficacy and side effects) of patients on antimuscarinic medication for urgency urinary incontinence (< 30 days).	A

IR = immediate release; ER = extended release.

*4.2.4 **Antimuscarinic agents: adherence and persistence***

Most studies on antimuscarinic medication are short term (12 weeks). Adherence in clinical trials is considered to be much higher than in real life practice.

4.2.4.1 Question

Do patients with UUI adhere to antimuscarinic drug treatment and persist with prescribed treatment in clinical practice?

4.2.4.2 Evidence

This topic has been reviewed for the development of these Guidelines [229]. Two recent open-label extensions of RCTs of fesoterodine 8 mg showed adherence rates at 2 years from 49-84% [230, 231]. The main drugs studied were oxybutynin and tolterodine IR and ER. Non-persistence rates were high for tolterodine at 12 months, and particularly high (68-95%) for oxybutynin.

'Median days to discontinuation' between < 30 days and 50 days were reported, with a maximum of 273 days, in a military health system where free medication was provided [232].

Data on adherence/persistence from open-label extension populations are questionable as these patients are self-selected to be compliant. Data from pharmacy databses is included in this section.

Several of the RCT trials tried to identify the factors associated with low/lower, adherence or persistence of antimuscarinic. These were identified as:

- low level of efficacy (41.3%)
- adverse events (22.4%)
- cost (18.7%), as higher adherence rates were observed when drugs were provided at no cost to the patient [232].

Other reasons for poor adherence included:

- IR versus ER formulations
- age (lower persistence among younger adults)
- unrealistic expectations of treatment
- gender distribution (better adherence/persistence in female patients)
- ethnic group (African-Americans and other minorities more likely to discontinue or switch treatment)

In addition, the source of data influenced the adherence figures.

Evidence summary	LE
More than half of patients will stop antimuscarinic agents within the first 3 months because of ineffectiveness, adverse events and cost.	2

*4.2.5 **Antimuscarinic agents, the elderly and cognition***

Limited trials have been conducted in elderly people with UI. Issues include the multifactorial etiology of UI in the elderly, comorbidities such as cognitive impairment, the effect of co-medications and the risk of adverse events.

The effects of antimuscarinic agents on cognition have been studied in more detail.

4.2.5.1 Question

What is the comparative efficacy, and risk of adverse effects, particularly the cognitive impact, of treatment with antimuscarinic medication in elderly men and women with UUI?

4.2.5.2 Evidence

Two systematic reviews are available [233, 234]. A community-based cohort study found a high incidence of cognitive dysfunction [235]. Other systematic reviews have included sections on the efficacy and safety of antimuscarinics in elderly patients [180, 214]. A systematic review in 2012 found inconclusive evidence as to the impact of antimuscarinics on cognition [236].

Very few trials specifically investigated the cognitive changes associated with antimuscarinic agents. In general, these trials have measured CNS side effects in a non-specific way and do not allow us to understand the impact on [237, 238].specific populations. There are studies on antimuscarinic effects in elderly persons [239], and in people with dementia with UUI [240]. No specific studies exist in vulnerable patient populations at risk of cognitive dysfunction and deterioration of it while on antimuscarinics.

4.2.5.2.1 Oxybutynin

There is evidence that oxybutynin IR may cause/worsen cognitive dysfunction in adults although there is no consensus about it [237, 239, 241-245].

More rapid functional deterioration might result from the combined use of cholinesterase inhibitors with antimuscarinic agents in elderly patients with cognitive dysfunction [246].

4.2.5.2.2 Solifenacin

One pooled analysis [247] has shown that solifenacin does not increase cognitive impairment in the elderly. No age-related differences in the pharmacokinetics of solifenacin in dfferent age grups was found although more frequent adverse events in subjects over 80 years old were observed. No cognitive effect on healthy elderly volunteers was showen [245]. In a subanalysis of a large trial, solifenacin 5-10 mg improved symptoms and QoL in people ≥ 75 years who had not responded to tolterodine [248]. In patients with mild cognitive impairment, over 65 years, solifenacin showed no difference in efficacy between age groups and a lower incidence of most side effects compared to oxybutynin IR [244, 249].

4.2.5.2.3 Tolterodine

No change in efficacy or side effects related to age have been reported, although a higher discontinuation rate was found for both tolterodine and placebo in elderly patients [237]. Two RCTs in the elderly found a similar efficacy and side effect profile to younger patients [250-253]. Post-hoc analysis has shown little effect on cognition. One non-randomised comparison showed lower rates of depression in elderly participants treated with tolterodine ER compared to oxybutynin IR [254].

4.2.5.2.4 Darifenacin

Two RCTs in the elderly population (one in patients with UUI and the other in volunteers) concluded that darifenacin was effective with no risk of cognitive change, measured as memory scanning tests, compared to placebo [255, 256]. Another study on darifenacin and oxybutynin ER in elderly subjects concluded that the two agents had a similar efficacy, but that cognitive function was more often affected in the oxybutynin ER arm [239].

4.2.5.2.5 Trospium chloride

Trospium is not supposed to cross the blood-brain barrier in healthy individuals. Two (EEG) studies in healthy volunteers showed no effect from trospium whilst tolterodine caused occasional changes and oxybutynin caused consistent changes [257, 258]. No evidence as to the comparative efficacy and side effect profiles of trospium in different age groups in available. However, there is some evidence that trospium does not impair cognitive function [240, 259] and that it is effective compared to placebo in the elderly [260].

4.2.5.2.6 Fesoterodine

There is no evidence comparing the efficacy and side effects of fesoterodine in elderly and younger patients. Pooled analyses of the RCTs of fesoterodine confirmed the efficacy of the 8 mg but not the 4 mg dose in over-75-year olds [261]. Adherence was lower in the over-75 year-old group but the effect on mental status was not reported [230, 262, 263]. No difference between fesoterodine and placebo on cognitive function was reported in healthy older patients [264].

4.2.5.2.7 Duloxetine in the elderly

RCTs comparing duloxetine and placebo included women up to 85 years, but no age stratification of the results is available.

4.2.5.2.8 Mirabegron

No trials of mirabegron have yet been reported in the elderly population with UI.

4.2.5.2.9 Applicability of evidence to general elderly population

It is not clear how much the data from pooled analyses and subgroup analyses from large RCTs can be extrapolated to a general ageing population. Community-based studies of the prevalence of antimuscarinic side effects may be the most helpful [235].

When starting anticholinergics in elderly patients, mental function should be assessed objectively and monitored [265]. No consensus exists as to the best mental function test to detect changes in cognition [246, 261].

4.2.5.2.10 Anticholinergic load

A number of medications have anticholinergic effects and their cumulative effects on cognignition should be considered [266].

4.2.5.2.11 Question

In older people suffering from UI what is the effect of anticholinergic burden (defined by anticholinergic cognitive burden scale, ACB) on cognitive function?

4.2.5.2.12 Evidence

There were no studies specifically in older people with UI, but evidence was available from observational cohort studies relating to the risk in a general population of older people.

Lists of drugs with anticholinergic properties are available from two sources [266, 267].

Two systematic reviews of largely retrospective cohort studies, showed a consistent association between longterm anticholinergic use and cognitive dysfunction [268, 269].

Longitudinal studies in older people over two to four years have found increased rate of decline in cognitive function for patients on definite and possible anticholinergics [270, 271].

Evidence summary	**LE**
All antimuscarinic drugs are effective in elderly patients.	1b
In older people, the cognitive impact of drugs which have anticholinergic effects, is cumulative, and increases with length of exposure.	3
There is inconsistent evidence as to whether oxybutynin IR may worsen cognitive function.	2
Solifenacin, darifenacin and fesoterodine have been shown not to cause increased cognitive dysfunction in elderly people.	1b
There is no evidence as to whether tolterodine and trospium chloride affect cognitive function.	3

4.2.5.2.13 Additional recommendations for antimuscarinic drugs in the elderly

Recommendations	GR
In older people being treated for urinary incontinence, every effort should be made to employ non-pharmacological treatments first.	C
Use antimuscarinic drugs with caution in elderly patients who are at risk of, or have, cognitive dysfunction.	B
In older people who are being prescribed antimuscarinic drugs for control of urinary incontinence, consider modifications to other medications to help reduce anticholinergic load.	C
Check mental function in patients on antimuscarinic medication if they are at risk of cognitive dysfunction.	C

*4.2.6 **Mirabegron***

Mirabegron is the first clinically available beta 3 agonist, available from 2013. Beta 3 adrenoceptors are the predominant beta receptors expressed in the smooth muscle cells of the detrusor and their stimulation is thought to induce detrusor relaxation.

Mirabegron has undergone evaluation in industry-sponsored phase 2 and phase 3 trials. Two systematic reviews of all currently reported studies assessing the clinical effectiveness of mirabegron [272, 273] reported that mirabegron at doses of 25, 50 and 100 mg, results in significantly greater reduction in incontinence episodes, urgency episodes and micturition frequency/24 hrs than placebo, with no difference in the rate of common adverse events [272]. The placebo dry rates in most of these trials are between 35-40%, and 43 and 50% for mirabegron. In all trials the statistically significant difference is consistent only for improvement but not for cure of UI. Similar improvement in frequency of incontinence episodes and micturitions/24 hrs was found in people who had previously tried and those who had not previously tried antinmuscarinin agents.

The most common treatment adverse events in the mirabegron groups were hypertension (7.3%), nasopharyngitis (3.4%) and UTI (3%) [272].

In a 12-month, active-controlled RCT of mirabegron 50/100 mg versus tolterdine ER 4 mg, the improvement in efficacy seen at 12 weeks was sustained at 12-month evaluation in all groups. The reported dry rates at 12 months were 43%,45% and 45% for mirabegron 50 mg, 100 mg and tolterodine 4 mg respectively [274].

No risk of QTc prolongation on electrocardiogram [275] and raised intraocular pressure [276] were observed up to 100 mg dose. There is no significant difference in rate of side effects at different doses of mirabegron [274].

Evaluation of urodynamic parameters in men with combined BOO and OAB concluded that mirabegron (50 or 100 mg) did not adversely affect voiding urodynamic parameters compared to placebo [277].

Equivalent adherence was observed for tolterodine and mirabegron at 12 months (5.5% and 3.6%), although the incidence of dry mouth was significantly higher in the tolterodine group [274]. In mirabegron treated patients, improvement in objective outcome measures correlates directly with clinically relevant PROMs (OAB-q and PPBC) [278, 279].

Evidence summary	LE
Mirabegron is better than placebo for improvement of UUI symptoms	1a
There is no evidence that mirabegron is better than placebo for curing incontinence.	1b
Mirabegron is no more effective than tolterodine.	1b
Adrenergic-mediated side effects of mirabegron appear mild and not clinically significant in a trial setting.	1a
Discontinuation rates from mirabegron are similar to tolterodine in a trial setting.	1b

Recommendation	GR
Offer mirabegron to people with urgency urinary incontinence, but warn patients receiving mirabegron that the possible long-term side effects remain uncertain.	B

*4.2.7 **Drugs for stress urinary incontinence***

Trials have focused on the effect of alpha-adrenoceptors in increasing the closure urethral pressure in women as a means of improving SUI.

A Cochrane review [280] found 22 trials of adrenergic drugs in women with predominant SUI in comparison to placebo or PFMT. Eleven of these trials involved phenylpropanolamine (withdrawn in some countries because of an increased risk of haemorrhagic stroke). The review found weak evidence that these drugs are better than placebo at improving UI in women. Comparative trials with PFMT gave inconsistent results. No new trials were published between 2007 and 2010. At present, these drugs are not licensed for use in UI.

Duloxetine inhibits the presynaptic re-uptake of the neurotransmitters, serotonin (5-HT) and norepinephrine (NE). In the sacral spinal cord, an increased concentration of 5-HT and NE in the synaptic cleft increases stimulation of 5-HT and NE receptors on the pudendal motor neurones, which in turn increases the resting tone and contraction strength of the urethral striated sphincter.

4.2.7.1 Questions

- In adults with SUI, does duloxetine cure or improve UI and/or improve QoL compared to no treatment?
- In adults with SUI, does duloxetine result in a greater cure or improvement of UI, or a greater improvement in QoL, or a lesser likelihood of adverse effects, compared to any other intervention?

4.2.7.2 Evidence

Duloxetine was evaluated as a treatment for female SUI or MUI in two systematic reviews [215, 280] of 10 RCTs, and one subsequent RCT. The typical dose of duloxetine was 80 mg daily, with dose escalation up to 120 mg daily allowed in one study, over a period of 8-12 weeks. One RCT extended the observation period up to 36 weeks and used the Incontinence Quality of Life (I-QoL) score as a primary outcome.

Improvement in UI compared to placebo was observed with no clear differences between SUI and MUI. One study reported cure for UI in about 10% of patients. An improvement in I-QoL was not found in the study using IQoL as a primary endpoint. In a further study comparing duloxetine, 80 mg daily, with PFMT alone, PFMT + duloxetine, and placebo [281], duloxetine reduced leakage compared to PFMT or no treatment. Global improvement and QoL were better for combined therapy than no treatment. There was no significant difference between PFMT and no treatment.

Two open-label studies with a follow-up of 1 year or more evaluated the long-term effect of duloxetine in controlling SUI however both had high discontinuation rates [282, 283].

Duloxetine, 80 mg daily, which could be increased up to 120 mg daily, was investigated in a 12-week study in patients, who had OAB but not SUI [284]. Episodes of UUI were also significantly reduced by duloxetine.

One study [285] compared PFMT + duloxetine versus PFMT + placebo, for 16 weeks, followed by 8 weeks of PFMT alone in males with post-prostatectomy incontinence. Duloxetine + PFMT significantly improved UI, but the effect did not last to the end of the study, indicating that duloxetine only accelerates cure and does not increase the percentage of patients cured.

All studies had a high patient withdrawal rate of about 20-40% in short-term studies and up to 90% in long-term studies. Cause of the high withdrawal rate included lack of efficacy and high incidence of adverse events, including nausea and vomiting (40% or more of patients), dry mouth, constipation, dizziness, insomnia, somnolence and fatigue.

Evidence summary	**LE**
Duloxetine does not cure UI.	1a
Duloxetine, 80 mg daily improves SUI and MUI in women.	1a
Duloxetine causes significant gastrointestinal and CNS side effects leading to a high rate of treatment discontinuation.	1a
Duloxetine, 80 mg daily, can improve SUI in men.	1b
Duloxetine 80 mg - 120 mg daily can improve UUI in women.	1b

Recommendations	**GR**
Duloxetine should not be offered to women or men who are seeking a cure for their incontinence.	A
Duloxetine can be offered to women or men who are seeking temporary improvement in incontinence symptoms.	B*
Duloxetine should be initiated using dose titration because of high adverse effect rates.	A

** Downgraded based on expert opinion.*

4.2.8 ***Oestrogen***

Oestrogen treatment for UI has been tested using oral, transdermal and vaginal routes of administration. Available evidence suggests that vaginal oestrogen treatment with oestradiol and oestriol is not associated with the increased risk of thromboembolism, endometrial hypertrophy, and breast cancer seen with systemic administration [286-288]. Vaginal (local) treatment is primarily used to treat symptoms of vaginal atrophy in postmenopausal women.

4.2.8.1 Questions

- In women with UI, does oral (systemic) oestrogen cure or improve UI compared to no treatment?
- In women with UI, does vaginal (local) oestrogen cure or improve UI compared to no treatment or other active treatment?

4.2.8.2 Evidence

In women with SUI the use of oral conjugated equine estrogens, estradiol, or estrone showed no improvement [289-291]. Two placebo-controlled trials using sub-cutaneous estradiol or oral estriol showed no benefit for improvement of UI [292].

A recent Cochrane systematic review looked at the use of oestrogen therapy in postmenopausal women [286] given local oestrogen therapy. There is also a more recent narrative review of oestrogen therapy in urogenital diseases [293]. No new RCTs have been published up to September 2012. The Cochrane review (search date June 2012) found that vaginal oestrogen treatment improved symptoms of UI in the short-term [286]. The review found single, small, low quality trials comparing vaginal oestrogen treatment with phenylpropanolamine, PFMT, electrical stimulation and its use as an adjunct to surgery for SUI. Local oestrogen was less likely to improve UI than PFMT but no differences in UI outcomes were observed for the other comparisons. A single trial of local oestrogen therapy comparing a ring device to pessaries found no difference in UI outcomes although more women preferred the ring device. No adverse effects of vaginal administration of estradiol for vulvovaginal atrophy over 2 years was seen in one trial [294].

Vaginal oestrogen therapy can be given as conjugated equine oestrogen, oestriol or oestradiol in vaginal pessaries, vaginal rings or creams. Current data do not allow differentiation among the various types of oestrogens or delivery methods. The ideal treatment duration and the long-term effects are uncertain. One RCT compared oestradiol ring pessary with treatment with oxybutynin ER showing no difference in outcomes [295].

Evidence summary	**LE**
Vaginal oestrogen therapy improves UI for post-menopausal women.	1b
Oral oestrogen therapy does not improve UI.	1a
Vaginal oestrogen therapy in post-menopausal women may improve or cure UUI.	1a
There is no consistent evidence that vaginal oestrogen therapy cures SUI.	2
There is no evidence that one method of vaginal delivery is better than another	4
There is no evidence available on the neoadjuvant or adjuvant use of local oestrogens at the time of surgery for UI.	1a
There is no evidence that oestrogen therapy by non-vaginal route confers any improvement in UI.	1a

Recommendations	**GR**
Offer post-menopausal women with urinary incontinence vaginal oestrogen therapy particularly if other symptoms of vulvovaginal atrophy are present.	A
Do not offer oral (systemic) oestrogen replacement therapy as treatment for urinary incontinence.	A
Vaginal oestrogen therapy should be long-term and in an appropriate dose.	C

4.2.9 ***Desmopressin***

Desmopressin is a synthetic analogue of vasopressin (also known as antidiuretic hormone). It can be taken orally, nasally or by injection. Desmopressin is most commonly used to treat diabetes insipidus and, when used at night, to treat nocturnal enuresis.

4.2.9.1 Questions

- In adults with UI, does desmopressin cure or improve UI and/or improve QoL compared to no treatment?
- In adults with UI, does desmopressin result in a lesser likelihood of adverse effects, compared to any other intervention?

4.2.9.2 Evidence

4.2.9.2.1 Improvement of incontinence

Few studies have examined the use of desmopressin exclusively for the treatment of UI. No evidence was found that demonstrated any effect on nocturnal incontinence. Two RCTs have compared desmopressin to placebo with daytime UI as an outcome measure. Improved continence was shown during the first 4 hours after taking desmopressin in women [296]. The continuous use of desmopressin improved frequency and urgency, but did not improve UI in men and women with OAB [297]. There is no evidence reporting desmopressin cure rates for UI and no evidence that compares desmopressin with other non-drug treatments for UI.

4.2.9.2.2 Monitoring for hyponatraemia

The use of desmopressin carries a risk of developing hyponatraemia (please refer to the EAU Guidelines on Male LUTS).

Evidence summary	**LE**
The risk of UI is reduced within 4 hours of taking oral desmopressin, but not after 4 hours.	1b
Continuous use of desmopressin does not improve or cure UI.	1b
Regular use of desmopressin may lead to hyponatraemia.	3

Recommendations	**GR**
Offer desmopressin to patients requiring occasional short-term relief from daytime urinary incontinence and inform them that this drug is not licensed for this indication.	B
Do not use desmopressin for long-term control of urinary incontinence.	A

4.2.10 ***Drug treatment in mixed urinary incontinence***

4.2.10.1 Question

In adults with MUI, is the outcome of a drug treatment different to that with the same treatment in patients with either pure SUI or pure UUI?

4.2.10.2 Evidence

Many RCTs include patients with MUI with predominant symptoms of either SUI or UUI but few report outcomes separately for those with MUI compared to pure SUI or UUI groups.

Tolterodine

In an RCT of 854 women with MUI, tolterodine ER was effective for improvement of UUI, but not SUI suggesting that the efficacy of tolterodine for UUI was not altered by the presence of SUI [298]. In another study (n = 1380) tolterodine was equally effective in reducing urgency and UUI symptoms, regardless of whether there was associated SUI [299]. Similar results were found for solifenacin [300, 301].

Duloxetine

In one RCT of duloxetine vs. placebo in 588 women, subjects were stratified into either stress-predominant, urgency-predominant or balanced MUI groups. Duloxetine was effective for improvement of incontinence and QoL in all subgroups [302].

Duloxetine was found to have equal efficacy for SUI and MUI in an RCT (n = 553) following secondary analysis of respective subpopulations [303].

Evidence summary	**LE**
Limited evidence suggests that antimuscarinic drugs are effective for improvement of UUI component in patients with MUI.	2
Duloxetine is effective for improvement of both SUI and UUI in patients with MUI.	1b

Recommendations	**GR**
Treat the most bothersome symptom first in patients with mixed urinary incontinence.	C
Offer antimuscarinic drugs to patients with urgency-predominant mixed urinary incontinence.	A*
Consider duloxetine for patients with MUI unresponsive to other conservative treatments and who are not seeking cure.	B

4.3 Surgical management

In line with the recommendations from the UK National Institute for Healthcare and Clinical Excellence (NICE) [58] the Panel agreed that surgeons and centres performing surgery should:

- be properly trained in each procedure;
- not be trained by someone who is not surgically qualified;
- perform sufficient numbers of a procedure to maintain expertise of him/herself and the surgical team;
- be able to offer alternative surgical treatments;
- be able to deal with the complications of surgery;
- provide suitable arrangements for follow-up long-term if necessary.

The section considers surgical options for the following situations:

- Women with uncomplicated SUI. This means no history of previous surgery, no neurological lower urinary tract dysfunction (LUTD), no bothersome genitourinary prolapse, and not considering further pregnancy.
- Women with complicated SUI. Neurogenic LUTD is reviewed in the EAU Guidelines on Neurogenic Lower Urinary Tract Dysfunction [2].
- Associated genitourinary prolapse has been included in these Guidelines in terms of treating the incontinence, but no attempt has been made to comment on treatment of prolapse itself.
- Men with SUI, mainly in men with post-prostatectomy incontinence without neurological disease affecting the lower urinary tract.
- Patients with refractory DO incontinence.

The Panel has tried to acknowledge emerging techniques as they think appropriate and have made a strong recommendation (section 4.3.1.5.2) that new devices are only used as part of a structured research programme.

*4.3.1 **Women with uncomplicated stress urinary incontinence***

4.3.1.1 Mid-urethral slings

Early clinical studies identified that slings should be made from monofilament, non-absorbable material, typically polypropylene, and constructed as a 1-2 cm wide mesh with a relatively large pore size (macroporous). Mid-urethral slings are now the most frequently used surgical intervention in Europe for women with SUI.

4.3.1.1.1 Questions

In women with SUI, what is the effectiveness in curing SUI and adverse effects at 1 year of:

- mid-urethral synthetic sling insertion compared to Burch colposuspension?
- one method of insertion of a mid-urethral synthetic sling compared to another method?
- one direction of insertion of a mid-urethral synthetic sling compared to another direction of insertion?

4.3.1.1.2 Evidence

For the purpose of these Guidelines, a new meta-analysis was performed.

Mid-urethral sling insertion compared to colposuspension

Thirteen RCTs (n = 1037) compared mid-urethral sling (retropubic) and colposuspension (open and laparoscopic). The meta-analysis found no difference in patient-reported cure rates at 12 months [304-314]. The overall patient-reported cure rate was 75%. There was weak evidence of higher clinician-reported cure rates at 12 months after mid-urethral sling (83%) compared to colposuspension (78%) [307-314]. However, longer term follow-up for up to 5 years reported no difference in effectiveness, though the numbers of participants lost to follow-up was high [87, 306]. Voiding dysfunction was more likely for colposuspension (relative risk 0.34, 95% CI 0.16-0.7) whilst bladder perforation was higher for the mid-urethral sling (15% vs. 9%, and 7% vs. 2%, respectively) [305, 307, 315-317].

Transobturator route versus retropubic route

The EAU Panel meta-analysis identified 34 RCTs (5786 women) comparing insertion of the mid-urethral sling by the retropubic and transobturator routes. There was no difference in cure rates at 12 months in either patient-reported or clinically reported cure rates (77% and 85%, respectively) [4]. Voiding dysfunction was less common (4%) following transobturator insertion compared to retropubic insertion (7%), as was the risk of bladder perforation (0.3%) or urethral perforation (5%). The risks of *de novo* urgency and vaginal perforation were 6% and 1.7%, respectively. Chronic perineal pain at 12 months after surgery was reported by 21 trials and meta-analysis showed a higher rate in women undergoing transobturator insertion (7%) compared to retropubic insertion (3%).

Insertion using a skin-to-vagina direction versus a vagina-to-skin direction
A Cochrane systematic review and meta-analysis found that the skin-to-vagina direction (top - down) for retropubic insertion of mid-urethral slings was less effective than the vagina-to-skin (bottom - up) direction and was associated with higher rates of voiding dysfunction, bladder perforation and vaginal erosion [318]. A further systematic review and meta-analysis found that the skin-to-vagina (outside in) direction of transobturator insertion of mid-urethral slings was equally effective compared to the vagina-to-skin route (inside out) using direct comparison. However, indirect comparative analysis gave weak evidence for a higher rate of voiding dysfunction and bladder injury [319].

4.3.1.2 Adjustability

4.3.1.2.1 Questions

- In women with SUI, does an adjustable sling cure SUI and improve QoL or does it cause adverse outcome(s)?
- How does an adjustable sling compare to other surgical treatments for SUI?

4.3.1.2.2 Evidence

There are no RCTs investigating outcome of adjustable sling insertion for women with SUI. There are limited data from cohort studies on adjustable tension slings with variable selection criteria and outcome definition. Few studies include sufficient numbers of patients or have a long enough follow-up to provide useful evidence. The available devices have differing designs, making it difficult to use existing data to make general conclusions about adjustable slings as a class of procedure.

4.3.1.3 Single-incision slings

4.3.1.3.1 Questions

- In women with SUI, do single-incision slings cure UI or improve QoL, or cause adverse outcomes?
- How does a single-incision sling compare to other surgical treatments for SUI?

4.3.1.3.2 Evidence

Although there have been many studies published on single-incision devices, it should be noted that there are significant differences in technical design between devices and it may be misleading to make general statements about them as a class of operations. It should also be noted that some devices have been withdrawn from the market (eg TVT Secur, Minitape), and yet evidence relating to these may be included in current meta analyses.
There was evidence to suggest single-incision slings are quicker to perform and cause less postoperative thigh pain, but there was no difference in the rate of chronic pain. There was not enough evidence to conclude any difference between single-incision slings in direct comparisons.

The most recent meta-analysis [320] and a reanalysis of the Cochrane review data by our panel (excluding TVT Secur data) have demonstrated that there was no difference in efficacy between available single incision devices and conventional mid-urethral slings. However, not all single incision devices have been subjected to RCT evaluation and it may be unsafe to assume that they are collectively technically similar devices.

Generalisability of evidence to adult women with SUI
Analysis of the population studied in trials included in this meta-analysis suggests that the evidence is generalisable to women, who have predominantly SUI, and no other clinically severe lower genitourinary tract dysfunction. The evidence is not adequate to guide choice of surgical treatment for those women with MUI, severe POP, or a history of previous surgery for SUI.
The results of the EAU Panel meta-analysis [4] were consistent with those of the Cochrane systematic review [318], except that in the EAU Panel meta-analysis the objective cure rates appeared slightly higher for retropubic (88%) compared to transobturator insertion (84%). The EAU Panel finding is consistent with an additional systematic review and meta-analysis [321] and the difference may result from the Panel's decision to only consider trial data with at least 12 months of follow-up.

Sexual function after mid-urethral tape surgery
A systematic review concluded there was a lack of RCTs addressing the effects of incontinence surgery on sexual function but noting a reduction in coital incontinence [322]. One recent RCT [323] and another cohort study [324] have shown that overall sexual activity improves after sling surgery.

SUI surgery in the elderly
There are no RCTs comparing surgical treatment in older versus younger women, although subgroup analyses

of some RCTs have included a comparison of older with younger cohorts. Definitions of "elderly" vary from one study to another so no attempt was made to define the term here. Instead, the Panel attempted to identify those studies which have addressed age difference as an important variable.

An RCT of 537 women comparing retropubic to transobturator tape, showed that increasing age was an independent risk factor for failure of surgery over the age of 50 [325]. An RCT assessing risk factors for the failure of TVT versus transobturator tension-free vaginal tape (TVT-O) in 162 women found that age is a specific risk factor (adjusted OR 1.7 per decade) for recurrence at 1 year [326]. In a subanalysis of a trial cohort of 655 women at 2 years' follow-up, it was shown that elderly women were more likely to have a positive stress test at follow-up (OR 3.7, 95% CI 1.7-7.97), are less likely to report objective or subjective improvement in stress and urgency UI, and are more likely to undergo retreatment for SUI (OR 3.9, 95% CI 1.3-11.48). There was no difference in time to postoperative normal voiding [72].

Another RCT comparing immediate TVT versus no surgery (delayed TVT) in older women, confirmed efficacy of surgery in terms of QOL and satisfaction, but with higher complication rates [327].

A cohort study of 256 women undergoing inside-out transobturator tape reported similar efficacy in older versus younger women, but found a higher risk of de novo urgency in older patients [328].

Evidence summary	**LE**
Compared to colposuspension, the retropubic insertion of a mid-urethral synthetic sling gives equivalent patient-reported cure of SUI at 5 years.	1a
Mid-urethral synthetic sling inserted by either the transobturator or retropubic route gives equivalent patient-reported outcome at 12 months.	1a
The skin-to-vagina (top down) direction of retropubic insertion of mid-urethral sling is less effective than a vagina-to-skin (bottom up) direction.	1a
Mid-urethral sling insertion is associated with a lower rate of a new symptom of urgency, and voiding dysfunction, compared to colposuspension.	1a
The retropubic route of insertion is associated with a higher intra-operative risk of bladder perforation and a higher rate of voiding dysfunction than the transobturator route.	1a
The transobturator route of insertion is associated with a higher risk of chronic pain and vaginal erosion and extrusion at 12 months than the retropubic route.	1a
The skin-to-vagina direction of both retropubic and transobturator insertion is associated with a higher risk of postoperative voiding dysfunction.	1b
Adjustable mid-urethral synthetic sling devices may be effective for cure or improvement of SUI in women.	3
There is no evidence that adjustable slings are superior to standard mid-urethral slings.	4
The comparative efficacy of single-incision slings against conventional mid-urethral slings is uncertain.	1c
Operation times for insertion of single-incision mid-urethral slings are shorter than for standard retropubic slings.	1b
Blood loss and immediate postoperative pain are lower for insertion of single-incision slings compared with conventional mid-urethral slings.	1b
There is no evidence that other adverse outcomes from surgery are more or less likely with single-incision slings than with conventional mid-urethral slings.	1b
Older women benefit from surgical treatment for UI.	1
The risk of failure from surgical repair of SUI, or suffering adverse events, appears to increase with age.	2
There is no evidence that any surgical procedure has greater efficacy or safety in older women than another procedure.	4
In women undergoing surgery for SUI, coital incontinence is likely to improve.	3
Overall, sexual function is unlikely to deteriorate following SUI surgery.	3
There is no consistent evidence that the risk of postoperative sexual dysfunction differs between midurethral sling procedures.	3

**NB: Most evidence on single-incision slings is from studies using the tension-free vaginal tape secure (TVTS) device and although this device is no longer available, many women still have the device in place.*

4.3.1.4 Open and laparoscopic surgery for stress urinary incontinence

Open colposuspension was previously considered the gold standard surgical intervention for SUI, and was used as the comparator in RCTs of newer, less invasive, surgical techniques. These include laparoscopic techniques, which have enabled colposuspension to be performed with a minimally invasive approach.

Although the outcome of open and laparoscopic procedures should be considered in absolute terms, it is also important to consider any associated complications, adverse events and costs. The outcome parameters used to evaluate surgery for SUI have included:

- continence rate and number of incontinence episodes;
- general and procedure-specific complications;
- generic, specific (UI) and correlated (sexual and bowel) QoL.

4.3.1.4.1 Question

In women with SUI, what is the effectiveness of open and laparoscopic surgery, compared to other surgical procedures, measured in terms of cure or improvement of incontinence or QoL, or the risk of adverse events?

4.3.1.4.2 Evidence

Four systematic reviews were found, which covered the subject of open surgery for SUI, including 46 RCTs [2, 329-331], but no RCTs comparing any operation to a sham procedure.

Open colposuspension

The Cochrane review [332] included 46 trials (4738 women) having open colposuspension. In most of these trials, open colposuspension was used as the comparator to an experimental procedure. Consequently, for this review we have only considered the absolute effect of colposuspension, but have not reviewed all of these comparisons. No additional trials have been reported since this review.

Within the first year, complete continence rates of approximately 85-90% were achieved for open colposuspension, while failure rates for UI were 17% up to 5 years and 21% over 5 years. The re-operation rate for UI was 2%. Colposuspension was associated with a higher rate of development at 5 years of enterocoele/vault/cervical prolapse (42%) and rectocele (49%) compared to tension-free vaginal tape (TVT) (23% and 32%, respectively). The rate of cystocoele was similar in colposuspension (37%) and with TVT (41%).

Four trials compared Burch colposuspension to the Marshall Marchetti Krantz procedure and one trial evaluated Burch colposuspension with paravaginal repair. All showed fewer surgical failures up to 5 years with colposuspension but otherwise similar outcomes.

Anterior colporrhaphy

Anterior colporrhaphy is now considered an obsolete operation for UI. In a Cochrane review [330], 10 trials compared anterior colporrhaphy (385 women) with colposuspension (627 women). The failure rate for UI at follow-up of up to 5 years was worse for anterior colporrhaphy with a higher requirement for re-operation for incontinence.

Autologous fascial sling

The Cochrane review [330, 333] described 26 RCTs, including 2284 women undergoing autologous sling procedure in comparison to other operations.

There were seven trials of autologous fascial sling versus colposuspension. Except for one very high-quality study [334], most of the studies were of variable quality, with a few very small studies, and a short follow-up. The metaanalysis showed that fascial sling and colposuspension had a similar cure rate at 1 year. Colposuspension had a lower risk of voiding difficulty and UTIs, but a higher risk of bladder perforation.

In 12 trials of autologous fascial sling versus mid-urethral synthetic slings, the procedures showed similar efficacy. However, use of the synthetic sling resulted in shorter operating times and lower rates of complications, including voiding difficulty. Six trials compared autologous fascial slings with other materials of different origins, with results favouring traditional autologous fascial slings.

Laparoscopic colposuspension

The Cochrane review [329] identified 22 RCTs, of which 10 trials compared laparoscopic colposuspension to open colposuspension. No other trials have been identified. Although these procedures had a similar subjective cure rate, there was limited evidence suggesting the objective outcomes were less good for laparoscopic

colposuspension. However, laparoscopic colposuspension had a lower risk of complications and shorter duration of hospital stay.

In eight RCTs comparing laparoscopic colposuspension to mid-uretheral slings, the subjective cure rates were similar, while the objective cure rate favoured the mid-urethral sling at 18 months. Complication rates were similar for the two procedures and operating times were shorter for the mid-urethral sling. Comparisons of colposuspension to mid-uretheral sling are covered in section 4.3.1.1.

Evidence summary	**LE**
Open colposuspension and autologous fascial sling are similarly effective for cure of SUI in women.	1b
Laparoscopic colposuspension has similar efficacy to open colposuspension for cure of SUI and a similar risk of voiding difficulty or de novo urgency.	1a
Laparoscopic colposuspension has a lower risk of other complications and shorter hospital stay than open colposuspension.	1a
Autologous fascial sling has a higher risk of operative complications than open colposuspension, particularly voiding dysfunction and postoperative UTI.	1b

4.3.1.5 Bulking agents

4.3.1.5.1 Question

In women with SUI, does injection of a urethral bulking agent cure SUI or improve QoL, or cause adverse outcomes?

4.3.1.5.2 Evidence

There have been two Cochrane systematic reviews [335, 336] and one independent SR [337], which reported on 12 RCTs or quasi-RCTs of injectable agents. In general, the trials were only of moderate quality and small and many of them had been reported in abstract form. Wide confidence intervals meant a meta-analysis was not possible. Since the Cochrane review, two further RCTs have been reported [338, 339].

Each injectable product has been the subject of many case series. Short-term efficacy in reducing the symptoms of SUI has been demonstrated for all materials used. In 2006, NICE published an extensive review of these case series [340]. These case series have added very little to the evidence provided by RCTs. There has been only one placebo-controlled RCT, in which an autologous fat injection was compared with the placebo of a saline injection.

Comparison with open surgery

Two RCTs compared collagen injection to conventional surgery for SUI (autologous sling vs. silicon particles and collagen vs. assorted procedures). The studies reported greater efficacy but higher complication rates for open surgery. In comparison, collagen injections showed inferior efficacy but equivalent levels of satisfaction and fewer serious complications [58, 341].

Another trial found that a periurethral route of injection can carry a higher risk of urinary retention compared to a transurethral injection [342]. A recent small RCT found no difference in efficacy between mid-urethral and bladder neck injection of collagen [338].

Evidence summary	**LE**
Periurethral injection of bulking agent may provide short-term improvement in symptoms (3 months), but not cure, in women with SUI.	2a
Repeat injections to achieve therapeutic effect are often required.	2a
Bulking agents are less effective than colposuspension or autologous sling for cure of SUI.	2a
Adverse effect rates are lower compared to open surgery.	2a
There is no evidence that one type of bulking agent is better than another type.	1b
Transperineal route of injection may be associated with a higher risk of urinary retention compared to the transurethral route.	2b

Recommendations for surgery for uncomplicated stress urinary incontinence in women	**GR**
Offer the mid-urethral sling to women with uncomplicated stress urinary incontinence as the preferred surgical intervention whenever available.	A
Warn women who are being offered a retropubic insertion of midurethral sling about the relatively higher risk of peri-operative complications compared to transobturator insertion.	A
Warn women who are being offered transobturator insertion of mid-urethral sling about the higher risk of pain and dyspareunia in the longer term.	A

Warn women who are being offered a single-incision sling that long-term efficacy remains uncertain.	A
Do a cystoscopy as part of retropubic insertion of a mid-urethral sling, or if difficulty is encountered during transobturator sling insertion, or if there is a significant cystocoele.	C
Offer colposuspension (open or laparoscopic) or autologous fascial sling to women with stress urinary incontinence if mid-urethral sling cannot be considered.	A
Warn women undergoing autologous fascial sling that there is a high risk of voiding difficulty and the need to perform clean intermittent self-catheterisation; ensure they are willing and able to do so.	C
Inform older women with stress urinary incontinence about the increased risks associated with surgery, including the lower probability of success.	B
Inform women that any vaginal surgery may have an impact on sexual function.	B
Only offer new devices, for which there is no level 1 evidence base, as part of a structured research programme.	A*
Only offer adjustable mid-urethral sling as a primary surgical treatment for stress urinary incontinence as part of a structured research programme.	A*
Do not offer bulking agents to women who are seeking a permanent cure for stress urinary incontinence.	A*

** Recommendation based on expert opinion.*

*4.3.2 **Complicated stress urinary incontinence in women***

This section will address surgical treatment for women who have had previous surgery for SUI, which has failed, or those women who have undergone previous radiotherapy affecting the vaginal or urethral tissues. Neurological lower urinary tract dysfunction is is reviewed by the EAU Guidelines on Neurogenic Lower Urinary Tract Dysfunction [2]. Women with associated genitourinary prolapse are included in this edition (see section 4.3.3).

4.3.2.1 Colposuspension or sling following failed surgery

There may be persistent or recurrent SUI, or the development of de novo UUI. This means that careful evaluation including urodynamics becomes an essential part of the work-up of these patients.

4.3.2.1.1 Question

In women who have had failed surgery for SUI, what is the effectiveness of any second-line operation, compared to any other second-line operation, in terms of cure or improvement of UI, QoL or adverse events?

4.3.2.1.2 Evidence

Most of the data on surgery for SUI refer to primary operations. Even when secondary procedures have been included, it is unusual for the outcomes in this subgroup to be separately reported. When they are, the numbers of patients is usually too small to allow meaningful comparisons.

The 4th International Consultation on Incontinence includes a review of this topic [343] up till 2008 and the subject has also been reviewed by Ashok [344] and Lovatsis et al. [345]. A further literature review has been carried out since that time by the Panel.

Cochrane reviews of individual operative techniques have not included separate evaluation of outcomes in women undergoing second-line surgery. However, there is a current protocol to address this issue [346]. Only one RCT was found (abstract only) comparing TVT to laparoscopic colposuspension in women with recurrent SUI. This small study found similar cure rates and adverse events in the short-term for both procedures [317].

Post-hoc subgroup analysis of high-quality RCTs comparing one procedure to another have shown conflicting evidence of relative effectiveness [72, 85, 347, 348]. One large non-randomised comparative series suggested that cure rates after more than two previous operations were 0% for open colposuspension and 38% for fascial sling [349].

Several cohort studies have reported outcomes for TVT specifically for primary and secondary cases. Evidence on the effectiveness of second-line retropubic tapes conflicts with some series showing equivalent outcomes for primary and secondary cases [350, 351], whilst other research has shown inferior outcomes for secondary surgery [352, 353]. Other confounding variables make meaningful conclusions difficult.

Systematic review of older trials of open surgery for SUI suggest that the longer term outcomes of redo open colposuspension may be poor compared to autologous fascial slings [354]. Successful results have been reported from mid-urethral slings after various types of primary surgery, while good outcomes are reported for

both repeat TVT and for 'tightening' of TVT, but data are limited to small case series only.

Evidence summary	LE
There is conflicting evidence whether prior surgery for stress incontinence or prolapse results in inferior outcomes from repeat operations for SUI.	2
Most procedures will be less effective when used as a second-line procedure than when used for primary surgery.	2
In women who have had more than two procedures for SUI, the results of open colposuspension are inferior to autologous fascial sling.	2

4.3.2.2 External compression devices

External compression devices are still widely used in the treatment of recurrent SUI after the failure of previous surgery and if there is thought to be profound intrinsic failure of the sphincter mechanism, characterised by very low leak point pressures or low urethral closure pressures. This should be confirmed by urodynamic evaluation.

The two intracorporeal external urethral compression devices available are the adjustable compression therapy (ACT) device and the artificial urinary sphincter (AUS). Using ultrasound or fluoroscopic guidance, the ACT device is inserted by placement of two inflatable spherical balloons on either side of the bladder neck. Each volume of each balloon can be adjusted through a subcutaneous port placed within the labia majora. More recently, an adjustable artificial urinary sphincter (Flowsecure) has been introduced. It has the added benefit of 'conditional occlusion', enabling it to respond to rapid changes in intra-abdominal pressure.

4.3.2.2.1 Questions

- In women with SUI, does insertion of an external compressive device cure SUI, improve QoL or cause adverse outcomes?
- How do external compression devices compare to other surgical treatments for SUI?

4.3.2.2.2 Evidence

The major advantage of AUS over other anti-incontinence procedures is the perceived ability to be able to void normally [136]. However, voiding dysfunction is a known side effect, with a lack of data making it difficult to assess its importance. Because of significant differences in design between devices and in selection criteria between case series, results obtained with specific devices cannot be extrapolated generally to the use of adjustable devices. A recent consensus report has standardised the terminology used for reporting complications arising from implantation of materials into the pelvic floor region [17].

Artificial urinary sphincter (AUS)

A previous review of mechanical devices concluded that there was insufficient evidence to support the use of AUS in women [355].

There are a few case series in women, including four series (n = 611), with study populations ranging from 45 to 215 patients and follow-up ranging from 1 month to 25 years [356-359]. Case series have been confounded by varying selection criteria, especially the proportion of women who have neurological dysfunction or who have had previous surgery. Most patients achieved an improvement in SUI, with reported subjective cures in 59-88% Common side effects included mechanical failure requiring revision (up to 42% at 10 years) and explantation (5.9-15%). In a retrospective series of 215 women followed-up for a mean of 6 years, the risk factors for failure were older age, previous Burch colposuspension and pelvic radiotherapy [359]. Peri-operative injury to the urethra, bladder or rectum was also a high-risk factor for explantation [357].

A newly introduced artificial sphincter using an adjustable balloon capacity through a self-sealing port, and stress responsive design, has been introduced to clinical use. A series of 100 patients reported 28% explantation at 4 years but the device has undergone redesign and more up-to-date evidence is awaited [360].

Early reports of laparoscopically implanted AUS do not have sufficient patient populations and/or sufficient follow-up to be able to draw any conclusions [361, 362].

Adjustable compression device (ACT)

There are four case series (n = 349), with follow-up ranging from 5 to 84 months [363-366]. Reported outcome ranged from 47% objective cure to 100% subjective improvement. However, most patients required adjustment to achieve continence and 21% required explantation.

Evidence summary	LE
Implantation of an artificial sphincter can improve or cure incontinence in women with SUI caused by sphincter insufficiency.	3
Implantation of the ACT device may improve complicated UI.	3
Complications, mechanical failure and device explantation often occur with both the artificial sphincter and the adjustable compression device.	3
Explantation is more frequent in older women and among those who have had previous Burch colposuspension or pelvic radiotherapy.	3

Recommendations for surgery for complicated stress urinary incontinence in women	GR
The choice of surgery for recurrent stress urinary incontinence should be based on careful evaluation of the individual patient including video-urodynamics.	C
Warn women with recurrent stress urinary incontinence, that the outcome of a surgical procedure, when used as a second-line treatment, is generally inferior to its use as a first-line treatment, both in terms of reduced efficacy and increased risk of complications.	C
Consider secondary synthetic sling, colposuspension or autologous sling as first options for women with complicated stress urinary incontinence.	C
Implantation of AUS or ACT for women with complicated stress urinary incontinence should only be offered in expert* centres.	C
Warn women receiving AUS or ACT that, even in expert centres, there is a high risk of complications, mechanical failure or a need for explantation.	C

AUS = artificial urinary sphincter; ACT = adjustable compression therapy.
** expert centres refers to the comments on surgeon volume in the introduction to the surgical chapter.*

*4.3.3 **Women with both stress urinary incontinence and pelvic organ prolapse***

There is a clear association between the presence of POP and SUI. Although the subject of prolapse is not part of the remit of these Guidelines, the extent to which it impacts on the management of SUI will be addressed. The aim is to assess the options available to women who require surgery for POP and who have associated UI (either symptomatic or after reduction of prolapse), and to assess the value of prophylactic antiincontinence surgery in women with no evidence of UI.

4.3.3.1 Questions

1. In women with POP and UI, does combined surgery for POP and SUI reduce the incidence of postoperative UI compared to POP surgery alone?
2. In continent women with POP, does combined surgery for POP and SUI reduce the incidence of postoperative de novo UI compared to POP surgery alone?
3. In women with POP and occult SUI, (i.e. seen only on prolapse reduction stress testing/urodynamics), does combined surgery for POP and SUI reduce the incidence of postoperative UI compared to POP surgery alone?
4. In women with POP and OAB, does surgery for POP improve OAB symptoms?
5. In adults with POP, what are the reliability, the diagnostic accuracy and predictive value of a prolapse reduction test to identify patients at risk for denovo SUI following prolapse repair?

4.3.3.2 Evidence

A Cochrane review in 2013 included sixteen trials concerning bladder function after surgery for pelvic organ prolapse [367]. After prolapse surgery 434 of 2125 women (20.4%) reported new subjective SUI in 16 trials. New voiding dysfunction was reported in 109 of 1209 (9%) women in 12 trials.

1. In women with POP does combined surgery for POP and SUI reduce the incidence of postoperative UI compared to POP surgery alone?

There are two well-designed RCTs relating to the prevalence of postoperative SUI in women who underwent prolapse surgery with and without an anti-incontinence procedure. Both of these trials involved women with POP who did not complain of symptoms of stress incontinence regardless of objective findings.

One trial compared abdominal sacrocolpopexy with and without Burch colposuspension [368], the other compared vaginal repair with and without a mid-urethral sling (3). In both trials addition of an anti-incontinence surgery reduced the risk of SUI at 12 months. In one trial there was a higher rate of adverse events reported in the combined surgery group [369]. This was also the finding of the Cochrane review and meta-analysis.

Two trials addressed postoperative SUI in patients who had had SUI preoperatively. Borstad et al., in a multicenter trial randomised women with POP and SUI to have a tension-free vaginal tape (TVT) at the time of prolapse repair or 3 months later, if they still had SUI. (n=53). One year after surgery there was no difference between the groups regarding continence, however, 44% of the women without initial TVT never required surgery and 29% were dry [370].

In contrast, Costantini et al. followed up women with POP and SUI randomised to abdominal POP repair with or without Burch colposuspension, (after a median of 97 months) finding that additional SUI surgery did not improve outcome [371]. On the contrary, a higher number of patients had de novo storage symptoms when a Burch colposuspension was performed.

In summary, it is difficult to generalise the results of trials using very different procedures to treat both POP and UI. It seems that with a combined procedure the rate of SUI postoperatively is lower. Studies using mid-urethral slings generally have shown more significant differences in UI outcomes with combined procedures than when other types of anti-incontinence procedure have been used. Individual patient characteristics may play the most important role in shaping treatment decisions. It must be taken into account that, although more women may be dry after combined surgery the risks of repeat surgery, should it become necessary, may outweigh the potential benefits.

2. Continent women with POP

The 2013 Cochrane review included 6 trials showing that postoperative incontinence rates at < 12 months were 19% in the combined surgery group vs. 32% in POP surgery alone. In this group of 438 women, undergoing continence surgery at the time of prolapse prevented 62 (14%) women from developing de novo SUI postprolapse surgery. A long-term update of a previously published RCT comparing POP surgery with or without Burch colposuspension in continent women suggested higher UI rates in women undergoing colposuspension [369].

3. Women with POP and occult SUI

The 2013 Cochrane review included five trials addressing this point. Overall, there was a significantly higher rate of postoperative patient-reported SUI with prolapse surgery alone compared with combined surgery.

4. Women with POP and OAB

There is evidence from 3 case series evaluating patients with concomitant OAB and pelvic organ prolapse assessing incontinence/OAB symptom scores postsurgical repair. Costantini et al. assessed the effect of posterior repair on OAB/DO and reported a 70-75% improvement rate in both parameters along with a 93% anatomic success rate [372].

Kummeling et al. assessed the effect of a modified laparosocopic sacrocolpopexy on urodynamic parameters and reported an improvement with no evidence to support a concomitant prophylactic colposuspension [373]. Lee et al. assessed the value of pre-op UDS and BOOI in predicting the degree of OAB symptoms post anterior prolapse repair. They reported a significant correlation between low pre-op BOOI and improvement in OAB symptom scores post-op [374].

5. Prolapse reduction stress test (PRST)

Data concerning PRST were made available from the CARE trial where significant differences were noted in the detection of urodynamic stress incontinence with prolapse reduction among the various methods studied ranging from 6% (pessary) to 30% (speculum). Manual, swab and forceps showed detection rates of 16%, 20% and 21%, respectively [375]. In the study by Duecy about one third of women were diagnosed with occult SUI using a pessary while two thirds were diagnosed with manual reduction of the prolapse [376]. In a further study occult SUI was only detected by a pessary test in 19% of patients, not by urodynamics, history or clinical examination [377].

Evidence summary	**LE**
Women with prolapse + UI	
Surgery for POP + SUI shows a higher rate of cure in the short-term than POP surgery alone.	1a
There is conflicting evidence on the relative benefit of combined surgery long-term.	1b
Combined surgery for POP+SUI carries a higher risk of adverse events.	1b
Continent women with POP	
Are at risk of developing UI postoperatively.	1a

The addition of a prophylactic anti-incontinence procedure reduces the risk of postoperative UI.	1b
The addition of a prophylactic anti-incontinence procedure increases the risk of adverse events.	1b
Women with POP and OAB	
There is some low-level inconsistent evidence to suggest that surgical repair of POP can improve symptoms of OAB.	3
Women with prolapse and occult SUI	
Surgery for POP + occult SUI shows a higher rate of cure in the short-term than POP surgery alone.	1a
Combined surgery for POP + SUI carries a higher risk of adverse events than POP surgery alone.	1b

Recommendations for women requiring surgery for bothersome POP who have symptomatic or unmasked stress urinary incontinence	**GR**
Offer simultaneous surgery for POP and stress urinary incontinence.	A
Warn women of the increased risk of adverse events with combined surgery compared to prolapse surgery alone.	A
Recommendations for women requiring surgery for bothersome POP without symptomatic or unmasked stress urinary incontinence	**GR**
Warn women that there is a risk of developing de novo stress urinary incontinence after prolapse surgery.	A
Inform women that the benefit of prophylactic stress urinary incontinence surgery is uncertain.	C
Warn women that the benefit of surgery for stress urinary incontinence may be outweighed by the increased risk of adverse events with combined surgery compared to prolapse surgery alone.	A

POP = pelvic organ prolapse.
** based on expert opinion.*

*4.3.4 **Urethral diverticulum***

A female urethral diverticulum is a sac-like protrusion made up by the entire urethral wall or only by the urethralmucosa laying between the periurethral tissues and the anterior vaginal wall. Urethral diverticulum give rise to a variety of symptoms that include pain, urgency, frequency, recurrent UTIs, vaginal discharge, dispareunia, voiding difficulties or urinary incontinence.

1. In a woman with the clinical suspicion of having an urethral diverticulum, what is the best test to confirm the diagnosis?

No robust diagnosctic accuracy studies address this question However, a case series of 27 patients concluded that endoluminal (vaginal or rectal) MRI has better diagnostic accuracy than video cystourethrography VCUG [378]. In a case series of 60 subjects Pathi et al reported that the sensitivity, specificity, positive predictive value and negative predictive value of MRI is 100%, 83%, 92% and 100%, respectively [379]. Dwarkasing et al. also reports 100% specificity and sensitivity of MRI in a case series of 60 patients [380]. However, in a case series of 41 patients, a study reported 25% discrepancy between MRI and surgical findings [381].

2. In a woman who has a bothersome urethral diverticulum, what is the relative effectiveness of available surgical treatments?

4.3.4.1 Surgical treatment

No RCTs were found. Surgical removal is the most commonly reported treatment in contemporary cases series. However, recurrence may occur; Han et al. found a recurrence rate of 33% in U-shaped and of 60% in circumferential diverticulum within 1 year [382], Ingber et al. found a 10.7% recurrence rate in 122 women undergoing diverticulectomy, with a higher risk of recurrence in those with proximal or multiple diverticula or after previous pelvic surgery [383]. SUI may occur in up to 20% of women after diverticulectomy, requiring additional correction [384-387]. De novo SUI seems to be more common in proximal and in large size (>30 mm) diverticula.

Diverticula may undergo neoplastic alterations (6%) including invasive adenocarcinomas [388].

Evidence Statement	
MRI has good sensitivity and specificity for the diagnosis of urethral diverticula, however there is a risk of mis-diagnosis and missing potential intraluminal neoplastic change.	3
Surgical removal of symptomatic urethral diverticula provides good long-term results, however, women should be counselled of the risk of recurrence and de novo SUI.	3

Recommendation	GR
Symptomatic urethral diverticula should be completely surgically removed.	A*

*4.3.5 **Men with stress urinary incontinence***

4.3.5.1 Bulking agents in men

Injection of bulking agents has been used to try and improve the coaptation of a damaged sphincter zone. Initial reports showed limited efficacy in treating incontinence following radical prostatectomy incontinence [389, 390].

4.3.5.1.1 Question

In men with post-prostatectomy incontinence or SUI, does injection of a urethral bulking agent cure SUI, improve QoL, or cause adverse outcomes?

4.3.5.1.2 Evidence

Most studies are case series with small sample sizes. Small cohort studies showed a lack of benefit using a number of different materials [391, 392]. However, polyacrylamide hydrogel resulted in limited improvement in QoL without curing the UI [391]. A Cochrane review on the surgical treatment of post-prostatectomy incontinence found only one study that fulfilled the inclusion criteria [393]. A prospective, randomised study compared the AUS to silicon particles (Macroplastique™) in 45 patients. Eighty-two per cent of patients receiving an AUS were continent compared to 46% receiving silicone particles. In patients with severe incontinence, outcome was significantly worse after silicon bulking injection.

Evidence summary	LE
There is no evidence that bulking agents cure post-prostatectomy incontinence.	2a
There is weak evidence that bulking agents can offer temporary, short-term, improvement in QoL in men with post-prostatectomy incontinence.	3
There is no evidence that one bulking agent is superior to another.	3

4.3.5.2 Fixed male sling

As well as external compression devices and bulking agents, slings have been introduced to treat postprostatectomy incontinence. Fixed slings are positioned under the urethra and fixed by a retropubic or transobturator approach. The tension is adjusted during the surgery and cannot be re-adjusted postoperatively.

For the restoration of continence by these male slings, two concepts are now being proposed:

- continence restoration by urethral compression (InVance®, Istop TOMS, Argus®)
- continence restoration by repositioning the bulb of urethra (AdVance) [394].

In principle, the AUS can be used for all degrees of post-prostatectomy incontinence, while male slings are advocated for mild-to-moderate UI. However, the definitions of mild and moderate UI are not clear. The definition of cure, used in most studies, was no pad use or one security pad per 24 hours. Some authors used a stricter criterion of less than 2 g urine loss in a 24-hour pad test [395].

4.3.5.2.1 Question

In men with post-prostatectomy SUI, does insertion of a fixed suburethral sling cure SUI, improve QoL, or cause adverse outcomes?

4.3.5.2.2 Evidence

Concerning the surgical treatment of post-prostatectomy incontinence, three recent literature reviews are available [396-398]. There are a large number of uncontrolled case series concerning men implanted with several types of slings [399, 400].

For the repositioning sling (AdVance), the benefit after a mean follow-up of 3 years has been published on 136 patients [401]. Earlier data were available from other cohort studies, totalling at least 614 patients with a mean follow-up of between 3 months and 3 years. Subjective cure rates for the device vary between 8.6% and 73.7%, with a mean of 49.5%. Radiotherapy was a negative prognostic factor [399]. Postoperative voiding dysfunction occurred in 5.7-1.3%, while erosions and chronic pain were uncommon (0-0.4%) [395, 401-403]. The overall failure rate was about 20%.

The previously available “InVance®” device has now been removed from the market in some countries.

Evidence summary	LE
There is limited short-term evidence that fixed male slings cure or improve post-prostatectomy incontinence in patients with mild-to-moderate incontinence.	3
Men with severe incontinence, previous radiotherapy or urethral stricture surgery may have less benefit from fixed male slings.	3
There is no evidence that one type of male sling is better than another.	3

4.3.5.3 Adjustable slings in males

Adjustability in male sling surgery attempts to adjust the tension of the sling postoperatively. Three main systems have been used in men: the Remeex® system, the Argus® system and the ATOMS system.

4.3.5.3.1 Question

In men with post-prostatectomy incontinence or SUI, does insertion of an adjustable suburethral sling cure or improve SUI, improve QoL, or cause adverse outcomes?

4.3.5.3.2 Evidence

There are no prospective RCTs. Most studies consist of prospective or retrospective case series, with variable follow-up and different definitions of success. Some have been published only as conference abstracts.

Remeex® system

For the Remeex® system, only two abstracts, with conflicting findings, have been published. One study followed 19 patients for nearly 7 years and reported 70% success, with no explants, infections or erosions. The second study followed 14 patients for 25 months. Only 36% of patients were satisfied and multiple re-adjustments were needed. Mechanical failure was reported in 21% [404].

Argus® system

Data on the Argus® system have been reported for 404 men, but only four series have reported on more than 50 patients [405, 406], with the longest follow-up being 2.4 years. Success rates varied between 17% and 91.6%, with a mean of 57.6% predominantly reporting a subjective cure. The number of implants requiring re-adjustment was reported as between 22.9% and 41.5% [406]. Infection of the device occurred in 5.4- 8% [405]. Erosions were reported in 5-10% [407]. Urethral perforations occurred in 2.7-16% [405]. Pain at the implant site was usually only temporary, but chronic pain has been reported [405, 407]. These complications resulted in explantation rates of 10-15% [406].

The ATOMS system consists of a mesh implant with an integrated adjustable cushion, which uses a titanium port left in the subcutaneous tissue of the lower abdomen for adjustment of cushion volume. Initial reports show objective cure rates of 60.5% and improvement rates of 23.7% but with the need for up to nine postoperative adjustments [408, 409].

Evidence summary	LE
There is limited evidence that adjustable male slings can cure or improve SUI in men.	3
There is limited evidence that early explantation rates are high.	3
There is no evidence that adjustability of the male sling offers additional benefit over other types of sling.	3

4.3.5.4 Compression devices in males

External compression devices can be divided into two types: circumferential and non-circumferential compression of the urethral lumen [396]. The artificial urinary sphincter (AUS) is the standard treatment for moderate-to-severe male SUI. Most data available on the efficacy and adverse effects of AUS implantation are from older retrospective cohort studies with RCTs not performed due to the lack of a comparator. Men considering insertion of an AUS should understand that if the ability of an individual to operate the pump is uncertain, it may not be appropriate to implant an AUS. There are several recognised complications of AUS implantation, e.g. mechanical dysfunction, urethral constriction by fibrous tissue, erosion and infection. The non-circumferential compression devices consist of two balloons placed close to the vesico-urethral anastomotic site. The balloons can be filled and their volume can be adjusted postoperatively through an intrascrotal port.

4.3.5.4.1 Question

In men with post-prostatectomy SUI, does insertion of an external compression device cure SUI, improve QoL,or cause adverse outcomes?

4.3.5.4.2 Evidence

Artificial urinary sphincter

Although the AUS is considered to be the standard treatment for men with SUI, there are two systematic reviews [393, 398] presenting limited evidence, of generally poor quality, except for one RCT comparing with bulking agents [389]. A continence rate of about 80% can be expected, while this may be lower in men who have undergone pelvic radiotherapy [396].

Trigo Rocha et al. published a prospective cohort study on 40 patients with a mean follow-up of 53 months, showing that from all urodynamic parameters, only low bladder compliance had a negative impact on the outcome [410]. Another retrospective study showed that no urodynamic factors adversely altered the outcome of AUS implantation [411].

The transcorporeal technique of placement can be used for repeat surgery but evidence of effectiveness is lacking [412]. The dual-cuff placement was introduced to treat patients who remained incontinent with a single 4 cm cuff in place. However, it has not improved control of UI, while the availability of a 3.5 cm cuff may have eliminated the need for a dual cuff [413, 414]. Patients who experienced complete continence after AUS implantation had a higher erosion risk [415]. One small series reported results of AUS implantation after failure of previous Advance sling, showing no difference in efficacy between secondary and primary implantation [416].

Non-circumferential compression device (ProAct®)

There have been trials to treat post-prostatectomy SUI by insertion of a device consisting of balloons with adjustable volume external to the proximal bulbar urethra. A prospective cohort study (n = 128) described the functional outcome as 'good' in 68%, while 18% of the devices had to be explanted [417]. A subgroup of radiotherapy patients only had 46% success and a higher percentage of urethral erosions.

A quasi-randomised trial comparing a non-circumferential compression device (ProAct®) with bone-anchored male slings found that both types of device resulted in similar improvement of SUI (68% vs. 65%, respectively) [418]. Other prospective series have shown that adverse events were frequent, leading to an explantation rate of 11-58% [398, 419-422]. A questionnaire study showed that 50% of patients were still bothered significantly by persistent incontinence [423].

Other designs of artifical sphincter remain the subject of ongoing evaluation though may have been introduced onto the market.

Evidence summary	**LE**
There is limited evidence that primary AUS implantation is effective for cure of SUI in men.	2b
Long-term failure rate for AUS is high although device replacement can be performed.	3
There are conflicting data on whether previous pelvic radiotherapy affects the outcome of AUS implantation.	3
Men who develop cognitive impairment or lose manual dexterity will have difficulty operating an AUS.	3
The usefulness of tandem-cuff placement is uncertain.	3
There is insufficient evidence to state whether one surgical approach for cuff placement is superior to another.	3
Very limited short-term evidence suggests that the non-circumferential compression device (ProACT®) is effective for treatment of post-prostatectomy SUI.	3
The non-circumferential compression device (ProACT®) is associated with a high failure and complication rate leading to frequent explantation.	3
The rate of explantation of the AUS because of infection or erosion remains high (up to 24% in some series).	3
Mechanical failure is common with the AUS.	3
Revision and reimplantation of AUS is possible after previous explantation or for mechanical failure.	3

Recommendations for surgery in men with stress urinary incontinence	**GR**
Only offer bulking agents to men with mild post-prostatectomy incontinence who desire temporary relief of incontinence symptoms.	C
Do not offer bulking agents to men with severe post-prostatectomy incontinence.	C
Offer fixed slings to men with mild-to-moderate * post-prostatectomy incontinence.	B
Warn men that severe incontinence, prior pelvic radiotherapy or urethral stricture surgery, may worsen the outcome of fixed male sling surgery.	C

Offer AUS to men with moderate-to-severe post-prostatectomy incontinence.	B
Implantation of AUS or ACT for men should only be offered in expert centres.	C
Warn men receiving AUS or ACT that, even in expert centres, there is a high risk of complications, mechanical failure or a need for explantation.	C
Do not offer non-circumferential compression device (ProACT®) to men who have had pelvic radiotherapy.	C

AUS = artificial urinary sphincter; ACT = artificial compression device.
** the terms mild and moderate post prostatectomy incontinence remain undefined.*

*4.3.6 **Surgical interventions for refractory detrusor-overactivity***

4.3.6.1 Bladder wall injection of botulinum toxin A

Onabotulinum toxin A (onabotA; BOTOX®) 100 U dissolved in 10 ml of saline and injected in 20 points of the bladder wall above the trigone (0.5 ml per injection site) is licenced in Europe to treat OAB with persistent or refractory UUI in adults of both gender, despite the small number of males included in the registration trials [424, 425]. Surgeons must realise that other doses of onabotA and other formulations of botulinum toxin A, abobotulinum toxinA and incobotulinum toxin A, are not licensed for use in UUI. Doses for OnabotA are not transposable to the other brands of botulinum toxin A. The continued efficacy of repeat injections is the rule but discontinuation rate may be high. The most important adverse events related to onabotA 100 U injection detected in the regulatory trials were UTI and an increase in PVR that may require clean intermittent catheterisation (CIC) [426].

4.3.6.1.1 Question

In adults with UUI, is bladder wall injection of onabotA better than no treatment for cure or improvement?

4.3.6.1.2 Evidence

Following a dose ranging study in which the 100U of onabotA was established as the ideal dose, two phase III trials randomised (1:1) 1105 OAB incontinent patients whose symptoms were not adequately managed with anticholinergics to receive bladder wall injections of onabotA (100 U) or saline. At baseline the population had in average more than 5 episodes of UUI, around 12 micturitions per day and small PVR. At week 12, in patients treated with onabotA UUI episodes/day were halved and number of micturitions/day reduced by more than 2. A total of 22.9% of the patients in the onabotA arm were fully dry, against 6.5% in the saline arm [427].

QoL was substantially improved in the onabotA arm, as shown by the more than 60% of positive responses in the TBS questionnaire at week 12, which doubled the positive responses in the saline arm. Cohort studies have shown the effectiveness of bladder wall injections of onabotA in the elderly and frail elderly [428], though the success rate might be lower and the PVR (> 150 mL) higher in this group.

A recent RCT compared onabotA injection 100 U to solifenacin (with dose escalation or switch to trospium possible in the solifenacin group) and showed a similar rates of improvement in UUI over the course of 6 months [429]. Patients receiving onabotA were more likely to have cure of UUI (27% vs. 13%, p = 0.003), but also had higher rates of urinary retention during the initial 2 months (5% vs. 0%) and of UTIs (33% vs. 13%). Patients taking antimuscarinics were more likely to have dry mouth.

Evidence summary	**LE**
A single treatment session ofl onabotulinum toxin A (100U) injected in the bladder wall is more effective than placebo at curing and improving UUI and QoL for up to 12 months.	1a
There is no evidence that repeated injections of onabotulinum toxin A have reduced efficacy.	3
There is a high risk of increased PVR when injecting elderly frail patients.	3
The risk of bacteruria after onabotulinum toxin A (100U) injection is high but the clinical significance of this remains uncertain.	1b
Onabotulinum toxin A 100 U is superior to solifenacin for cure of UUI.	1a
Long-term treatment with of onabotulinum toxin A may be associated with a high discontinuation rate.	2

Recommendations	**GR**
Offer bladder wall injections of onabotulinum toxin A (100 units) to patients with urgency urinary incontinence refractory to antimuscarinic therapy.	A
Warn patients of the limited duration of response, risk of UTI and the possible prolonged need to selfcatheterise (ensure that they are willing and able to do so) and risk of UTI.	A

UTI = urinary tract infection.

4.3.6.2 Sacral nerve stimulation (neuromodulation)

In the first stage of a two-stage implantation, an electrode is placed percutaneously under fluoroscopic control in the sacral foramen alongside a sacral nerve, usually S3. In earlier techniques, a temporary wire electrode was used. More recently, a permanent tined electrode has been used for a longer test phase. Patients, in whom selected symptoms of UUI are reduced by more than 50% during the test phase, are candidates for the full implant, including the pulse generator.

4.3.6.2.1 Question

In adults suffering from refractory UUI, what is the clinical effectiveness of sacral nerve neuromodulation compared to alternative treatments?

4.3.6.2.2 Evidence

All randomised studies suffer from the limitation that assessors and patients were not blind to the treatment allocation since all recruited subjects had to respond to a test phase before randomisation. A Cochrane review of the literature until March 2008 [430] identified three RCTs that investigated sacral nerve stimulation in patients with refractory UUI.

One study compared implantation to controls who stayed on medical treatment and received delayed implantation at 6 months. Fifty percent of the immediately implanted group had > 90% improvement in UUI at 6 months compared to 1.6% of the control group [222]. The other RCT [431] achieved similar results, although these patients had already been included in the first report [222]. However, Weil et al. [431] showed that the effect on generic QoL measured by the SF-36, was unclear as it differed between the groups in only one of the eight dimensions.

The results of 17 case series of patients with UUI, who were treated early in the experience with sacral nerve stimulation were reviewed [432]. After a follow-up duration of between 1 and 3 years, approximately 50% of patients with UUI demonstrated > 90% reduction in UI, 25% demonstrated 50-90% improvement, and another 25% demonstrated < 50% improvement. Two case series describing the outcome of sacral nerve neuromodulation, with a mean or median follow-up of at least 4 years [433, 434] reported continued success (> 50% improvement on original symptoms) by about 50 of patients available for follow-up. Cure rates for UUI were 15% [434].

Adverse events occurred in 50% of implanted cases, with surgical revision necessary in 33-41% [433, 434].

In a subanalysis of the RCT, the outcomes of UUI patients, with or without pre-implant DO, were compared. Similar success rates were found in patients with and without urodynamic DO [435].

Evidence summary	**LE**
Sacral nerve neuromodulation is more effective than continuation of failed conservative treatment for cure of UUI, but no sham controls have been used.	1b
In those patients who have been implanted, at longterm 50% improvement of UUI is maintained in at least 50% of patients and 15% may remain cured.	3
One-stage implantation. The use of tined, permanent electrodes results in more patients receiving the final implant than occurs with temporary test stimulation.	4

Recommendation	**GR**
If available, offer sacral nerve modulation to patients who have urgency urinary incontinence refractory to conservative therapy.	A

4.3.6.3 Cystoplasty/urinary diversion

4.3.6.3.1 Augmentation cystoplasty

In augmentation cystoplasty (also known as clam cystoplasty), a detubularised segment of bowel is inserted into the bivalved bladder wall. The distal ileum is the bowel segment most often used but any bowel segment can be used if it has the appropriate mesenteric length. One study did not find any difference between bivalving the bladder in the sagittal or in the coronal plane [436, 437].

There are no RCTs comparing bladder augmentation to other treatments for patients with UUI. Most often, bladder augmentation is used to correct neurogenic DO or small-capacity, low-compliant, bladders caused by fibrosis, tuberculosis, radiation or chronic infection.

The largest case series of bladder augmentation in a mixed population of ideopathic and neurogenic UUI included 51 women [438]. At an average follow-up of 74.5 months, only 53% were continent and satisfied with the surgery, whereas 25% had occasional leaks and 18% continued to have disabling UUI. It seems that the results for patients with idiopathic DO (58%) seemed to be less satisfactory than for patients with neurogenic UUI (90%).
Adverse effects were common and have been summarised in a review over 5-17 years of more than 267 cases, 61 of whom had non-neurogenic UUI [439]. In addition, many patients may require clean intermittent selfcatheterisation to obtain adequate bladder emptying (Table 7).

Table 7: Complications of bladder augmentation

Short-term complications	**Affected patients (%)**
Bowel obstruction	2
Infection	1.5
Thromboembolism	1
Bleeding	0.75
Fistula	0.4
Long-term complications	**Affected patients (%)**
Clean intermittent self-catheterisation	38
Urinary tract infection	70% asymptomatic; 20% symptomatic
Urinary tract stones	13
Metabolic disturbance	16
Deterioration in renal function	2
Bladder perforation	0.75
Change in bowel symptoms	25

4.3.6.3.2 Detrusor myectomy (bladder auto-augmentation)
Detrusor myectomy aims to increase bladder capacity and reduce storage pressures by incising or excising a portion of the detrusor muscle, to create a bladder mucosal 'bulge' or pseudodiverticulum. It was initially described as an alternative to bladder augmentation in children [440]. Two case series [441, 442], in adult patients with idiopathic and neurogenic bladder dysfunction, demonstrated poor long-term results caused by fibrosis of the peudodiverticulum This technique is rarely if ever used nowadays.

4.3.6.3.3 Urinary diversion
Urinary diversion remains a reconstructive option for patients, who decline repeated surgery for UI. However, there are no studies that have specifically examined this technique in the treatment of non-neurogenic UI [436].

Evidence summary summary	**LE**
There is limited evidence on the effectiveness of augmentation cystoplasty and urinary diversion in treatment of idiopathic DO.	3
Augmentation cystoplasty and urinary diversion are associated with high risks of short-term and long-term severe complications.	3
The need to perform clean intermittent self-catheterisation following augmentation cystoplasty is very common.	3
There is no evidence comparing the efficacy or adverse effects of augmentation cystoplasty with urinary diversion.	3
Detrusor myectomy is ineffective in adults with UI.	3

Recommendations	**GR**
Only offer augmentation cystoplasty to patients with detrusor overactivity incontinence who have failed conservative therapy, in whom the possibility of botulinum toxin and sacral nerve stimulation has been discussed.	C
Warn patients undergoing augmentation cystoplasty of the high risk of having to perform clean intermittent self-catheterisation; ensure they are willing and able to do so.	C
Do not offer detrusor myectomy as a treatment for urinary incontinence.	C
Only offer urinary diversion to patients who have failed less invasive therapies for the treatment of urinary incontinence and who will accept a stoma.	C

Warn patients undergoing augmentation cystoplasty or urinary diversion of the high risk of short-term and long-term complications, and the possible small risk of malignancy.	C
Life-long follow-up is recommended for patients who have undergone augmentation cystoplasty or urinary diversion.	C

*4.3.7 **Surgery in patients with mixed urinary incontinence***

4.3.7.1 Question

In adults with MUI, is the outcome of surgery different to that obtained with the same treatment in patients with either pure SUI or pure UUI?

4.3.7.2 Evidence

Many RCTs include both patients with pure SUI or pure UUI and patients with MUI. However, very few RCTs report separate outcomes for MUI and pure UI groups.

Transvaginal obturator tape

In an RCT including 96 women with MUI, objective improvement was better for patients treated with transvaginal obturator tape + the Ingelman Sundberg operation versus patients treated with obturator tape alone [443].

Post-hoc analysis of the SISTER trial showed that in women undergoing either autologous fascial sling or Burch colposuspension, the outcomes were poorer for women with a concomitant complaint of pre-operative urgency [72]. A similar post-hoc review of another RCT comparing transobturator and retropubic mid-urethral slings showed that the greater the severity of pre-operative urgency the more likely that treatment would fail [85]. However, an earlier study had found that surgery provided similar outcomes, whether or not urgency was present prior to surgery (this study included only a few patients with urodynamic DO).

Case series tend to show poorer results in patients with MUI compared with those with pure SUI. In a case series of 192 women undergoing mid-urethral sling insertion, overall satisfaction rates were lower for women with mixed symptoms and detrusor overactivity on pre-operative urodynamics compared to those with pure SUI and normal urodynamics (75% vs. 98%, respectively) [444]. Comparison of two parallel cohorts of patients undergoing surgery for SUI, with and without DO, found inferior outcomes in women with MUI [445].

One cohort of 450 women, found that In urgency-predominant MUI, the success rate fell to 52% compared to 80% in stress-predominant MUI [446]. In a study with 1113 women treated with transvaginal obturator tape, SUI was cured equally in stress-predominant MUI or urgency-predominant MUI. However, women with stress-predominant MUI were found to have significantly better overall outcomes than women with urgency-predominant MUI [447].

Overall, the outcome for women with pre-existing urgency incontinence remains uncertain.

Evidence summary	**LE**
Women with MUI are less likely to be cured of their incontinence by SUI surgery than women with SUI alone.	1c
The response of pre-existing urgency symptoms to SUI surgery is unpredictable and symptoms may improve or worsen.	3

Recommendations	**GR**
Treat the most bothersome symptom first in patients with mixed urinary incontinence.	C
Warn patients with mixed urinary incontinence that surgery is less likely to be successful than surgery in patients with stress urinary incontinence alone.	A
Warn patients with mixed urinary incontinence that one single treatment may not cure UI; it may be necessary to treat other components of the incontinence problem as well as the most bothersome symptom.	A*

** upgraded following panel consensus.*

*4.3.8 **Surgery for urinary incontinence in the elderly***

There are no RCTs comparing surgical treatment in older versus younger women although subgroup analyses of some RCTs have included a comparison of older with younger cohorts.

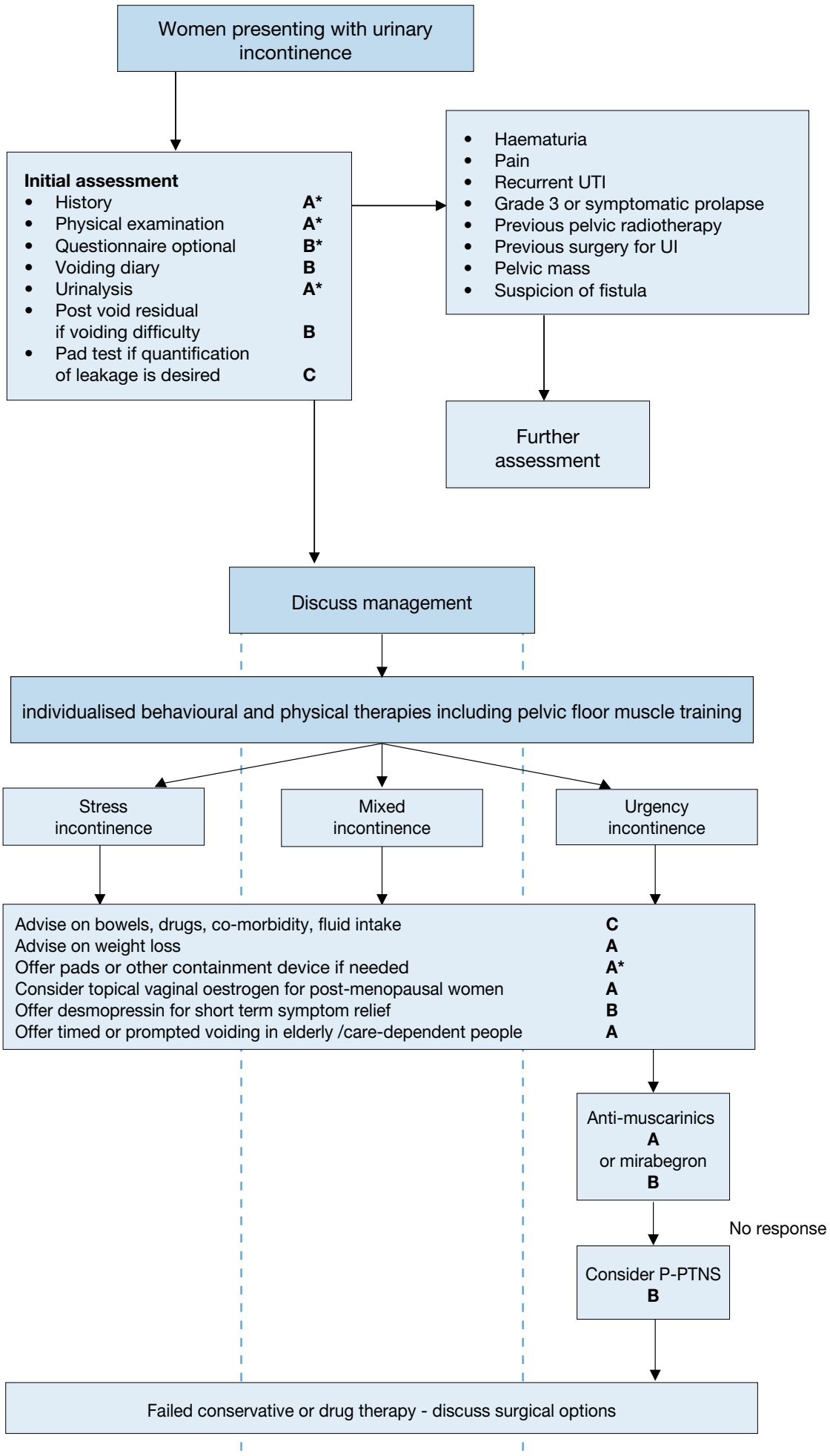
An RCT of 537 women comparing retropubic to transobturator tape, showed that cure rates decreased and failure increased with each decade over the age of 50 [448]. An RCT assessing risk factors for failure of tension free vaginal tape (TVT) versus transobturator tension-free vaginal tape (TVT-O) in 162 women found that age is a specific risk factor (adjusted OR 1.7 per decade) for recurrence at 1 year [326]. In a subanalysis of the SISTER trial cohort of 655 women at 2 years of follow-up, it was shown that elderly women were more likely to have a positive stress test at follow-up (OR 3.7, 95% CI 1.7-7.97), are less likely to report objective or subjective improvement in stress and urgency UI, and are more likely to undergo retreatment for SUI (OR 3.9, 95% CI 1.3-11.48). There was no difference in time to normal postoperative voiding [72].

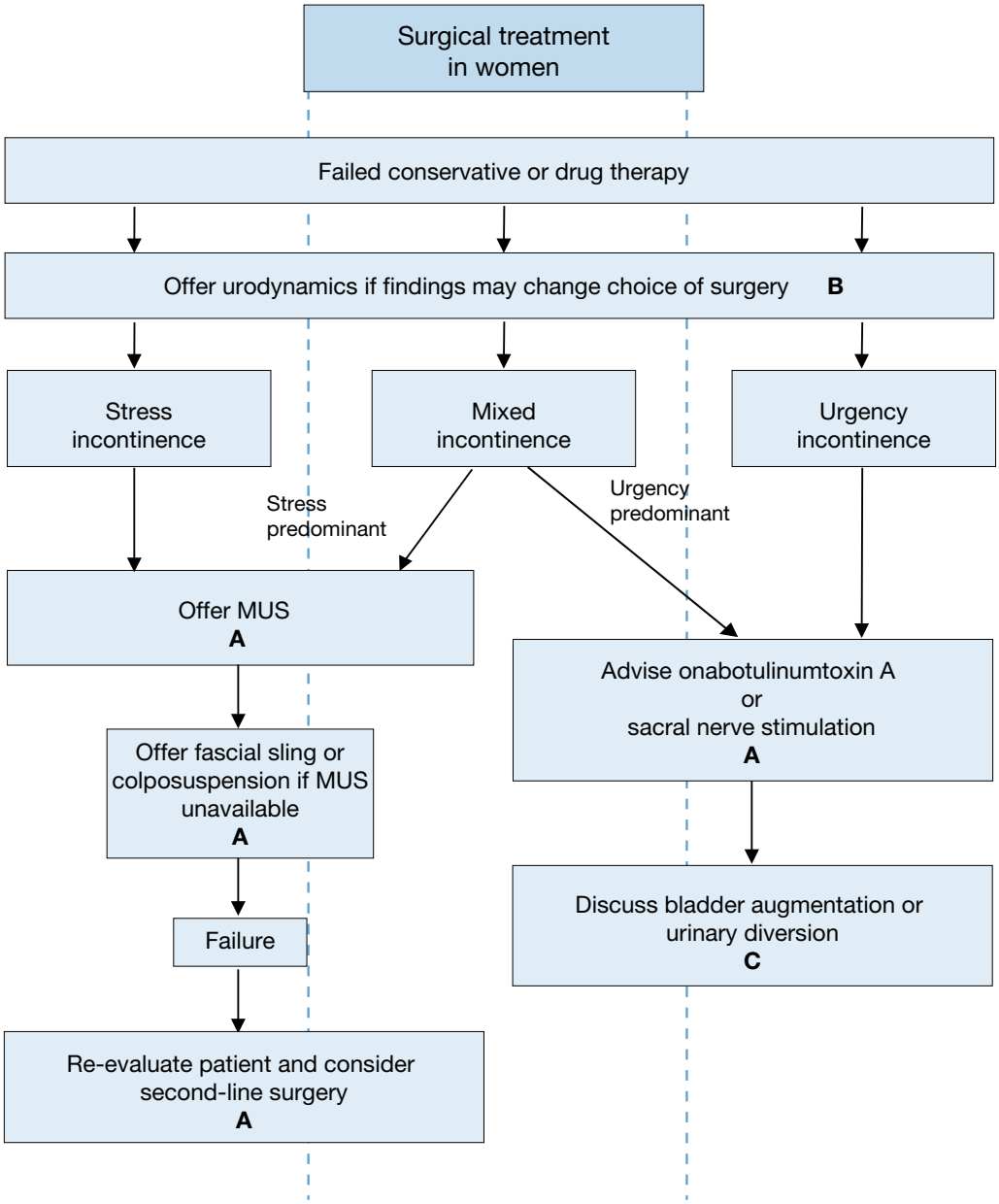
Another RCT compared immediate TVT versus delayed TVT in older women, confirming significant efficacy for the operated women, but the cohort as a whole suffered higher complication rates, particularly bladder perforation (22%) and urinary retention (13%) [327].

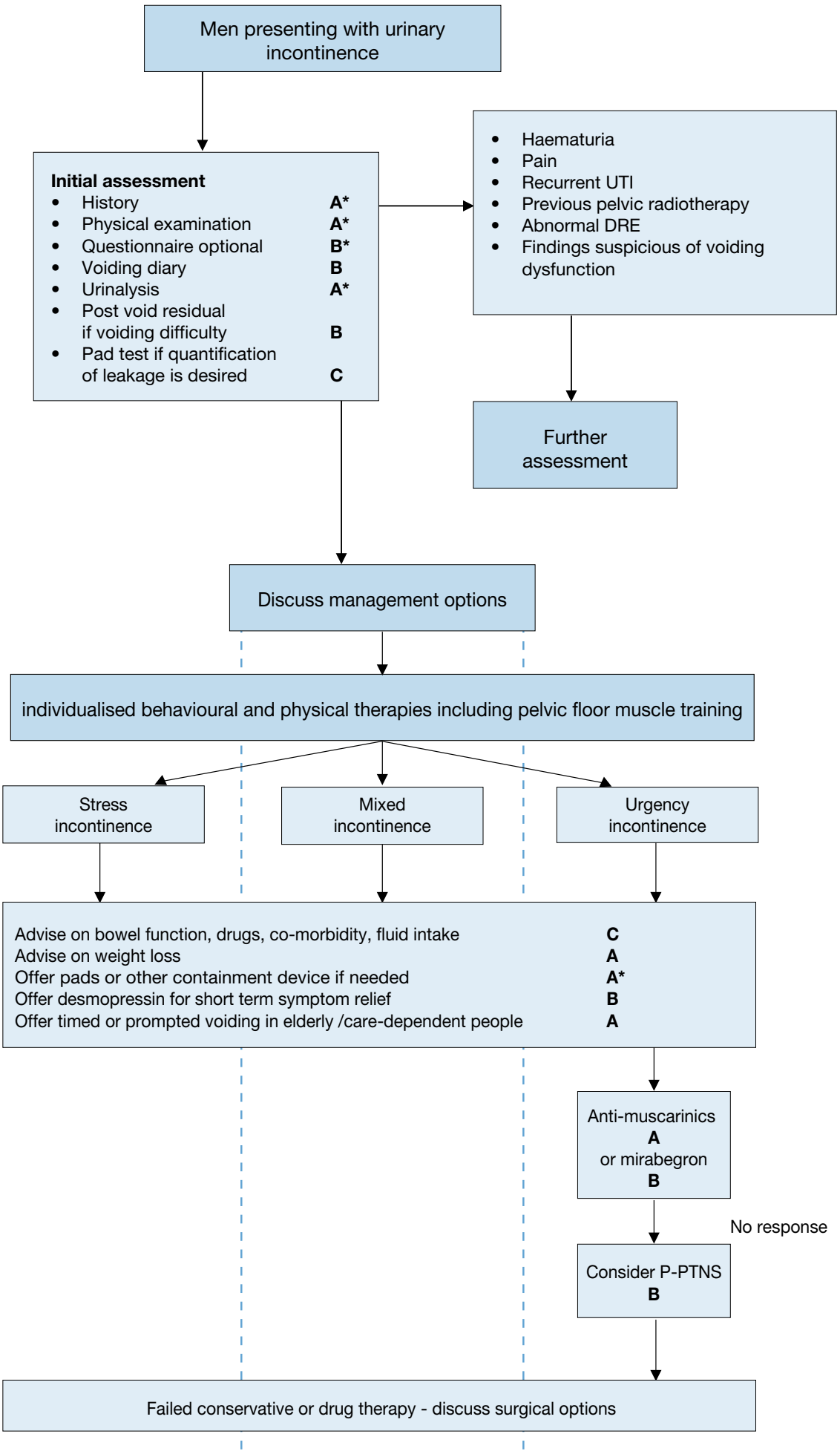
A cohort study of 256 women undergoing inside-out TVT-O reported similar efficacy in older versus younger women but there was a higher risk of de novo urgency in older patients [328].
Cohort studies have shown the effectiveness of onabotulinum toxin A injections in the elderly and frail elderly [428, 449], although a comparison of cohort groups suggests that there is a lower success rate in the frail elderly and also a higher rate of increased PVR (> 150 mL) in this group.

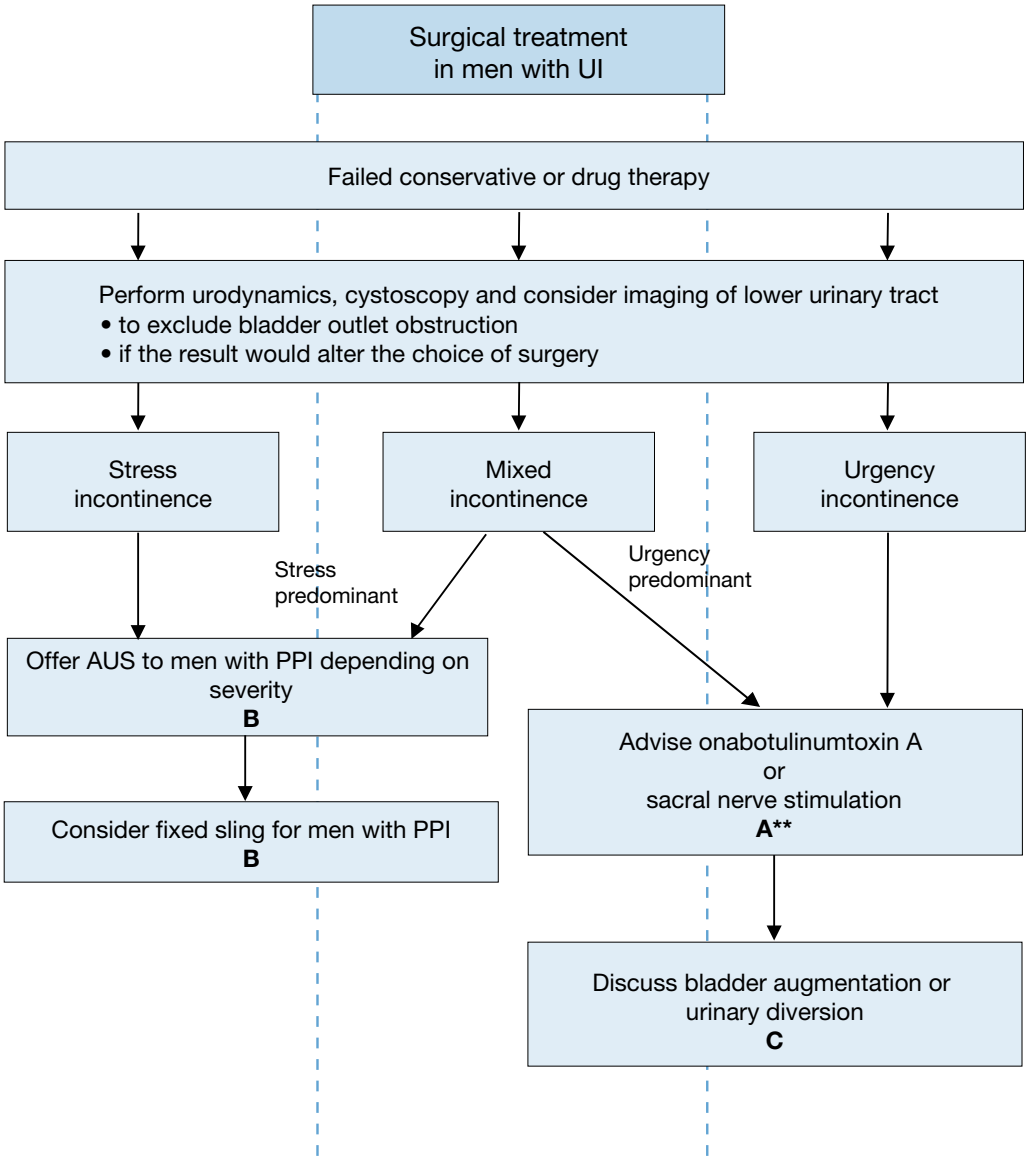
Evidence summary	**LE**
Older women benefit from surgical treatment for incontinence.	1
The risk of failure from surgical repair of SUI, or of suffering adverse events, appears to increase with age.	2
There is no evidence that any surgical procedure has greater efficacy or safety in older women than another procedure.	4

Recommendation	**GR**
Inform older women with urinary incontinence about the increased risks associated with surgery, (including onabotA injection), together with the lower probability of benefit.	B


Women presenting with urinary incontinence
Initial assessment
History A*
Physical examination A*
Questionnaire optional B*
Voiding diary B
Urinalysis A*
Post void residual if voiding difficulty B
Pad test if quantification of leakage is desired C
Haematuria
Pain
Recurrent UTI
Grade 3 or symptomatic prolapse
Previous pelvic radiotherapy
Previous surgery for UI
Pelvic mass
Suspicion of fistula
Further assessment
Discuss management
individualised behavioural and physical therapies including pelvic floor muscle training
Stress incontinence
Mixed incontinence
Urgency incontinence
Advise on bowels, drugs, co-morbidity, fluid intake C
Advise on weight loss A
Offer pads or other containment device if needed A*
Consider topical vaginal oestrogen for post-menopausal women A
Offer desmopressin for short term symptom relief B
Offer timed or prompted voiding in elderly /care-dependent people A
Anti-muscarinics A or mirabegron B
No response
Consider P-PTNS B
Failed conservative or drug therapy - discuss surgical options


Surgical treatment in women
Failed conservative or drug therapy
Offer urodynamics if findings may change choice of surgery B
Stress incontinence
Mixed incontinence
Urgency incontinence
Stress predominant
Urgency predominant
Offer MUS A
Offer fascial sling or colposuspension if MUS unavailable A
Failure
Re-evaluate patient and consider second-line surgery A
Advise onabotulinumtoxin A or sacral nerve stimulation A
Discuss bladder augmentation or urinary diversion C


Men presenting with urinary incontinence
Initial assessment
History A*
Physical examination A*
Questionnaire optional B*
Voiding diary B
Urinalysis A*
Post void residual if voiding difficulty B
Pad test if quantification of leakage is desired C
Haematuria
Pain
Recurrent UTI
Previous pelvic radiotherapy
Abnormal DRE
Findings suspicious of voiding dysfunction
Further assessment
Discuss management options
individualised behavioural and physical therapies including pelvic floor muscle training
Stress incontinence
Mixed incontinence
Urgency incontinence
Advise on bowel function, drugs, co-morbidity, fluid intake C
Advise on weight loss A
Offer pads or other containment device if needed A*
Offer desmopressin for short term symptom relief B
Offer timed or prompted voiding in elderly /care-dependent people A
Anti-muscarinics A or mirabegron B
No response
Consider P-PTNS B
Failed conservative or drug therapy - discuss surgical options



** *Available evidence on onabutulinumtoxinA and sacral nerve stimulation refers mainly to women.*

5. REFERENCES

1. Abrams P, et al., 5th International Consultation on Incontinence 2013. Paris February 2012.
2. Stohrer M, et al. EAU guidelines on neurogenic lower urinary tract dysfunction. Eur Urol 2009 56(1): p. 81-8.
3. Tekgül S, et al., EAU Guidelines on Paediatric Urology. In: EAU Guidelines, edition presented at the 28th EAU Annual Congress, Milan 2013. ISBN 978-90-79754-71-7.
4. Lucas MG, et al. EAU guidelines on surgical treatment of urinary incontinence. Eur Urol 2012 62(6): p. 1118-29.
5. Lucas MG, et al. EAU guidelines on assessment and nonsurgical management of urinary incontinence. European Urology 2012 62(6): p. 1130-1142.
6. Higgins J, et al., Cochrane Handbook for Systematic Reviews of Interventions 5.1.0 (updated March 2011).
7. Richardson WS, et al. The well-built clinical question: a key to evidence-based decisions. ACP J Club 1995 123(3): p. A12-3. [no abstract]
8. Kelleher R, et al., Committee 5B. Patient reported outcome assessment. In: Abrams P, Cardozo L, Khoury S, et al. 5th International Consultation on Incontinence, Paris February 2012.
9. Farrell SA, et al. Women's ability to assess their urinary incontinence type using the QUID as an educational tool. Int Urogynecol J. 2013 24(5):759-62.
10. Hess R, et al. Long-term efficacy and safety of questionnaire-based initiation of urgency urinary incontinence treatment. Am J Obstet Gynecol. 2013 209(3):244.e1-9.
11. Reis RB, et al. Lack of association between the ICIQ-SF questionnaire and the urodynamic diagnosis in men with post radical prostatectomy incontinence. Acta Cir Bras. 2013 28 Suppl 1:37-42.
12. Chan SSC, et al. Responsiveness of the Pelvic Floor Distress Inventory and Pelvic Floor Impact Questionnaire in women undergoing treatment for pelvic floor disorders. Int Urogynecol J. 2013 24(2):213-21
13. Kim J, et al. Is there a relationship between incontinence impact questionnaire 7 score after surgery for stress urinary incontinence and patient-perceived satisfaction and improvement? Neurourol Urodyn 2013 32(2) p. 108-109
14. Tran MGB, et al. Prospective assessment of patient reported outcome measurements (PROMs) in male stress incontinence (MSI) surgery. BJU Int 2013 111 Suppl 3 p. 59-60. [abstract]
15. Shy M, et al. Objective Evaluation of Overactive Bladder: Which Surveys Should I Use? 2013 8:1 p. 45-50 Curr Bladder Dysfunct Rep. 2013 1;8(1):45-50.
16. Abrams P, et al. The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. Neurourol Urodyn 2002 21(2): p. 167-78.
17. Haylen BT, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint terminology and classification of the complications related directly to the insertion of prostheses (meshes, implants, tapes) and grafts in female pelvic floor surgery. Neurourol Urodyn 2011 30(1): p. 2-12.
18. Guan ZC, et al. [Development of remote wireless mobile voiding diary and a report of its objective voiding in 20 young people]. Beijing Da Xue Xue Bao 2010 42(4): p. 476-9.
19. Quinn P, et al. Assessment of an electronic daily diary in patients with overactive bladder. BJU Int 2003 91(7): p. 647-52.
20. Rabin JM, et al. Computerized voiding diary. Neurourol Urodyn 1993 12(6): p. 541-53; discussion 553-4.
21. Rabin JM, et al. A computerized voiding diary. J Reprod Med 1996 41(11): p. 801-6.
22. Rabin JM, et al. "Compu-Void II": the computerized voiding diary. J Med Syst 1996 20(1): p. 19-34.
23. Brown JS, et al. Measurement characteristics of a voiding diary for use by men and women with overactive bladder. Urology 2003 61(4): p. 802-9.
24. Gordon D, et al. Evaluation of female lower urinary tract symptoms: overview and update. Curr Opin Obstet Gynecol 2001 13(5): p. 521-7.
25. Homma Y, et al. Voiding and incontinence frequencies: variability of diary data and required diary length. Neurourol Urodyn 2002 21(3): p. 204-9.
26. Ku JH, et al. Voiding diary for the evaluation of urinary incontinence and lower urinary tract symptoms: prospective assessment of patient compliance and burden. Neurourol Urodyn 2004 23(4): p. 331-5.
27. Locher JL, et al. Reliability assessment of the bladder diary for urinary incontinence in older women. J Gerontol A Biol Sci Med Sci 2001 56(1): p. M32-5.
28. Nygaard I, et al. Reproducibility of the seven-day voiding diary in women with stress urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct 2000 11(1): p. 15-7.
29. Ertberg P, et al. A comparison of three methods to evaluate maximum bladder capacity: cystometry, uroflowmetry and a 24-h voiding diary in women with urinary incontinence. Acta Obstet Gynecol Scand 2003 82(4): p. 374-7.
30. Fitzgerald MP, et al. Variability of 24-hour voiding diary variables among asymptomatic women. J Urol 2003 169(1): p. 207-9.

31. Fayyad AM, et al. Urine production and bladder diary measurements in women with type 2 diabetes mellitus and their relation to lower urinary tract symptoms and voiding dysfunction. Neurourol Urodyn 2010 29(3): p. 354-8.
32. Homma Y, et al. Assessment of overactive bladder symptoms: comparison of 3-day bladder diary and the overactive bladder symptoms score. Urology 2011 77(1): p. 60-4.
33. Stav K, et al. Women overestimate daytime urinary frequency: the importance of the bladder diary. J Urol 2009 181(5): p. 2176-80.
34. van Brummen HJ, et al. The association between overactive bladder symptoms and objective parameters from bladder diary and filling cystometry. Neurourol Urodyn 2004 23(1): p. 38-42.
35. Grabe M, et al. EAU Guidelines on Urological Infections. In: EAU Guidelines, edition presented at the 28th EAU Annual Congress, Milan 2013
36. Buchsbaum GM, et al. Utility of urine reagent strip in screening women with incontinence for urinary tract infection. Int Urogynecol J Pelvic Floor Dysfunct 2004 15(6): p. 391-3; discussion 393.
37. Arinzon Z, et al. Clinical presentation of urinary tract infection (UTI) differs with aging in women. Archives of Gerontology and Geriatrics 2012 55(1): p. 145-7.
38. Moore EE, et al. Urinary incontinence and urinary tract infection: temporal relationships in postmenopausal women. Obstet Gynecol 2008 111(2 Pt 1): p. 317-23.
39. Ouslander JG, et al. Does eradicating bacteriuria affect the severity of chronic urinary incontinence in nursing home residents? Ann Intern Med 1995 122(10): p. 749-54.
40. Goode PS, et al. Measurement of postvoid residual urine with portable transabdominal bladder ultrasound scanner and urethral catheterization. Int Urogynecol J Pelvic Floor Dysfunct 2000 11(5): p. 296-300.
41. Griffiths DJ, et al. Variability of post-void residual urine volume in the elderly. Urol Res 1996 24(1): p. 23-6.
42. Marks LS, et al. Three-dimensional ultrasound device for rapid determination of bladder volume. Urology 1997 50(3): p. 341-8.
43. Nygaard IE. Postvoid residual volume cannot be accurately estimated by bimanual examination. Int Urogynecol J Pelvic Floor Dysfunct 1996 7(2): p. 74-6.
44. Ouslander JG, et al. Use of a portable ultrasound device to measure post-void residual volume among incontinent nursing home residents. J Am Geriatr Soc 1994 42(11): p. 1189-92.
45. Stoller ML, et al. The accuracy of a catheterized residual urine. J Urol 1989 141(1): p. 15-6.
46. Gehrich A, et al. Establishing a mean postvoid residual volume in asymptomatic perimenopausal and postmenopausal women. Obstet Gynecol 2007 110(4): p. 827-32.
47. Tseng LH, et al. Postvoid residual urine in women with stress incontinence. Neurourol Urodyn 2008 27(1): p. 48-51.
48. Haylen BT, et al. Immediate postvoid residual volumes in women with symptoms of pelvic floor dysfunction. Obstet Gynecol 2008 111(6): p. 1305-12.
49. Lukacz ES, et al. Elevated postvoid residual in women with pelvic floor disorders: prevalence and associated risk factors. Int Urogynecol J Pelvic Floor Dysfunct 2007 18(4): p. 397-400.
50. Milleman M, et al. Post-void residual urine volume in women with overactive bladder symptoms. J Urol 2004 172(5 Pt 1): p. 1911-4.
51. Brostrom S, et al. Short-term reproducibility of cystometry and pressure-flow micturition studies in healthy women. Neurourol Urodyn 2002 21(5): p. 457-60.
52. Broekhuis SR, et al. Reproducibility of same session repeated cystometry and pressure-flow studies in women with symptoms of urinary incontinence. Neurourology and Urodynamics 2010 29(3): p. 428-431.
53. Schick E, et al. Predictive value of maximum urethral closure pressure, urethral hypermobility and urethral incompetence in the diagnosis of clinically significant female genuine stress incontinence. J Urol 2004 171(5): p. 1871-5.
54. Dorflinger A, et al. Urethral pressure profile: is it affected by position? Neurourol Urodyn 2002 21(6): p. 553-7.
55. Wang AC, et al. A comparison of urethral pressure profilometry using microtip and double-lumen perfusion catheters in women with genuine stress incontinence. BJOG 2002 109(3): p. 322-6.
56. Zehnder P, et al. Air charged and microtip catheters cannot be used interchangeably for urethral pressure measurement: a prospective, single-blind, randomized trial. J Urol 2008 180(3): p. 1013-7.
57. Almeida FG, et al. Correlation between urethral sphincter activity and Valsalva leak point pressure at different bladder distentions: revisiting the urethral pressure profile. J Urol 2005 174(4 Pt 1): p. 1312-5; discussion 1315-6.
58. Urinary incontinence in women: the management of urinary incontinence in women Clinical Guidelines CG171. September 2013.
59. van Leijsen SA, et al. The correlation between clinical and urodynamic diagnosis in classifying the type of urinary incontinence in women. A systematic review of the literature. Neurourol Urodyn 2011 30(4): p. 495-502.
60. Rosier P, et al. Committee 6: Urodynamic Testing. In: 5th International Consultation on Incontinence. Paris February 2012. p. 429-505.
61. Klarskov N. Urethral pressure reflectometry. A method for simultaneous measurements of pressure and cross-sectional area in the female urethra. Dan Med J. 2012 59(3):B4412.

62. Dokmeci F, et al. Comparison of ambulatory versus conventional urodynamics in females with urinary incontinence. Neurourol Urodyn. 2010 29(4):518-21.
63. Radley SC, et al. Conventional and ambulatory urodynamic findings in women with symptoms suggestive of bladder overactivity. J Urol 2001 166(6): p. 2253-8.
64. Glazener Cathryn MA, et al. Urodynamic studies for management of urinary incontinence in children and adults. Cochrane Database Syst Rev. 2012 Jan 18;1:CD003195.
65. Nitti VW, et al. Response to fesoterodine in patients with an overactive bladder and urgency urinary incontinence is independent of the urodynamic finding of detrusor overactivity. BJU Int. 2010 105(9):1268-75
66. Rovner E, et al. Urodynamic results and clinical outcomes with intradetrusor injections of onabotulinumtoxina in a randomized, placebo-controlled dose-finding study in idiopathic overactive bladder. Neurourol Urodyn 2011 30(4): p. 556-562.
67. Nager CW, et al. Baseline urodynamic predictors of treatment failure 1 year after mid urethral sling surgery. J Urol. 2011 186(2):597-603.
68. Sirls LT, et al. The effect of urodynamic testing on clinical diagnosis, treatment plan and outcomes in women undergoing stress urinary incontinence surgery. J Urol. 2013 189(1):204-9.
69. Nager CW, et al. A randomized trial of urodynamic testing before stress-incontinence surgery. New N Engl J Med. 2012 366(21):1987-97.
70. van Leijsen SA, et al. Can preoperative urodynamic investigation be omitted in women with stress urinary incontinence? A non-inferiority randomized controlled trial. Neurourol Urodyn 2012 31(7): p. 1118-23.
71. Van Leijsen SAL, et al. Value of urodynamics before stress urinary incontinence surgery: A Randomized Controlled Trial. Obstet Gynecol. 2013 121:5 p. 999-1008
72. Richter HE, et al. Predictors of treatment failure 24 months after surgery for stress urinary incontinence. J Urol 2008 179(3): p. 1024-30.
73. Nager CW, et al. Urodynamic measures do not predict stress continence outcomes after surgery for stress urinary incontinence in selected women. J Urol 2008 179(4): p. 1470-4.
74. Dawson T, et al. Factors predictive of post-TVT voiding dysfunction. Int Urogynecol J Pelvic Floor Dysfunct 2007 18(11): p. 1297-302.
75. Hong B, et al. Factors predictive of urinary retention after a tension-free vaginal tape procedure for female stress urinary incontinence. J Urol 2003 170(3): p. 852-6.
76. Abdel-Fattah M, et al. (2004) Pelvicol pubovaginal sling versus tension-free vaginal tape for treatment of urodynamic stress incontinence: a prospective randomized three-year follow-up study. Eur Urol. 2004 46(5): 629-35.
77. Lemack GE, et al. Normal preoperative urodynamic testing does not predict voiding dysfunction after Burch colposuspension versus pubovaginal sling. J Urol 2008 180(5): p. 2076-80.
78. Gomha MA, et al. Artificial urinary sphincter for post-prostatectomy incontinence in men who had prior radiotherapy: a risk and outcome analysis. J Urol 2002 167(2 Pt 1): p. 591-6.
79. Thiel DD, et al. Do clinical or urodynamic parameters predict artificial urinary sphincter outcome in post-radical prostatectomy incontinence? Urology 2007 69(2): p. 315-9.
80. Schafer W, et al. Good urodynamic practices: uroflowmetry, filling cystometry, and pressure-flow studies. Neurourol Urodyn 2002 21(3): p. 261-74.
81. Al Afraa TA, et al. Normal lower urinary tract assessment in women: I. Uroflowmetry and post-void residual, pad tests, and bladder diaries. Int Urogynecol J. 2012 23(6):681-5.
82. Krhut J, et al. Pad weight testing in the evaluation of urinary incontinence. Neurourol Urodyn 2014 33 (5): p. 507-510.
83. Painter V, et al. Does patient activity level affect 24-hr pad test results in stress-incontinent women? Neurourol Urodyn 2012 31 (1): p. 143-147.
84. Rimstad L, et al. Pad stress tests with increasing load for the diagnosis of stress urinary incontinence. Neurourol Urodyn 2014 33 (7): p. 1135-1139.
85. Richter HE, et al. Demographic and clinical predictors of treatment failure one year after midurethral sling surgery. Obstet Gynecol 2011 117(4): p. 913-21.
86. Sato Y, et al. Simple and reliable predictor of urinary continence after radical prostatectomy: Serial measurement of urine loss ratio after catheter removal. Int J Urol 2014 21 (7): p. 647-651.
87. Ward KL, et al. A prospective multicenter randomized trial of tension-free vaginal tape and colposuspension for primary urodynamic stress incontinence: two-year follow-up. Am J Obstet Gynecol 2004 190(2): p. 324-31.
88. Lewicky-Gaupp C, et al. “The cough game”: are there characteristic urethrovesical movement patterns associated with stress incontinence? Int Urogynecol J Pelvic Floor Dysfunct 2009 20(2): p. 171-5.
89. Shek KL, et al. The effect of childbirth on urethral mobility: a prospective observational study. J Urol 2010 184(2): p. 629-34.
90. Woodfield CA, et al. Imaging pelvic floor disorders: trend toward comprehensive MRI. AJR Am J Roentgenol 2010 194(6): p. 1640-9.

91. Lockhart ME, et al. Reproducibility of dynamic MR imaging pelvic measurements: a multi-institutional study. Radiology 2008 249(2): p. 534-40.
92. Shek KL, et al. The urethral motion profile before and after suburethral sling placement. J Urol 2010 183(4): p. 1450-4.
93. Chantarasorn V, et al. Sonographic appearance of transobturator slings: implications for function and dysfunction. Int Urogynecol J 2011 22(4): p. 493-8.
94. Morgan DM, et al. Urethral sphincter morphology and function with and without stress incontinence. J Urol 2009 182(1): p. 203-9.
95. Digesu GA, et al. Three-dimensional ultrasound of the urethral sphincter predicts continence surgery outcome. Neurourol Urodyn 2009 28(1): p. 90-4.
96. Nguyen L, et al. Surgical technique to overcome anatomical shortcoming: balancing post-prostatectomy continence outcomes of urethral sphincter lengths on preoperative magnetic resonance imaging. J Urol 2008 179(5): p. 1907-11.
97. Paparel P, et al. Recovery of urinary continence after radical prostatectomy: association with urethral length and urethral fibrosis measured by preoperative and postoperative endorectal magnetic resonance imaging. Eur Urol 2009 55(3): p. 629-37.
98. Chung SD, et al. Transabdominal ultrasonography of detrusor wall thickness in women with overactive bladder. BJU Int 2010 105(5): p. 668-72.
99. Kuhn A, et al. Sonographic transvaginal bladder wall thickness: does the measurement discriminate between urodynamic diagnoses? Neurourol Urodyn 2011 30(3): p. 325-8.
100. Kuo HC, et al. Urinary nerve growth factor is a better biomarker than detrusor wall thickness for the assessment of overactive bladder with incontinence. Neurourol Urodyn 2010 29(3): p. 482-7.
101. Panayi DC, et al. Ultrasound measurement of bladder wall thickness is associated with the overactive bladder syndrome. Neurourol Urodyn 2010 29(7): p. 1295-8.
102. Serati M Fau - Salvatore S, et al. Ultrasound measurement of bladder wall thickness in different forms of detrusor overactivity. Int Urogynecol J. 2010 Nov;21(11):1405-11.
103. Lee PG, et al. The co-occurrence of chronic diseases and geriatric syndromes: the health and retirement study. J Am Geriatr Soc 2009 57(3): p. 511-6.
104. Vischer UM, et al. A call to incorporate the prevention and treatment of geriatric disorders in the management of diabetes in the elderly. Diabetes Metab 2009 35(3): p. 168-77.
105. Hirayama F, et al. Urinary incontinence in men with chronic obstructive pulmonary disease. Int J Urol 2008 15(8): p. 751-3.
106. Sarma AV, et al. Risk factors for urinary incontinence among women with type 1 diabetes: findings from the epidemiology of diabetes interventions and complications study. Urology 2009 73(6): p. 1203-9.
107. Grady D, et al. Postmenopausal hormones and incontinence: the Heart and Estrogen/Progestin Replacement Study. Obstet Gynecol 2001 97(1): p. 116-20.
108. Hendrix SL, et al. Effects of estrogen with and without progestin on urinary incontinence. JAMA 2005 293(8): p. 935-48.
109. Rossouw JE, et al. Risks and benefits of estrogen plus progestin in healthy postmenopausal women: principal results From the Women's Health Initiative randomized controlled trial. JAMA 2002 288(3): p. 321-33.
110. Steinauer JE, et al. Postmenopausal hormone therapy: does it cause incontinence? Obstet Gynecol 2005 106(5 Pt 1): p. 940-5.
111. Goldstein SR, et al. Incidence of urinary incontinence in postmenopausal women treated with raloxifene or estrogen. Menopause 2005 12(2): p. 160-4.
112. Molander U, et al. Effect of oral oestriol on vaginal flora and cytology and urogenital symptoms in the post-menopause. Maturitas 1990 12(2): p. 113-20.
113. Samsioe G, et al. Occurrence, nature and treatment of urinary incontinence in a 70-year-old female population. Maturitas 1985 7(4): p. 335-42.
114. Schnelle JF, et al. A controlled trial of an intervention to improve urinary and fecal incontinence and constipation. J Am Geriatr Soc 2010 58(8): p. 1504-11.
115. Spence-Jones C, et al. Bowel dysfunction: a pathogenic factor in uterovaginal prolapse and urinary stress incontinence. Br J Obstet Gynaecol 1994 101(2): p. 147-52.
116. Coyne KS, et al. The prevalence of lower urinary tract symptoms (LUTS) and overactive bladder(OAB) by racial/ethnic group and age: Results from OAB-POLL. Neurourol Urodyn. 2013 32(3):230-7.
117. Diokno AC, et al. Medical correlates of urinary incontinence in the elderly. Urology 1990 36(2): p. 129-38.
118. Alling Moller L, et al. Risk factors for lower urinary tract symptoms in women 40 to 60 years of age. Obstet Gynecol 2000 96(3): p. 446-51.
119. Byles J, et al. Living with urinary incontinence: a longitudinal study of older women. Age Ageing 2009 38(3): p. 333-8; discussion 251.

120. Geng H, et al., Catheterisation, Indwelling catheters in adults, Urethral and Suprapubic - Evidence-based Guidelines for Best Practice in Urological Health Care. Edition presented at the 13th International EAUN Meeting, Paris. 2012, EAUN Office: Arnhem.
121. Geng V, et al. The Male External Catheter, Condom Catheter, Urinary Sheath - Good Practice in Health Care. Edition presented at the 9th International EAUN Meeting, Berlin. 2008, EAUN Office: Arnhem.
122. Vahr S, et al., Catheterisation, Urethral intermittent in adults - Evidence-based Guidelines for Best Practice in Urological Health Care. Edition presented at the 14th International EAUN Meeting, Milan. 2013, EAUN Office: Arnhem.
123. McMurdo MET, et al. A cost-effectiveness study of the management of intractable urinary incontinence by urinary catheterisation or incontinence pads. J Epidemiol Community Health. 1992 46(3):222-6.
124. Saint S, et al. Condom versus indwelling urinary catheters: a randomized trial. J Am Geriatr Soc 2006 54(7): p. 1055-61.
125. Chartier-Kastler E, et al. Randomized, crossover study evaluating patient preference and the impact on quality of life of urisheaths vs absorbent products in incontinent men. BJU international 2011 108(2): p. 241-247.
126. Brazzelli M, et al. Absorbent products for containing urinary and/or fecal incontinence in adults. J Wound Ostomy Continence Nurs. 2002 29(1):45-54.
127. Fader M, et al. A multi-centre evaluation of absorbent products for men with light urinary incontinence. Neurourol Urodyn. 2006;25(7):689-95.
128. Fader M, et al. Absorbent products for urinary/faecal incontinence: a comparative evaluation of key product designs. Health Technol Assess 2008 12(29): p. iii-iv, ix-185.
129. Jahn P, et al. Types of indwelling urinary catheters for long-term bladder drainage in adults. Cochrane Database Syst Rev. 2012 10:CD004997. doi: 10.1002/14651858.CD004997.pub3.
130. Hunter KF, et al. Long-term bladder drainage: Suprapubic catheter versus other methods: a scoping review. Neurourol Urodyn 2013 32(7): p. 944-51.
131. Moore KN, et al. Long-term bladder management by intermittent catheterisation in adults and children. Cochrane Database Syst Rev 2007(4): p. CD006008.
132. Hagen S, et al. Washout policies in long-term indwelling urinary catheterisation in adults. Cochrane Database Syst Rev. 2010 (3):CD004012.
133. Niel-Weise BS, et al. Urinary catheter policies for long-term bladder drainage. Cochrane Database Syst Rev 2012 8: p. CD004201.
134. Fader M, et al. Sheaths for urinary incontinence: a randomized crossover trial. BJU Int. 2001 88(4):367-72.
135. Moore KN, et al. Assessing comfort, safety, and patient satisfaction with three commonly used penile compression devices. Urology 2004 63(1): p. 150-4.
136. Lipp A, et al. (2011) Mechanical devices for urinary incontinence in women. Cochrane Database Syst Rev. 2011 (7):CD001756.
137. Hannestad YS, et al. Are smoking and other lifestyle factors associated with female urinary incontinence? The Norwegian EPINCONT Study. BJOG 2003 110(3): p. 247-54.
138. Arya LA, et al. Dietary caffeine intake and the risk for detrusor instability: a case-control study. Obstet Gynecol 2000 96(1): p. 85-9.
139. Bryant CM, et al. Caffeine reduction education to improve urinary symptoms. Br J Nurs 2002 11(8): p. 560-5.
140. Swithinbank L, et al. The effect of fluid intake on urinary symptoms in women. J Urol 2005 174(1): p. 187-9.
141. Tomlinson BU, et al. Dietary caffeine, fluid intake and urinary incontinence in older rural women. Int Urogynecol J Pelvic Floor Dysfunct 1999 10(1): p. 22-8.
142. Townsend MK, et al. Caffeine intake and risk of urinary incontinence progression among women. Obstetrics and gynecology 2012 119(5): p. 950-957.
143. Jorgensen S, et al. Heavy lifting at work and risk of genital prolapse and herniated lumbar disc in assistant nurses. Occup Med (Lond) 1994 44(1): p. 47-9.
144. Nygaard I, et al. Exercise and incontinence. Obstet Gynecol 1990 75(5): p. 848-51.
145. Nygaard IE, et al. Urinary incontinence in elite nulliparous athletes. Obstet Gynecol 1994 84(2): p. 183-7.
146. Bo K, et al. Prevalence of stress and urge urinary incontinence in elite athletes and controls. Med Sci Sports Exerc 2001 33(11): p. 1797-802.
147. Bo K, et al. Are former female elite athletes more likely to experience urinary incontinence later in life than non-athletes? Scand J Med Sci Sports 2010 20(1): p. 100-4.
148. Bo K MS, Oseid S, et al. The prevalence of stress urinary incontinence amongst physically active and sedentary female students. Scand J Sports Sci 1989 11(3): p. 113-6.
149. Caylet N, et al. Prevalence and occurrence of stress urinary incontinence in elite women athletes. Can J Urol 2006 13(4): p. 3174-9.
150. Kruger JA, et al. Pelvic floor function in elite nulliparous athletes. Ultrasound Obstet Gynecol 2007 30(1): p. 81-5.
151. Thyssen HH, et al. Urinary incontinence in elite female athletes and dancers. Int Urogynecol J Pelvic Floor Dysfunct 2002 13(1): p. 15-7.

152. Brown WJ, et al. Too wet to exercise? Leaking urine as a barrier to physical activity in women. J Sci Med Sport 2001 4(4): p. 373-8.
153. Nygaard IE. Does prolonged high-impact activity contribute to later urinary incontinence? A retrospective cohort study of female Olympians. Obstet Gynecol 1997 90(5): p. 718-22.
154. Eliasson K, et al. Influence of physical activity on urinary leakage in primiparous women. Scand J Med Sci Sports 2005 15(2): p. 87-94.
155. Kikuchi A, et al. Association between physical activity and urinary incontinence in a community-based elderly population aged 70 years and over. Eur Urol 2007 52(3): p. 868-74.
156. Kim H, et al. Effectiveness of multidimensional exercises for the treatment of stress urinary incontinence in elderly community-dwelling Japanese women: a randomized, controlled, crossover trial. J Am Geriatr Soc 2007 55(12): p. 1932-9.
157. Kim H, et al. (2011) The effects of multidimensional exercise treatment on community-dwelling elderly Japanese women with stress, urge, and mixed urinary incontinence: a randomized controlled trial. Int J Nurs Stud. 2011 48(10):1165-72.
158. Dowd TT, et al. Fluid intake and urinary incontinence in older community-dwelling women. J Community Health Nurs 1996 13(3): p. 179-86.
159. Hashim H, et al. How should patients with an overactive bladder manipulate their fluid intake? BJU Int 2008 102(1): p. 62-6.
160. Zimmern P, et al. Effect of fluid management on fluid intake and urge incontinence in a trial for overactive bladder in women. BJU international 2010 105(12): p. 1680-1685.
161. Danforth KN, et al. Risk factors for urinary incontinence among middle-aged women. Am J Obstet Gynecol 2006 194(2): p. 339-45.
162. Chen CC, et al. Obesity is associated with increased prevalence and severity of pelvic floor disorders in women considering bariatric surgery. Surg Obes Relat Dis 2009 5(4): p. 411-5.
163. Hunskaar S. A systematic review of overweight and obesity as risk factors and targets for clinical intervention for urinary incontinence in women. Neurourol Urodyn 2008 27(8): p. 749-57.
164. Imamura M, et al. Systematic review and economic modelling of the effectiveness and cost-effectiveness of non-surgical treatments for women with stress urinary incontinence. Health Technol Assess 2010 14(40): p. 1-188, iii-iv.
165. Subak LL, et al. Weight loss to treat urinary incontinence in overweight and obese women. N Engl J Med 2009 360(5): p. 481-90.
166. Brown JS, et al. Lifestyle intervention is associated with lower prevalence of urinary incontinence: the Diabetes Prevention Program. Diabetes Care 2006 29(2): p. 385-90.
167. Bump RC, et al. Obesity and lower urinary tract function in women: effect of surgically induced weight loss. Am J Obstet Gynecol 1992 167(2): p. 392-7; discussion 397-9.
168. Subak LL, et al. Does weight loss improve incontinence in moderately obese women? Int Urogynecol J Pelvic Floor Dysfunct 2002 13(1): p. 40-3.
169. Subak LL, et al. Weight loss: a novel and effective treatment for urinary incontinence. J Urol 2005 174(1): p. 190-5.
170. Wing RR, et al. Improving urinary incontinence in overweight and obese women through modest weight loss. Obstet Gynecol. 2010 116(2 Pt 1):284-92.
171. Phelan S, et al. Weight loss prevents urinary incontinence in women with type 2 diabetes: Results from the look AHEAD trial. Journal of Urology 2012 187(3): p. 939-944.
172. Burgio KL, et al. Changes in urinary and fecal incontinence symptoms with weight loss surgery in morbidly obese women. Obstet Gynecol 2007 110(5): p. 1034-40.
173. Deitel M, et al. Gynecologic-obstetric changes after loss of massive excess weight following bariatric surgery. J Am Coll Nutr 1988 7(2): p. 147-53.
174. Laungani RG, et al. Effect of laparoscopic gastric bypass surgery on urinary incontinence in morbidly obese women. Surg Obes Relat Dis 2009 5(3): p. 334-8.
175. Lopez M, et al. Prevalence of urinary incontinence and its association with body mass index among women in Puerto Rico. J Womens Health (Larchmt) 2009 18(10): p. 1607-14.
176. Mishra GD, et al. Body weight through adult life and risk of urinary incontinence in middle-aged women: results from a British prospective cohort. Int J Obes (Lond) 2008 32(9): p. 1415-22.
177. Richter HE, et al. The impact of obesity on urinary incontinence symptoms, severity, urodynamic characteristics and quality of life. J Urol 2010 183(2): p. 622-8.
178. Auwad W, et al. Moderate weight loss in obese women with urinary incontinence: a prospective longitudinal study. Int Urogynecol J Pelvic Floor Dysfunct 2008 19(9): p. 1251-9.
179. IUGA-ICS Conservative Management for Female Pelvic Floor Dysfunction 2012.

180. Shamliyan T, et al. Nonsurgical Treatments for Urinary Incontinence in Adult Women: Diagnosis and Comparative Effectiveness [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2012 Apr. Report No.: 11(12)-EHC074-EF. AHRQ Comparative Effectiveness Reviews.
181. Sherburn M, et al. Incontinence improves in older women after intensive pelvic floor muscle training: an assessor-blinded randomized controlled trial. Neurourol Urodyn 2011 30(3): p. 317-24.
182. Berghmans B, et al. Efficacy of physical therapeutic modalities in women with proven bladder overactivity. Eur Urol 2002 41(6): p. 581-7.
183. Dumoulin C, et al. Pelvic floor muscle training versus no treatment for urinary incontinence in women. A Cochrane systematic review. Eur J Phys Rehabil Med 2008 44(1): p. 47-63.
184. Hay-Smith EJC, et al. (2011) Comparisons of approaches to pelvic floor muscle training for urinary incontinence in women. Cochrane Database Syst Rev. 2011 (12):CD009508.
185. Bo K, et al. Lower urinary tract symptoms and pelvic floor muscle exercise adherence after 15 years. Obstet Gynecol 2005 105(5 Pt 1): p. 999-1005.
186. Herderschee R, et al. Feedback or biofeedback to augment pelvic floor muscle training for urinary incontinence in women. Cochrane Database Syst Rev. 2011 (7):CD009252.
187. McFall SL, et al. Outcomes of a small group educational intervention for urinary incontinence: health-related quality of life. J Aging Health 2000 12(3): p. 301-17.
188. Campbell SE, et al. Conservative management for postprostatectomy urinary incontinence. Cochrane Database Syst Rev. 2012 1:CD001843.
189. Centemero A, et al. Preoperative pelvic floor muscle exercise for early continence after radical prostatectomy: a randomised controlled study. Eur Urol 2010 57(6): p. 1039-43.
190. Manassero F, et al. Contribution of early intensive prolonged pelvic floor exercises on urinary continence recovery after bladder neck-sparing radical prostatectomy: results of a prospective controlled randomized trial. Neurourol Urodyn 2007 26(7): p. 985-9.
191. Marchiori D, et al. Pelvic floor rehabilitation for continence recovery after radical prostatectomy: role of a personal training re-educational program. Anticancer Res 2010 30(2): p. 553-6.
192. Ribeiro LH, et al. Long-term effect of early postoperative pelvic floor biofeedback on continence in men undergoing radical prostatectomy: a prospective, randomized, controlled trial. J Urol 2010 184(3): p. 1034-9.
193. Van Kampen M, et al. Effect of pelvic-floor re-education on duration and degree of incontinence after radical prostatectomy: a randomised controlled trial. Lancet 2000 355(9198): p. 98-102.
194. Dubbelman Y, et al. The recovery of urinary continence after radical retropubic prostatectomy: a randomized trial comparing the effect of physiotherapist-guided pelvic floor muscle exercises with guidance by an instruction folder only. BJU Int 2010 106(4): p. 515-22.
195. Moore KN, et al. Return to continence after radical retropubic prostatectomy: a randomized trial of verbal and written instructions versus therapist-directed pelvic floor muscle therapy. Urology 2008 72(6): p. 1280-6.
196. Goode PS, et al. Behavioral therapy with or without biofeedback and pelvic floor electrical stimulation for persistent postprostatectomy incontinence: A randomized controlled trial. JAMA - Journal of the American Medical Association 2011 305(2): p. 151-159.
197. Eustice S, et al. Prompted voiding for the management of urinary incontinence in adults. Cochrane Database Syst Rev. 2000;(2):CD002113.
198. Flanagan L, et al. Systematic review of care intervention studies for the management of incontinence and promotion of continence in older people in care homes with urinary incontinence as the primary focus (1966-2010). Geriatr Gerontol Int. 2012 12(4):600-11.
199. Ostaszkiewicz J, et al. Habit retraining for the management of urinary incontinence in adults. Cochrane Database Syst Rev. 2004 (2):CD002801.
200. Berghmans LC, et al. Conservative treatment of stress urinary incontinence in women: a systematic review of randomized clinical trials. Br J Urol 1998 82(2): p. 181-91.
201. Berghmans LC, et al. Conservative treatment of urge urinary incontinence in women: a systematic review of randomized clinical trials. BJU Int 2000 85(3): p. 254-63.
202. Hartmann KE, et al. Treatment of overactive bladder in women. Evid Rep Technol Assess (Full Rep) 2009(187): p. 1-120, v.
203. Berghmans B, et al. Electrical stimulation with non-implanted electrodes for urinary incontinence in men. Cochrane Database Syst Rev. 2013 6:CD001202.
204. Lucas M, EAU Guidelines on Urinary Incontinence. In: EAU Guidelines, edition presented at the 29th EAU Annual Congress, Stockholm 2014. ISBN 978-90-79754-65-6.
205. Finazzi-Agro E, et al. Percutaneous tibial nerve stimulation effects on detrusor overactivity incontinence are not due to a placebo effect: a randomized, double-blind, placebo controlled trial. J Urol 2010 184(5): p. 2001-6.
206. Peters KM, et al. Randomized trial of percutaneous tibial nerve stimulation versus Sham efficacy in the treatment of overactive bladder syndrome: results from the SUmiT trial. J Urol 2010 183(4): p. 1438-43.

207. Peters KM, et al. Randomized trial of percutaneous tibial nerve stimulation versus extended-release tolterodine: results from the overactive bladder innovative therapy trial. J Urol 2009 182(3): p. 1055-61.
208. Peters KM, et al. Sustained therapeutic effects of percutaneous tibial nerve stimulation: 24-month results of the STEP study. Neurourol Urodyn. 2013 32(1):24-9.
209. Schreiner L, et al. Randomized trial of transcutaneous tibial nerve stimulation to treat urge urinary incontinence in older women. Int Urogynecol J. 2010 21(9):1065-70.
210. Nygaard IE, et al. Efficacy of pelvic floor muscle exercises in women with stress, urge, and mixed urinary incontinence. Am J Obstet Gynecol 1996 174(1 Pt 1): p. 120-5.
211. Lagro-Janssen T, et al. Long-term effect of treatment of female incontinence in general practice. Br J Gen Pract 1998 48(436): p. 1735-8.
212. Chapple C, et al. The effects of antimuscarinic treatments in overactive bladder: a systematic review and meta-analysis. Eur Urol 2005 48(1): p. 5-26.
213. Chapple CR, et al. The effects of antimuscarinic treatments in overactive bladder: an update of a systematic review and meta-analysis. Eur Urol 2008 54(3): p. 543-62.
214. McDonagh, et al., Drug class review: agents for overactive bladder. Final report Update 4. Portland (OR): Oregon Health & Science University; 2009 Drug Class Reviews.
215. Shamliyan TA, et al. Systematic review: randomized, controlled trials of nonsurgical treatments for urinary incontinence in women. Ann Intern Med 2008 148(6): p. 459-73.
216. Novara G, et al. A systematic review and meta-analysis of randomized controlled trials with antimuscarinic drugs for overactive bladder. Eur Urol 2008 54(4): p. 740-63.
217. Chapple C, et al. Clinical efficacy, safety, and tolerability of once-daily fesoterodine in subjects with overactive bladder. Eur Urol 2007 52(4): p. 1204-12.
218. Herschorn S, et al. Comparison of fesoterodine and tolterodine extended release for the treatment of overactive bladder: A head-to-head placebo-controlled trial. BJU international 2010 105(1): p. 58-66.
219. Goode PS, et al. Incontinence in older women. JAMA 2010 303(21): p. 2172-81.
220. Gormley EA, et al. Diagnosis and Treatment of Overactive Bladder (Non-Neurogenic) in Adults: AUA/SUFU Guideline. J Urol. 2012 188(6 Suppl):2455-63.
221. Rai B, et al. (2012) Anticholinergic drugs versus non-drug active therapies for non-neurogenic overactive bladder syndrome in adults. Cochrane Database Syst Rev. 2012 12:CD003193.
222. Schmidt RA, et al. Sacral nerve stimulation for treatment of refractory urinary urge incontinence. Sacral Nerve Stimulation Study Group. J Urol 1999 162(2): p. 352-7.
223. Burgio KL, et al. Behavioral versus drug treatment for overactive bladder in men: the Male Overactive Bladder Treatment in Veterans (MOTIVE) Trial. J Am Geriatr Soc 2011 59(12): p. 2209-16.
224. Mattiasson A, et al. Efficacy of simplified bladder training in patients with overactive bladder receiving a solifenacin flexible-dose regimen: Results from a randomized study. BJU international 2010 105(8): p. 1126-1135.
225. Soomro NA, et al. A crossover randomized trial of transcutaneous electrical nerve stimulation and oxybutynin in patients with detrusor instability. J Urol 2001 166(1): p. 146-9.
226. Svihra J, et al. Neuromodulative treatment of overactive bladder--noninvasive tibial nerve stimulation. Bratisl Lek Listy 2002 103(12): p. 480-3.
227. Franzén K, et al. (2010) Electrical stimulation compared with tolterodine for treatment of urge/urge incontinence amongst women--a randomized controlled trial. Int Urogynecol J. 2010 21(12):1517-24.
228. Sancaktar M, et al. The outcome of adding peripheral neuromodulation (Stoller afferent neuro-stimulation) to anti-muscarinic therapy in women with severe overactive bladder. Gynecol Endocrinol. 2010 26(10):729-32.
229. Veenboer PW, et al. Long-term adherence to antimuscarinic therapy in everyday practice: a systematic review. J Urol 2014 191(4): p. 1003-8.
230. Sand PK, et al. Long-term safety, tolerability and efficacy of fesoterodine in subjects with overactive bladder symptoms stratified by age: pooled analysis of two open-label extension studies. Drugs Aging. 2012 Feb 1;29(2): 119-31.
231. Scarpero H, et al. Long-term safety, tolerability, and efficacy of fesoterodine treatment in men and women with overactive bladder symptoms. Curr Med Res Opin. 2011 27(5):921-30.
232. Sears CL, et al. Overactive bladder medication adherence when medication is free to patients. J Urol 2010 183(3): p. 1077-81.
233. DuBeau CE, et al. Incontinence in the frail elderly: report from the 4th International Consultation on Incontinence. Neurourol Urodyn 2010 29(1): p. 165-78.
234. Fink HA, et al. Treatment interventions in nursing home residents with urinary incontinence: a systematic review of randomized trials. Mayo Clin Proc 2008 83(12): p. 1332-43.
235. Ancelin ML, et al. Non-degenerative mild cognitive impairment in elderly people and use of anticholinergic drugs: longitudinal cohort study. BMJ 2006 332(7539): p. 455-9.

236. Tannenbaum, et al. A systematic review of amnestic and non-amnestic mild cognitive impairment induced by anticholinergic, antihistamine, GABAergic and opioid drugs. Drugs Aging. 2012 Aug 1;29(8):639-58.
237. Kessler TM, et al. Adverse event assessment of antimuscarinics for treating overactive bladder: a network meta-analytic approach. PLoS One 2011 6(2): p. e16718.
238. Paquette A, et al. Systematic review and meta-analysis: do clinical trials testing antimuscarinic agents for overactive bladder adequately measure central nervous system adverse events? J Am Geriatr Soc 2011 59(7): p. 1332-9.
239. Kay G, et al. Differential effects of the antimuscarinic agents darifenacin and oxybutynin ER on memory in older subjects. Eur Urol 2006 50(2): p. 317-26.
240. Isik AT, et al. Trospium and cognition in patients with late onset Alzheimer disease. J Nutr Health Aging 2009 13(8): p. 672-6.
241. Lackner TE, et al. Randomized, placebo-controlled trial of the cognitive effect, safety, and tolerability of oral extended-release oxybutynin in cognitively impaired nursing home residents with urge urinary incontinence. J Am Geriatr Soc 2008 56(5): p. 862-70.
242. Lackner TE, et al. Efficacy of oral extended-release oxybutynin in cognitively impaired older nursing home residents with urge urinary incontinence: A randomized placebo-controlled trial. J Am Med Dir Assoc. 2011 12(9):639-47.
243. Minassian VA, et al. Randomized trial of oxybutynin extended versus immediate release for women aged 65 and older with overactive bladder: lessons learned from conducting a trial. J Obstet Gynaecol Can 2007 29(9): p. 726-32.
244. Wagg A, et al. Randomised, multicentre, placebo-controlled, double-blind crossover study investigating the effect of solifenacin and oxybutynin in elderly people with mild cognitive impairment: the SENIOR study. Eur Urol 2013 64(1): p. 74-81.
245. Wesnes KA, et al. Exploratory pilot study assessing the risk of cognitive impairment or sedation in the elderly following single doses of solifenacin 10 mg. Expert Opin Drug Saf 2009 8(6): p. 615-26.
246. Sink KM, et al. Dual use of bladder anticholinergics and cholinesterase inhibitors: long-term functional and cognitive outcomes. J Am Geriatr Soc 2008 56(5): p. 847-53.
247. Wagg A, et al. Efficacy and tolerability of solifenacin in elderly subjects with overactive bladder syndrome: a pooled analysis. Am J Geriatr Pharmacother 2006 4(1): p. 14-24.
248. Zinner N, et al. Impact of solifenacin on quality of life, medical care use, work productivity, and health utility in the elderly: an exploratory subgroup analysis. Am J Geriatr Pharmacother 2009 7(6): p. 373-82.
249. Herschorn S, et al. Tolerability of solifenacin and oxybutynin immediate release in older (> 65 years) and younger (</= 65 years) patients with overactive bladder: sub-analysis from a Canadian, randomized, double-blind study. Curr Med Res Opin 2011 27(2): p. 375-82.
250. Drutz HP, et al. Clinical efficacy and safety of tolterodine compared to oxybutynin and placebo in patients with overactive bladder. Int Urogynecol J Pelvic Floor Dysfunct 1999 10(5): p. 283-9.
251. Michel MC, et al. Does gender or age affect the efficacy and safety of tolterodine? J Urol 2002 168(3): p. 1027-31.
252. Millard R, et al. Clinical efficacy and safety of tolterodine compared to placebo in detrusor overactivity. J Urol 1999 161(5): p. 1551-5.
253. Zinner NR, et al. Efficacy, safety, and tolerability of extended-release once-daily tolterodine treatment for overactive bladder in older versus younger patients. J Am Geriatr Soc 2002 50(5): p. 799-807.
254. Jumadilova Z, et al. Retrospective evaluation of outcomes in patients with overactive bladder receiving tolterodine versus oxybutynin. Am J Health Syst Pharm 2006 63(23): p. 2357-64.
255. Chapple C, et al. Darifenacin treatment of patients >or= 65 years with overactive bladder: results of a randomized, controlled, 12-week trial. Curr Med Res Opin 2007 23(10): p. 2347-58.
256. Lipton RB, et al. Assessment of cognitive function of the elderly population: effects of darifenacin. J Urol 2005 173(2): p. 493-8.
257. Pietzko A, et al. Influences of trospium chloride and oxybutynin on quantitative EEG in healthy volunteers. Eur J Clin Pharmacol 1994 47(4): p. 337-43.
258. Todorova A, et al. Effects of tolterodine, trospium chloride, and oxybutynin on the central nervous system. J Clin Pharmacol 2001 41(6): p. 636-44.
259. Staskin DR, et al. Trospium chloride once-daily extended release is effective and well tolerated for the treatment of overactive bladder syndrome: an integrated analysis of two randomised, phase III trials. Int J Clin Pract 2009 63(12): p. 1715-23.
260. Sand PK, et al. (2011) Trospium chloride once daily extended release is efficacious and tolerated in elderly subjects (aged ≥ 75 years) with overactive bladder syndrome. BJU Int. 2011 107(4):612-20.
261. Wagg A, et al. Long-term safety, tolerability and efficacy of flexible-dose fesoterodine in elderly patients with overactive bladder: Open-label extension of the SOFIA trial. Neurourol Urodyn. 2014 33(1):106-14.

262. DuBeau CE, et al. Efficacy and tolerability of fesoterodine versus tolterodine in older and younger subjects with overactive bladder: a post hoc, pooled analysis from two placebo-controlled trials. Neurourol Urodyn 2012 31(8): p. 1258-65.
263. Kraus SR, et al. Efficacy and tolerability of fesoterodine in older and younger subjects with overactive bladder. Urology 2010 76(6): p. 1350-1357.
264. Kay GG, et al. Evaluation of cognitive function in healthy older subjects treated with fesoterodine. Postgrad Med 2012 124(3): p. 7-15.
265. Wagg A, et al. Review of cognitive impairment with antimuscarinic agents in elderly patients with overactive bladder. Int J Clin Pract 2010 64(9): p. 1279-86.
266. American Geriatrics Society updated Beers Criteria for potentially inappropriate medication use in older adults. J Am Geriatr Soc 2012 60(4): p. 616-31.
267. Boustani M, et al. Impact of anticholinergics on the aging brain: a review and practical application. Aging Health 2008 4(3): p. 311-320.
268. Cai X, et al. Long-term anticholinergic use and the aging brain. Alzheimers Dement 2013 9(4): p. 377-85.
269. Campbell N, et al. The cognitive impact of anticholinergics: a clinical review. Clin Interv Aging 2009 4: p. 225-33.
270. Carriere I, et al. Drugs with anticholinergic properties, cognitive decline, and dementia in an elderly general population: the 3-city study. Arch Intern Med 2009 169(14): p. 1317-24.
271. Fox C, et al. Anticholinergic medication use and cognitive impairment in the older population: the medical research council cognitive function and ageing study. J Am Geriatr Soc 2011 59(8): p. 1477-83.
272. Chapple CR, et al. Mirabegron in overactive bladder: A review of efficacy, safety, and tolerability. Neurourol Urodyn. 2014 33(1):17-30.
273. Cui Y, et al. The efficacy and safety of mirabegron in treating OAB: A systematic review and meta-analysis of phase III trials. Int Urol Nephrol. 2014 46(1):275-84.
274. Chapple C, et al. Randomized double-blind, active-controlled phase 3 study to assess 12-month safety and efficacy of mirabegron, a beta3-adrenoceptor agonist, in overactive bladder. Eur Urol. 2013 63(2):296-305.
275. Malik M, et al. Proarrhythmic safety of repeat doses of mirabegron in healthy subjects: a randomized, double-blind, placebo-, and active-controlled thorough QT study. Clinical pharmacology and therapeutics Clin Pharmacol Ther. 2012 92(6):696-706.
276. Martin N, et al. Randomised, double-blind, placebo-controlled study to assess the ocular safety of mirabegron in normotensive IOP research subjects. Eur Urol 2012 11(2): p. e686-e686a.
277. Nitti VW, et al. Urodynamics and safety of the beta3-adrenoceptor agonist mirabegron in males with lower urinary tract symptoms and bladder outlet obstruction. J Urol. 2013 190(4):1320-7.
278. Castro Diaz D, et al. Post hoc responder analyses of subjective and objective outcomes using pooled data from three randomised phase iii trials of mirabegron in patients with overactive bladder. Neurourol Urodyn 2013 Aug:32(6)928-929. [abstract]
279. Kelleher C, et al. A post-HOC analysis of pooled data from 3 randomised phase 3 trials ofmirabegronin patients with overactive bladder (OAB): Correlations between objective and subjective outcome measures. Int Urogynecol J 2013:24(suppl 1): S119-S120. [abstract]
280. Mariappan P, et al. Duloxetine, a serotonin and noradrenaline reuptake inhibitor (SNRI) for the treatment of stress urinary incontinence: a systematic review. Eur Urol 2007 51(1): p. 67-74.
281. Ghoniem GM, et al. A randomized controlled trial of duloxetine alone, pelvic floor muscle training alone, combined treatment and no active treatment in women with stress urinary incontinence. J Urol 2005 173(5): p. 1647-53.
282. Bump RC, et al. Long-term efficacy of duloxetine in women with stress urinary incontinence. BJU Int 2008 102(2): p. 214-8.
283. Vella M, et al. Duloxetine 1 year on: the long-term outcome of a cohort of women prescribed duloxetine. Int Urogynecol J Pelvic Floor Dysfunct 2008 19(7): p. 961-4.
284. Steers WD, et al. Duloxetine compared with placebo for treating women with symptoms of overactive bladder. BJU Int 2007 100(2): p. 337-45.
285. Filocamo MT, et al. Pharmacologic treatment in postprostatectomy stress urinary incontinence. Eur Urol 2007 51(6): p. 1559-64.
286. Cody JD, et al. Oestrogen therapy for urinary incontinence in post-menopausal women. Cochrane Database Syst Rev 2012 10: p. CD001405.
287. Lyytinen H, et al. Breast cancer risk in postmenopausal women using estrogen-only therapy. Obstet Gynecol 2006 108(6): p. 1354-60.
288. Yumru AE, et al. The use of local 17beta-oestradiol treatment for improving vaginal symptoms associated with post-menopausal oestrogen deficiency. J Int Med Res 2009 37(1): p. 198-204.
289. Fantl JA, et al. Efficacy of estrogen supplementation in the treatment of urinary incontinence. The Continence Program for Women Research Group. Obstet Gynecol 1996 88(5): p. 745-9.

290. Jackson S, et al. The effect of oestrogen supplementation on post-menopausal urinary stress incontinence: a double-blind placebo-controlled trial. Br J Obstet Gynaecol 1999 106(7): p. 711-8.
291. Wilson PD, et al. Treatment with oral piperazine oestrone sulphate for genuine stress incontinence in postmenopausal women. Br J Obstet Gynaecol 1987 94(6): p. 568-74.
292. Cardozo L, et al. Oestriol in the treatment of postmenopausal urgency: a multicentre study. Maturitas 1993 18(1): p. 47-53.
293. Robinson D, et al. Estrogens and the lower urinary tract. Neurourol Urodyn 2011 30(5): p. 754-7.
294. Mettler L, et al. Long-term treatment of atrophic vaginitis with low-dose oestradiol vaginal tablets. Maturitas 1991 14(1): p. 23-31.
295. Nelken RS, et al. Randomized trial of estradiol vaginal ring versus oral oxybutynin for the treatment of overactive bladder. Menopause. 2011 18(9):962-6.
296. Lose G, et al. Clinical experiences with desmopressin for long-term treatment of nocturia. J Urol 2004 172(3): p. 1021-5.
297. Robinson D, et al. Antidiuresis: a new concept in managing female daytime urinary incontinence. BJU Int 2004 93(7): p. 996-1000.
298. Khullar V, et al. Treatment of urge-predominant mixed urinary incontinence with tolterodine extended release: A randomized, placebo-controlled trial. Urology 2004 64(2): p. 269-275.
299. Kreder KJ, Jr., et al. Tolterodine is equally effective in patients with mixed incontinence and those with urge incontinence alone. BJU Int 2003 92(4): p. 418-21.
300. Kelleher C, et al. Solifenacin: As effective in mixed urinary incontinence as in urge urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct. 2006 17(4):382-8.
301. Staskin DR, et al. Short- and long-term efficacy of solifenacin treatment in patients with symptoms of mixed urinary incontinence. BJU international 2006 97(6): p. 1256-1261.
302. Bent AE, et al. Duloxetine compared with placebo for the treatment of women with mixed urinary incontinence. Neurourol Urodyn 2008 27(3): p. 212-21.
303. Bump RC, et al. Mixed urinary incontinence symptoms: urodynamic findings, incontinence severity, and treatment response. Obstet Gynecol 2003 102(1): p. 76-83.
304. Bai SW, et al. Comparison of the efficacy of Burch colposuspension, pubovaginal sling, and tension-free vaginal tape for stress urinary incontinence. Int J Gynaecol Obstet 2005 91(3): p. 246-51.
305. Foote AJ, et al. Laparoscopic colposuspension versus vaginal suburethral slingplasty: a randomised prospective trial. Aust N Z J Obstet Gynaecol 2006 46(6): p. 517-20.
306. Jelovsek JE, et al. Randomised trial of laparoscopic Burch colposuspension versus tension-free vaginal tape: long-term follow up. BJOG 2008 115(2): p. 219-25; discussion 225.
307. Liapis A, et al. Burch colposuspension and tension-free vaginal tape in the management of stress urinary incontinence in women. Eur Urol 2002 41(4): p. 469-73.
308. Paraiso MF, et al. Laparoscopic Burch colposuspension versus tension-free vaginal tape: a randomized trial. Obstet Gynecol 2004 104(6): p. 1249-58.
309. Persson J, et al. Cost-analyzes based on a prospective, randomized study comparing laparoscopic colposuspension with a tension-free vaginal tape procedure. Acta Obstet Gynecol Scand 2002 81(11): p. 1066-73.
310. Tellez Martinez-Fornes M, et al. A three year follow-up of a prospective open randomized trial to compare tension-free vaginal tape with Burch colposuspension for treatment of female stress urinary incontinence. Actas Urol Esp 2009 33(10): p. 1088-96.
311. Ustun Y, et al. Tension-free vaginal tape compared with laparoscopic Burch urethropexy. J Am Assoc Gynecol Laparosc 2003 10(3): p. 386-9.
312. Valpas A, et al. Tension-free vaginal tape and laparoscopic mesh colposuspension for stress urinary incontinence. Obstet Gynecol 2004 104(1): p. 42-9.
313. Wang AC, et al. Comparison of tension-free vaginal taping versus modified Burch colposuspension on urethral obstruction: a randomized controlled trial. Neurourol Urodyn 2003 22(3): p. 185-90.
314. Ward K, et al. Prospective multicentre randomised trial of tension-free vaginal tape and colposuspension as primary treatment for stress incontinence. BMJ 2002 325(7355): p. 67.
315. Drahoradova P, et al. Comparative development of quality of life between TVT and Burch colposuspension. Joint Meeting of the International Continence Society and the International UroGynecological Association, 34rd Annual Meeting, Paris, France, 25th-27th August 2004. Neurourol Urodyn 2004;23(5/6):387-616, abstract no. 278.
316. El-Barky E, et al. Tension free vaginal tape versus Burch colposuspension for treatment of female stress urinary incontinence. Int Urol Nephrol 2005 37(2): p. 277-81.
317. Maher C, et al. Laparoscopic colposuspension or tension-free vaginal tape for recurrent stress urinary incontinence and/or intrinsic sphincter deficiency-a randomised controlled trial (Abstract). Joint Meeting of the International Continence Society and the International UroGynecological Association, 34rd Annual Meeting, Paris, France, 25th-27th August 2004. Neurourol Urodyn 2004;23(5/6):433.

318. Ogah J, et al. Minimally invasive synthetic suburethral sling operations for stress urinary incontinence in women. Cochrane Database Syst Rev 2009(4): p. CD006375.
319. Latthe PM, et al. Two routes of transobturator tape procedures in stress urinary incontinence: a meta-analysis with direct and indirect comparison of randomized trials. BJU Int 2010 106(1): p. 68-76.
320. Mostafa A, et al. Single-incision mini-slings versus standard midurethral slings in surgical management of female stress urinary incontinence: an updated systematic review and meta-analysis of effectiveness and complications. Eur Urol 2014 65(2): p. 402-27.
321. Novara G, et al. Updated systematic review and meta-analysis of the comparative data on colposuspensions, pubovaginal slings, and midurethral tapes in the surgical treatment of female stress urinary incontinence. Eur Urol 2010 58(2): p. 218-38.
322. Jha S, et al. Impact of Incontinence Surgery on Sexual Function: A Systematic Review and Meta-Analysis. J Sex Med. 2012 9(1):34-43.
323. De Souza A, et al. Sexual function following retropubic TVT and transobturator Monarc sling in women with intrinsic sphincter deficiency: a multicentre prospective study. Int Urogynecol J 2012 23(2): p. 153-8.
324. Filocamo MT, et al. The impact of mid-urethral slings for the treatment of urodynamic stress incontinence on female sexual function: a multicenter prospective study. J Sex Med 2011 8(7): p. 2002-8.
325. Rechberger T, et al. Body mass index does not influence the outcome of anti-incontinence surgery among women whereas menopausal status and ageing do: a randomised trial. Int Urogynecol J. 2010 21(7):801-6.
326. Barber MD, et al. Risk factors associated with failure 1 year after retropubic or transobturator midurethral slings. Am J Obstet Gynecol 2008 199(6): p. 666 e1-7.
327. Campeau L, et al. A multicenter, prospective, randomized clinical trial comparing tension-free vaginal tape surgery and no treatment for the management of stress urinary incontinence in elderly women. Neurourol Urodyn 2007 26(7): p. 990-4.
328. Groutz A, et al. The safety and efficacy of the “inside-out” trans-obturator TVT in elderly versus younger stress-incontinent women: a prospective study of 353 consecutive patients. Neurourol Urodyn 2011 30(3): p. 380-3.
329. Dean N, et al. Laparoscopic colposuspension for urinary incontinence in women. Cochrane Database Syst Rev. 2006 19;(3):CD002239.
330. Glazener CM, et al. Anterior vaginal repair for urinary incontinence in women. Cochrane Database Syst Rev 2001(1): p. CD001755.
331. Lapitan MC, et al. Open retropubic colposuspension for urinary incontinence in women: a short version Cochrane review. Neurourol Urodyn 2009 28(6): p. 472-80.
332. Lapitan MC, et al. Open retropubic colposuspension for urinary incontinence in women. Cochrane Database Syst Rev 2009(4): p. CD002912.
333. Rehman H, et al. (2011) Traditional suburethral sling operations for urinary incontinence in women. Cochrane Database Syst Rev. 2011 (1):CD001754.
334. Albo ME, et al. Burch colposuspension versus fascial sling to reduce urinary stress incontinence. N Engl J Med 2007 356(21): p. 2143-55.
335. Keegan PE, et al. Periurethral injection therapy for urinary incontinence in women. Cochrane Database Syst Rev 2007(3): p. CD003881.
336. Kirchin V, et al. Urethral injection therapy for urinary incontinence in women. Cochrane Database Syst Rev. 2012 Feb 15;2:CD003881.
337. Ghoniem GM. Systematic review of polydimethylsiloxane injection: Short and long term durability outcomes for female stress urinary incontinence. [Abstract presented at SUFU 2012]
338. Kuhn A, et al. Where should bulking agents for female urodynamic stress incontinence be injected? Int Urogynecol J Pelvic Floor Dysfunct 2008 19(6): p. 817-21.
339. Lightner D, et al. A new injectable bulking agent for treatment of stress urinary incontinence: results of a multicenter, randomized, controlled, double-blind study of Durasphere. Urology 2001 58(1): p. 12-5.
340. Urinary incontinence: the management of urinary incontinence in women. Clinical guidelines CG40 National Institute for Health and Clinical Excellence.
341. Carr LK, et al. Autologous muscle derived cell therapy for stress urinary incontinence: A prospective, dose ranging study. J Urol. 2013 189(2):595-601.
342. Maher CF, et al. Pubovaginal sling versus transurethral Macroplastique for stress urinary incontinence and intrinsic sphincter deficiency: a prospective randomised controlled trial. BJOG 2005 112(6): p. 797-801.
343. Abrams P, et al. 4th International Consultation on Incontinence. 2009, Paris July 5-8, 2008: Plymouth: Health Publication Ltd, 2009.
344. Ashok K, et al. Recurrent urinary stress incontinence: an overview. J Obstet Gynaecol Res 2010 36(3): p. 467-73.
345. Lovatsis D, et al. Guidelines for the evaluation and treatment of recurrent urinary incontinence following pelvic floor surgery. J Obstet Gynaecol Can 2010 32(9): p. 893-904.
346. Bakali E, et al. Treatment of recurrent stress urinary incontinence after failed minimally invasive synthetic suburethral tape surgery in women. Cochrane Database Syst Rev. 2013 2:CD009407.

347. Abdel-Fattah M, et al. Evaluation of transobturator tension-free vaginal tapes in management of women with recurrent stress urinary incontinence. Urology 2011 77(5): p. 1070-5.
348. Richter HE, et al. Baseline predictors of one year treatment failure of retropubic and transobturator midurethral sling procedures for stress urinary incontinence. Female Pelvic Med Reconstr Surg 2010 16 (5) supplement 2:S62. [abstract]
349. Amaye-Obu FA, et al. Surgical management of recurrent stress urinary incontinence: A 12-year experience. Am J Obstet Gynecol 1999 181(6): p. 1296-307; discussion 1307-9.
350. Rardin CR, et al. Tension-free vaginal tape: outcomes among women with primary versus recurrent stress urinary incontinence. Obstet Gynecol 2002 100(5 Pt 1): p. 893-7.
351. Rezapour M, et al. Tension-Free vaginal tape (TVT) in women with mixed urinary incontinence--a long-term follow-up. Int Urogynecol J Pelvic Floor Dysfunct 2001 12 Suppl 2: p. S15-18.
352. Lee KS, et al. Outcomes following repeat mid urethral synthetic sling after failure of the initial sling procedure: rediscovery of the tension-free vaginal tape procedure. J Urol 2007 178(4 Pt 1): p. 1370-4; discussion 1374.
353. Stav K, et al. Repeat synthetic mid urethral sling procedure for women with recurrent stress urinary incontinence. J Urol 2010 183(1): p. 241-6.
354. Jarvis GJ. Surgery for genuine stress incontinence. Br J Obstet Gynaecol 1994 101(5): p. 371-4. [no abstract]
355. Shaikh S, et al. Mechanical devices for urinary incontinence in women. Cochrane Database Syst Rev 2006(3): p. CD001756.
356. Chung E, et al. 25-year experience in the outcome of artificial urinary sphincter in the treatment of female urinary incontinence. BJU Int 2010 106(11): p. 1664-7.
357. Costa P, et al. The use of an artificial urinary sphincter in women with type III incontinence and a negative Marshall test. J Urol 2001 165(4): p. 1172-6.
358. Heitz M, et al. [Therapy of female urinary incontinence with the AMS 800 artificial sphincter. Indications, outcome, complications and risk factors]. Urologe A 1997 36(5): p. 426-31.
359. Vayleux B, et al. Female urinary incontinence and artificial urinary sphincter: study of efficacy and risk factors for failure and complications. Eur Urol 2011 59(6): p. 1048-53.
360. Alonso RD, et al. Four years experience with the flowsecure artificial urinary sphincter. Problems and solutions. 2011 30:6 p. 1145-1146
361. Mandron E, et al. Laparoscopic artificial urinary sphincter implantation for female genuine stress urinary incontinence: technique and 4-year experience in 25 patients. BJU Int 2010 106(8): p. 1194-8; discussion 1198.
362. Roupret M, et al. Laparoscopic approach for artificial urinary sphincter implantation in women with intrinsic sphincter deficiency incontinence: a single-centre preliminary experience. Eur Urol 2010 57(3): p. 499-504.
363. Aboseif SR, et al. The adjustable continence therapy system for recurrent female stress urinary incontinence: 1-year results of the North America Clinical Study Group. J Urol 2009 181(5): p. 2187-91.
364. Aboseif SR, et al. Treatment of moderate to severe female stress urinary incontinence with the adjustable continence therapy (ACT) device after failed surgical repair. World J Urol 2011 29(2): p. 249-53.
365. Kocjancic E, et al. Adjustable continence therapy for severe intrinsic sphincter deficiency and recurrent female stress urinary incontinence: long-term experience. J Urol 2010 184(3): p. 1017-21.
366. Wachter J, et al. Adjustable continence therapy for female urinary incontinence: a minimally invasive option for difficult cases. Urol Int 2008 81(2): p. 160-6.
367. Maher C, et al. Surgical management of pelvic organ prolapse in women. Cochrane Database Syst Rev. 2013 4:CD004014.
368. Brubaker L, et al. Two-year outcomes after sacrocolpopexy with and without burch to prevent stress urinary incontinence. Obstet Gynecol. 2008 112(1):49-55.
369. Wei JT, et al. A midurethral sling to reduce incontinence after vaginal prolapse repair. N Engl J Med 2012 366(25): p. 2358-67.
370. Borstad E, et al. Surgical strategies for women with pelvic organ prolapse and urinary stress incontinence. Int Urogynecol J. 2010 21(2):179-86.
371. Costantini E, et al. Pelvic organ prolapse repair with and without prophylactic concomitant Burch colposuspension in continent women: a randomized, controlled trial with 8-year followup. J Urol 2011 185(6): p. 2236-40.
372. Costantini E, et al. Urgency, detrusor overactivity and posterior vault prolapse in women who underwent pelvic organ prolapse repair. Urol Int 2013 90(2): p. 168-73.
373. Kummeling MTM, et al. Sequential urodynamic assessment before and after laparoscopic sacrocolpopexy. Acta Obstet Gynecol Scand. 2013 92(2):172-7.
374. Lee DM, et al. A predictive factor in overactive bladder symptoms improvement after combined anterior vaginal wall prolapse repair: A pilot study. Korean J Urol. 2012 53(6):405-9.
375. Visco AG, et al. The role of preoperative urodynamic testing in stress-continent women undergoing sacrocolpopexy: the Colpopexy and Urinary Reduction Efforts (CARE) randomized surgical trial. Int Urogynecol J Pelvic Floor Dysfunct. 2008 May;19(5):607-14

376. Duecy EE, et al. Urodynamic prediction of occult stress urinary incontinence before vaginal surgery for advanced pelvic organ prolapse: evaluation of postoperative outcomes. Female Pelvic Med Reconstr Surg. 2010 16(4): 215-7.
377. Chughtai B, et al. Ambulatory pessary trial unmasks occult stress urinary incontinence. Obstet Gynecol Int 2012: p. 392027.
378. Blander DS, et al. Endoluminal magnetic resonance imaging in the evaluation of urethral diverticula in women. Urology. 2001 57(4):660-5.
379. Pathi SD, et al. Utility of clinical parameters, cystourethroscopy, and magnetic resonance imaging in the preoperative diagnosis of urethral diverticula. Int Urogynecol J 2013 24(2): p. 319-23.
380. Dwarkasing RS, et al. MRI evaluation of urethral diverticula and differential diagnosis in symptomatic women. AJR Am J Roentgenol 2011 197(3): p. 676-82.
381. Chung DE, et al. Urethral diverticulae in women: Discrepancies between MRI and surgical findings. J Urol. 2010 183(6):2265-9.
382. Han DH, et al. Outcomes of Surgery of Female Urethral Diverticula Classified Using Magnetic Resonance Imaging. Eur Urol. 2007 51(6):1664-70.
383. Ingber MS, et al. Surgically corrected urethral diverticula: Long-term voiding dysfunction and reoperation rates. Urology. 2011 77(1):65-9.
384. Lee UJ, et al. Rate of De Novo Stress Urinary Incontinence after Urethal Diverticulum Repair. Urology. 2008 71(5):849-53.
385. Ljungqvist L, et al. Female Urethral Diverticulum: 26-Year Followup of a Large Series. J Urol. 2007 177(1):219-24; discussion 224.
386. Migliari R, et al. Recurrent Pseudodiverticula of Female Urethra: Five-year Experience. Urology. 2009 73(6): 1218-22.
387. Stav K, et al. Urinary symptoms before and after female urethral diverticulectomy--can we predict de novo stress urinary incontinence? J Urol. 2008 180(5):2088-90.
388. Thomas AA, et al. Urethral Diverticula in 90 Female Patients: A Study With Emphasis on Neoplastic Alterations. J Urol. 2008;180(6):2463-7.
389. Imamoglu MA, et al. The comparison of artificial urinary sphincter implantation and endourethral macroplastique injection for the treatment of postprostatectomy incontinence. Eur Urol 2005 47(2): p. 209-13.
390. Secin FP, et al. [Limited efficacy of permanent injectable agents in the treatment of stress urinary incontinence after radical prostatectomy]. Arch Esp Urol 2005 58(5): p. 431-6.
391. Mantovani F, et al. Bulkamide hydrogel: Limits of a new bulking agent in the mini-invasive therapy of incontinence after prostatectomy. 34th Congress SIUD, 17-19 2010, Verona, Italy. Neurourol Urodyn 2010 29(S2):95.
392. Werther M, et al. Stress urinary incontinence after radical prostatectomy: Long term effects of endoscopic injection with dextranomer/hylauronic acid copolymer. 39th Annual Meeting of the International Continence Society, San Francisco, USA. 29 September to 3 October. Neurourol Urodyn 2009;28(7):567-935, abstract no. 643.
393. Silva LA, et al. Surgery for stress urinary incontinence due to presumed sphincter deficiency after prostate surgery. Cochrane Database Syst Rev 2011(4): p. CD008306.
394. Zeif HJ, et al. The male sling for post-radical prostatectomy urinary incontinence: urethral compression versus urethral relocation or what is next? Br J Med Surg Urol 2010;3(4):134-143.
395. Cornel EB, et al. Can advance transobturator sling suspension cure male urinary postoperative stress incontinence? J Urol 2010 183(4): p. 1459-63.
396. Abrams P, et al. Fourth International Consultation on Incontinence Recommendations of the International Scientific Committee: Evaluation and treatment of urinary incontinence, pelvic organ prolapse, and fecal incontinence. Neurourol Urodyn 2010 29(1): p. 213-40.
397. Bauer RM, et al. Contemporary management of postprostatectomy incontinence. Eur Urol 2011 59(6): p. 985-96.
398. Herschorn S, et al. Surgical treatment of stress incontinence in men. Neurourol Urodyn 2010 29(1): p. 179-90.
399. Bauer RM, et al. Results of the AdVance transobturator male sling after radical prostatectomy and adjuvant radiotherapy. Urology 2011 77(2): p. 474-9.
400. Bauer RM, et al. Mid-term results for the retroluminar transobturator sling suspension for stress urinary incontinence after prostatectomy. BJU Int 2011 108(1): p. 94-8.
401. Cornu JN, et al. Mid-term evaluation of the transobturator male sling for post-prostatectomy incontinence: focus on prognostic factors. BJU Int 2011 108(2): p. 236-40.
402. Gill BC, et al. Patient Perceived Effectiveness of a New Male Sling as Treatment for Post-Prostatectomy Incontinence. J Urol. 2010 183(1):247-52.
403. Rehder P, et al. The 1 year outcome of the transobturator retroluminal repositioning sling in the treatment of male stress urinary incontinence. BJU Int 2010 106(11): p. 1668-72.

404. Kim JH, et al. Long term follow-up of readjustable urethral sling procedure (Remeex System) for male stress urinary incontinence. (Abstract 11.) Society for Urodynamics and Female Urology, 2011 Winter Meeting, March 1-5, 2011, Arizona Biltmore Hotel, Phoenix, Arizona. Neurourology Urodyn 2011;30:204-279.
405. Bochove-Overgaauw DM, et al. An adjustable sling for the treatment of all degrees of male stress urinary incontinence: Retrospective evaluation of efficacy and complications after a minimal followup of 14 months. J Urol. 2011 185(4):1363-8.
406. Hubner WA, et al. Adjustable bulbourethral male sling: Experience after 101 cases of moderate-to-severe male stress urinary incontinence. BJU international 2011 107(5): p. 777-782.
407. Dalpiaz O, et al. Mid-term complications after placement of the male adjustable suburethral sling: a single center experience. J Urol 2011 186(2): p. 604-9.
408. Hoda MR, et al. Early results of a European multicentre experience with a new self-anchoring adjustable transobturator system for treatment of stress urinary incontinence in men. BJU Int. 2013 111(2):296-303.
409. Seweryn J, et al. Initial experience and results with a new adjustable transobturator male system for the treatment of stress urinary incontinence. J Urol. 2012 187(3):956-61.
410. Trigo Rocha F, et al. A prospective study evaluating the efficacy of the artificial sphincter AMS 800 for the treatment of postradical prostatectomy urinary incontinence and the correlation between preoperative urodynamic and surgical outcomes. Urology 2008 71(1): p. 85-9.
411. Lai HH, et al. Urodynamic testing in evaluation of postradical prostatectomy incontinence before artificial urinary sphincter implantation. Urology 2009 73(6): p. 1264-9.
412. Aaronson DS, et al. Transcorporal artificial urinary sphincter placement for incontinence in high-risk patients after treatment of prostate cancer. Urology 2008 72(4): p. 825-7.
413. Hudak SJ, et al. Impact of 3.5 cm artificial urinary sphincter cuff on primary and revision surgery for male stress urinary incontinence. J Urol 2011 186(5): p. 1962-6.
414. O'Connor RC, et al. Long-term follow-up of single versus double cuff artificial urinary sphincter insertion for the treatment of severe postprostatectomy stress urinary incontinence. Urology 2008 71(1): p. 90-3.
415. Smith P, et al. Hypercontinence and cuff erosion after artificial urinary sphincter insertion: A comparison of cuff sizes and placement techniques. American Urological Association 2011 Annual Meeting, Washington DC, USA, 14-19 May 2011. Abstract no. 1348.
416. Lentz A, et al. Outcomes following artificial sphincter implantation after prior unsuccessful advance male sling. J Urol. 2012 187(6):2149-53.
417. Roupret M, et al. Management of stress urinary incontinence following prostate surgery with minimally invasive adjustable continence balloon implants: functional results from a single center prospective study. J Urol 2011 186(1): p. 198-203.
418. Crivellaro S, et al. Adjustable continence therapy (ProACT) and bone anchored male sling: Comparison of two new treatments of post prostatectomy incontinence. Int J Urol 2008 15(10): p. 910-4.
419. Gilling PJ, et al. An adjustable continence therapy device for treating incontinence after prostatectomy: a minimum 2-year follow-up. BJU Int 2008 102(10): p. 1426-30; discussion 1430-1.
420. Gregori A, et al. Transrectal Ultrasound-Guided Implantation of Adjustable Continence Therapy (ProACT): Surgical Technique and Clinical Results After a Mean Follow-Up of 2 Years. Eur Urol. 2010 Mar;57(3):430-6.
421. Hubner WA, et al. Treatment of incontinence after prostatectomy using a new minimally invasive device: adjustable continence therapy. BJU Int 2005 96(4): p. 587-94.
422. Martens FM, et al. ProACT for stress urinary incontinence after radical prostatectomy. Urol Int 2009 82(4): p. 394-8.
423. Kjaer L, et al. Adjustable continence balloons: Clinical results of a new minimally invasive treatment for male urinary incontinence. Scand J Urol Nephrol. 2012 46(3):196-200.
424. Duthie JB, et al. Botulinum toxin injections for adults with overactive bladder syndrome. Cochrane Database Syst Rev 2011(12): p. CD005493.
425. Mangera A, et al. Contemporary management of lower urinary tract disease with botulinum toxin A: a systematic review of botox (onabotulinumtoxinA) and dysport (abobotulinumtoxinA). Eur Urol 2011 60(4): p. 784-95.
426. Chapple C, et al. OnabotulinumtoxinA 100 U significantly improves all idiopathic overactive bladder symptoms and quality of life in patients with overactive bladder and urinary incontinence: a randomised, double-blind, placebo-controlled trial. Eur Urol 2013 64(2): p. 249-56.
427. Nitti VW, et al. OnabotulinumtoxinA for the treatment of patients with overactive bladder and urinary incontinence: results of a phase 3, randomized, placebo controlled trial. J Urol 2013 189(6): p. 2186-93.
428. White WM, et al. Short-term efficacy of botulinum toxin a for refractory overactive bladder in the elderly population. J Urol 2008 180(6): p. 2522-6.
429. Visco AG, et al. Anticholinergic therapy vs. onabotulinumtoxina for urgency urinary incontinence. N Engl J Med 2012 367(19): p. 1803-13.
430. Herbison GP, et al. Sacral neuromodulation with implanted devices for urinary storage and voiding dysfunction in adults. Cochrane Database Syst Rev 2009(2): p. CD004202.

431. Weil EH, et al. Sacral root neuromodulation in the treatment of refractory urinary urge incontinence: a prospective randomized clinical trial. Eur Urol 2000 37(2): p. 161-71.
432. Brazzelli M, et al. Efficacy and safety of sacral nerve stimulation for urinary urge incontinence: a systematic review. J Urol 2006 175(3 Pt 1): p. 835-41.
433. Groen J, et al. Sacral neuromodulation as treatment for refractory idiopathic urge urinary incontinence: 5-year results of a longitudinal study in 60 women. J Urol 2011 186(3): p. 954-9.
434. van Kerrebroeck PE, et al. Results of sacral neuromodulation therapy for urinary voiding dysfunction: outcomes of a prospective, worldwide clinical study. J Urol 2007 178(5): p. 2029-34.
435. Groenendijk PM, et al. Urodynamic evaluation of sacral neuromodulation for urge urinary incontinence. BJU Int 2008 101(3): p. 325-9.
436. Cody June D, et al. Urinary diversion and bladder reconstruction/replacement using intestinal segments for intractable incontinence or following cystectomy. Cochrane Database Syst Rev. 2012 Feb 15;2:CD003306.
437. Kockelbergh RC, et al. Clam enterocystoplasty in general urological practice. Br J Urol 1991 68(1): p. 38-41.
438. Awad SA, et al. Long-term results and complications of augmentation ileocystoplasty for idiopathic urge incontinence in women. Br J Urol 1998 81(4): p. 569-73.
439. Greenwell TJ, et al. Augmentation cystoplasty. BJU Int 2001 88(6): p. 511-25. [no abstract]
440. Cartwright PC, et al. Bladder autoaugmentation: partial detrusor excision to augment the bladder without use of bowel. J Urol 1989 142(4): p. 1050-3.
441. Leng WW, et al. Enterocystoplasty or detrusor myectomy? Comparison of indications and outcomes for bladder augmentation. J Urol 1999 161(3): p. 758-63.
442. ter Meulen PH, et al. A study on the feasibility of vesicomyotomy in patients with motor urge incontinence. Eur Urol 1997 32(2): p. 166-9.
443. Juang CM, et al. Efficacy analysis of trans-obturator tension-free vaginal tape (TVT-O) plus modified Ingelman-Sundberg procedure versus TVT-O alone in the treatment of mixed urinary incontinence: a randomized study. Eur Urol 2007 51(6): p. 1671-8; discussion 1679.
444. Kuo HC. Effect of detrusor function on the therapeutic outcome of a suburethral sling procedure using a polypropylene sling for stress urinary incontinence in women. Scand J Urol Nephrol 2007 41(2): p. 138-43.
445. Colombo M, et al. The Burch colposuspension for women with and without detrusor overactivity. Br J Obstet Gynaecol 1996 103(3): p. 255-60.
446. Kulseng-Hanssen S, et al. The tension free vaginal tape operation for women with mixed incontinence: Do preoperative variables predict the outcome? Neurourol Urodyn 2007 26(1): p. 115-21; discussion 122.
447. Kulseng-Hanssen S, et al. Follow-up of TVT operations in 1,113 women with mixed urinary incontinence at 7 and 38 months. Int Urogynecol J Pelvic Floor Dysfunct 2008 19(3): p. 391-6.
448. Rechberger T, et al. The clinical effectiveness of retropubic (IVS-02) and transobturator (IVS-04) midurethral slings: randomized trial. Eur Urol 2009 56(1): p. 24-30.
449. Liao CH, et al. Increased risk of large post-void residual urine and decreased long-term success rate after intravesical onabotulinumtoxinA injection for refractory idiopathic detrusor overactivity. J Urol 2013 189(5): p. 1804-10.

6. CONFLICT OF INTEREST

All members of the Urinary Incontinence Guidelines Panel have provided disclosure statements on all relationships that they have and that might be perceived to be a potential source of conflict of interest. This information is publically accessible through the European Association of Urology website. This Guidelines document was developed with the financial support of the European Association of Urology. No external sources of funding and support have been involved. The EAU is a non-profit organisation and funding is limited to administrative assistance and travel and meeting expenses. No honoraria or other reimbursements have been provided.