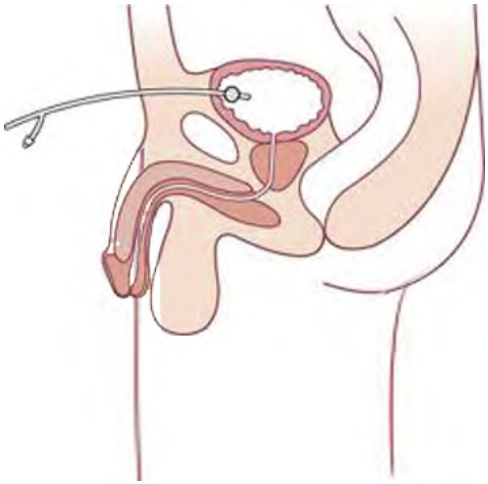
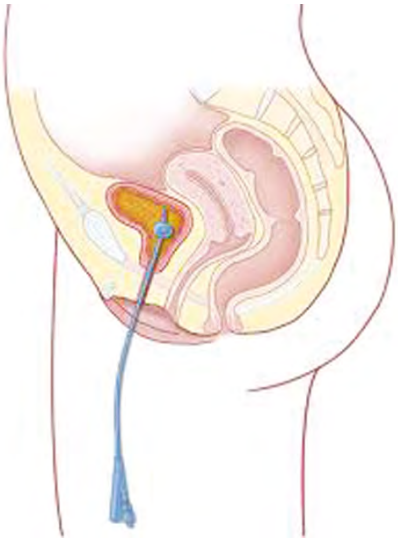
Evidence-based Guidelines for
Best Practice in Urological Health Care

Indwelling catheterisation in adults

Urethral and Suprapubic

2024





European Association of Urology Nurses

Evidence-based Guidelines for
Best Practice in Urological Health Care

Indwelling catheterisation in adults

Urethral and Suprapubic

V. Geng
H. Lurvink
I. Pearce
S. Vahr Lauridsen

Preface

The European Association of Urology Nurses (EAUN) was created in April 2000 to represent European urological nurses. The EAUN's underlying goal is to foster the highest standards of urological nursing care throughout Europe and beyond. With administrative, financial and advisory support from the European Association of Urology (EAU), the EAUN also encourages research and aspires to develop European standards for education and accreditation of urology nurses.

We believe that excellent health care goes beyond geographical boundaries. Improving current standards of urological nursing care has been top of our agenda, with the aim of directly helping our members develop or update their expertise. To fulfil this essential goal, we are publishing an update of one of our Evidence-based Guidelines for Best Practice in Urological Health Care booklets; a comprehensive compilation of theoretical knowledge and practical guidelines on indwelling urinary catheters. The EAUN Guidelines Working Group believes there is a need to provide guidelines with recommendations clearly stating the level of evidence of each procedure with the aim of improving current practices and delivering a standard and reliable protocol.

With our emphasis on delivering these guidelines based on consensus underpinned by scientific evidence in the published literature, we intend to support nurses and practitioners who are already assessed as competent in indwelling catheter procedures and to inform and educate other nurses and health care professionals. Although these guidelines aim to be comprehensive, effective practice can only be achieved if nurses or practitioners have a clear and thorough knowledge of the anatomy under discussion, and the necessary grasp and understanding of basic nursing principles.

In Europe, there is quite some variation among countries in the education, competency, activities and roles of urological nurses. It is therefore difficult for any guidelines to fulfil all requirements. However, the Working Group has tried to ensure that every nurse and health care professional may gain some benefit from using these guidelines.

Table of contents

1. Introduction

Topic

Indwelling catheters are widely applied. Catheter-associated urinary tract infection (CAUTI) is one of the most common health care-acquired infections, and 70–80% of these are attributable to use of indwelling urethral catheters. Recent prevalence surveys have reported that urinary catheters are the most common indwelling devices, with 17.5% of patients in 66 European hospitals having a catheter and 23.6% in 183 US hospitals. [1]

Although there is a lot of literature on indwelling catheters, to our knowledge, prior to our 2012 publication, there was only limited evidence-based guidance on this topic available for nurses. We have included clear illustrations, extensive references, and annotated procedures to help nurses identify potential problem areas and support effective and efficient patient care. Included are topics such as indications and contraindications, equipment, nursing principles and interventions in catheter-related care, as well as instructions to patients and carers. We also highlight the psychological and social aspects unique to the experience of patients with indwelling catheters. These aspects have a profound influence on the patients' quality of life and supporting patients in these aspects is typically part of the nurses' role.

Limitations

This publication focuses on suprapubic and urethral indwelling catheters. The guidelines only describe the procedures and materials in adults and not children. The content has been restricted to what is encountered in regular indwelling catheterisation practice and not in exceptional situations, unless mentioned. These guidelines are intended to complement, or provide support to, established clinical practice and should be used within the context of local policies and existing protocols.

Disclosures

The EAUN Guidelines Working Group members have provided disclosure statements of all relationships that might be a potential source of conflict of interest. The information has been stored in the EAU database. This guidelines document was developed with the financial support of the EAU.

The EAUN 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.

Availability

The full text of these guidelines can be accessed on the EAUN website (www.eaun.org) and in the ECRI Guidelines Trust (https://guidelines.ecri.org/).

2. Methodology

The EAUN Guidelines Working Group for indwelling catheters have prepared this guideline document to help nurses assess the evidence-based management of catheter care, and to incorporate the guidelines' recommendations into their clinical practice. These guidelines are not meant to be proscriptive, nor will adherence to these guidelines guarantee a successful outcome in all cases. Ultimately, decisions regarding care must be made on a case-by-case basis by healthcare professionals after consultation with their patients using their clinical judgement, knowledge and expertise.

The Expert Panel consists of a multidisciplinary team of nurse specialists and a urologist (*see Chapter 17, About the authors*). Job titles within the specialty differ among countries, and even within countries. To the purpose of this document, we refer to all nurses who are working with indwelling catheters as nurse specialists.

2.1 PICO questions

Prior to the literature search, PICO questions were formulated to help answer questions from practice with evidence. The individual PICO questions can be found in Appendix S.

However, hardly any PICO questions were answered by the literature. There is a need for research in this area because these issues are often costly and time-consuming and restrict the quality of life of catheter users. By answering relevant questions, the gap between practice and science can be increasingly narrowed.

2.2 Search keywords

Search terms:

- Urinary catheter
- Indwelling catheter (suprapubic and transurethral)
- Urinary tract infection
- Bacteriuria
- Hospital-acquired infection
- Quality of life
- Sexual (dys)function

Limit to:

- years: 2010 – current
- English language

Exclude:

- Children and adolescents
- Notes/editorials/letters/comments/news/opinions
- Case reports
- Abstracts

Remove:

Duplicates

2.3 Literature search

The information offered in these guidelines was obtained through a systematic literature search and through review of current procedures undertaken in member countries of the EAUN. All group members participated in the critical assessment of the scientific papers identified. Bibliographical databases consulted included Embase, Medline, the Cochrane Library database CENTRAL, Cochrane Database of Systematic Reviews (CDSR) and Cinahl. The search was based on the keywords listed above. The question for which the references were searched was: "Is there any evidence for indwelling catheterisation for nursing interventions in different care situations such as preparation, insertion, or care of indwelling catheters as well as catheter materials or complications?" Both Embase and Medline were searched using both free text and the respective thesauri MeSH and Emtree. If a topic was not covered by the results of the search, earlier references were used.

Whenever possible, the Guidelines Working Group graded treatment recommendations using a three-grade system (A–C) and inserted levels of evidence to help readers assess the validity of the statements made. The aim of this practice was to ensure transparency between the underlying evidence and the recommendations given. This system is further described in Tables 1 and 2. (*see Section 2.9*)

2.4 Limitations of the search

EAUN commissioned Yuhong Yuan, Department of Medicine, Hamilton Health Science Center, McMaster University, Hamilton, ON, Canada to do the search. The initial search was performed on 31 January 2017 and updated searches on 25 July 2018 and 7 December 2020. The search results from Medline, Embase, CENTRAL, CDSR and Cinahl were not limited to any type of study. In all databases, output was limited to human studies. In Embase, Medline and Cinahl output was limited to English language publications.

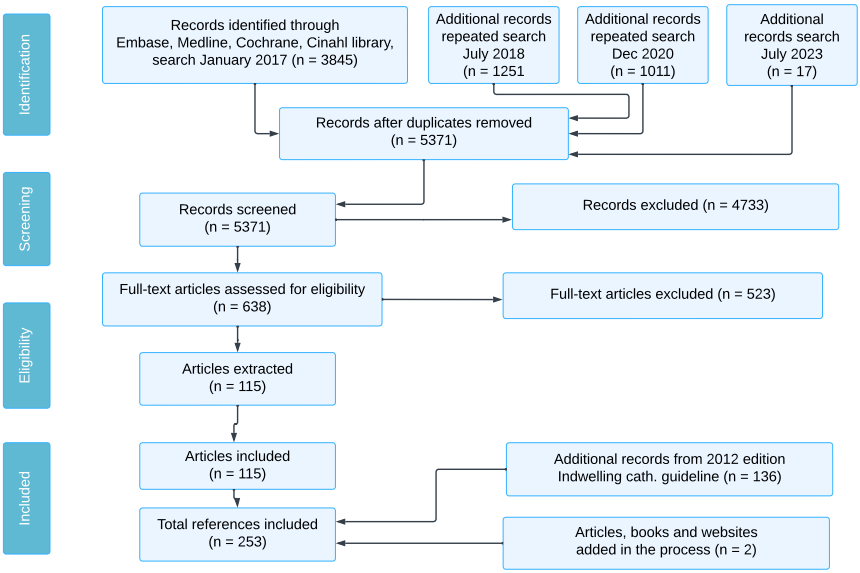
In 2023 an additional focussed search was performed in Medline for systematic reviews and meta-analysis from December 2020 - 15 July 2023.

2.5 Search results

The search resulted in 5371 abstracts from scientific publications. After reading the abstracts, 638 were left and full-text articles were made available to the Working Group. Of these, 115 articles were used in the guidelines. It was a policy decision to restrict the search in this way, though the group were aware that more complex strategies were possible and would be encouraged in the context of a formal systematic review. In the process of working with the articles, 2 new references were found and added to the reference list, that were relevant for the topic and cited in the text. 136 references from the previous version of these guidelines were retained.

The time frame covered by the referenced literature is 1976 to July 2023.

Diagram 1. PRISMA Flow diagram of the search



2.6 Expert nurse survey and discussion

In May 2021, several issues for which no clear evidence was found in the literature were surveyed with an online survey and the results were discussed in a consensus video meeting with a group of specialist nurses for better understanding of the survey answers and to seek consensus.

The survey confirmed there is a lot of difference in current nursing practice. In the consensus meeting, the authors were able to confirm the text in the current guideline

regarding possible reasons and solutions for leakage, advice for encrustation, advise for sex with an indwelling catheter, instructions for catheter bag and valve replacement, and reasons and good practice for flushing a long-term catheter. These survey results and discussion support the recommendations with an evidence level 4, grade of recommendation C.

2.7 Limitations of the document

The EAUN acknowledges and accepts the limitations of this document. It must be emphasised that the current guidelines provide information about the treatment of individual patients according to standardised approach. The information should be considered as providing recommendations without legal implications. The intended readership is the pan-European practising urology nurse and nurses working in a related field.

Cost-effectiveness considerations and non-clinical questions are best addressed locally and therefore fall outside the remit of these guidelines. Other stakeholders have not been involved in producing this document.

2.8 Review process

The Working Group included an extensive number of topics, which are not always only applicable to catheterisation, but decided to include them because they make the guidelines more complete. A blinded review was carried out by specialised nurses and urologists in several countries. To ensure high quality nurse reviewers from various countries, national urology nurses societies were invited to propose reviewers. The Working Group revised the document based on the comments received. A final version was approved by the EAUN Board and the EAU Executive member responsible for EAUN activities.

2.9 Rating system

The recommendations provided in these documents are based on a rating system (Table 1 and 2) modified from that produced by the Oxford Centre for Evidence-based Medicine. [2]

Some of the literature was not easy to grade. If, however, the EAUN Working Group thought that the information would be useful in practice, it was ranked with an evidence level 4, grade of recommendation C. Low level evidence indicates that no higher level was found in the literature when writing these guidelines, but cannot be regarded as an indication of the importance of the topic or recommendation for daily practice.

Table 1: Level of evidence (LE)

LE	Type of evidence
1a	Evidence obtained from meta-analysis of randomised trials
1b	Evidence obtained from at least one randomised trial
2a	Evidence obtained from one well-designed controlled study without randomisation
2b	Evidence obtained from at least one other type of well-designed quasi-experimental study
3	Evidence obtained from well-designed non-experimental studies, such as comparative studies, correlation studies and case reports
4	Evidence obtained from expert committee reports or opinions or clinical experience of respected authorities

Table 2: Grade of recommendation (GR)

GR	Nature of recommendation
A	Based on clinical studies of good quality and consistency addressing the specific recommendation and including at least one randomised trial
B	Based on well-conducted clinical studies, but without randomised clinical trials
C	Made despite the absence of directly applicable clinical studies of good quality

The definition of evidence-based nursing according to Behrens 2004 is: "Integration of the latest, highest level scientific research into the daily nursing practice, with regard to theoretical knowledge, nursing experience, the ideas of the patient and available resources". [3]

There are four components for nursing decisions:
- results of nursing science
- personal clinical experience of the nurse
- existing resources
- patient wishes. [4]

This definition makes clear that both the literature and the experience of nurses and patients are necessary for decision-making.

3. Terminology (definitions)

A catheter is a thin hollow flexible tube that can be inserted in the bladder either through the urethra (urethral) or suprapubic to drain the urine or other bladder contents.

3.1 Transurethral or suprapubic catheterisation

Transurethral indwelling catheterisation or urinary catheterisation is defined as passage of a catheter into the urinary bladder via the urethra (urethral catheter) [5] (Figs. 1 and 2). Transurethral indwelling catheterisation is also called urethral catheterisation. In this document, we only use the term urethral catheterisation.

Suprapubic catheterisation is the insertion of a catheter into the bladder via the anterior abdominal wall (Figs. 3 and 4).

Urethral catheterisation

Fig. 1 Urethral catheter in female

(Courtesy of Coloplast A./S, see chapter 15)

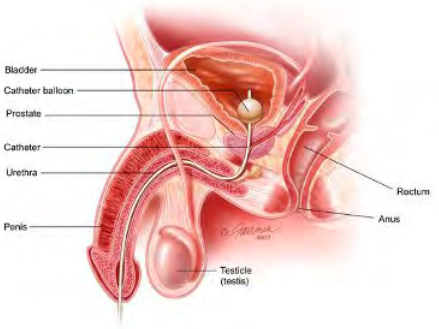


Fig. 2 Urethral catheter in male

(Courtesy of: Urologyhealth.org, see chapter 15)

Suprapubic catheterisation

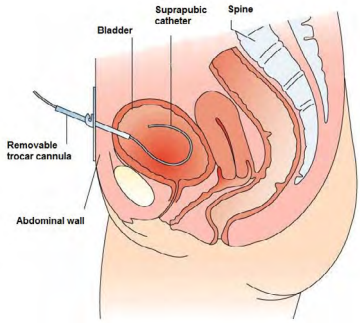


Fig. 3 Suprapubic catheter
(Courtesy of: Hospital Santa Maria Lleida)

Fig. 4 Suprapubic catheter with balloon
(Courtesy of Coloplast A./S, see chapter 15)

3.2 Short-term or long-term catheterisation

Short-term or long-term catheterisation depends on the indication. Short-term catheterisation is defined as a duration of catheterisation which is intended to be < 14 days. [6]

Accordingly, long-term catheters remain *in situ* for ≥ 14 days, usually because of urinary retention secondary to disease conditions. [6-9]

3.3 Closed drainage system

A closed catheter drainage system is an aseptic system in which the path from the tip of the catheter inserted into the bladder, to the bag which catches urine, is closed and should not be disconnected. This is intended to eliminate inoculation of the urinary tract with bacteria via the catheter drainage tubing and from the collection bag. [10]

The term closed drainage is, however, not strictly accurate as there are numerous portals of entry for pathogens and the system must be opened to allow emptying and be disconnected when the drainage bag is changed.

4. Alternatives, indications, and contraindications

4.1 Alternatives to placing an indwelling catheter

An indwelling catheter should only be placed when there is a clear indication. It should not stay in place longer than necessary. It is important first to consider alternatives before placing an indwelling catheter. A catheter is usually the last resort when other options have failed or proved to be insufficient but may be placed by patient choice in preference to other alternatives. To insert a catheter only for the comfort of the nursing staff and or carers is irresponsible.

The following alternatives to an indwelling catheter should be considered:

1. Male external catheter or sheath [11-22]
2. Female external urinary catheter [23]
3. Intermittent catheterisation by a nurse, carer, family member or the patient [12, 13, 18-21, 24, 25]
4. Continence pad/containment product. [16, 19]

Recommendations	LE	GR
Consider other methods for management, including male external catheters or intermittent catheterisation, when appropriate [13]	1b	A
Intermittent catheterisation is preferable to indwelling urethral or suprapubic catheters in patients with bladder emptying dysfunction if it is clinically appropriate and a practical option for the patient [24]	1b	B
Use of a suprapubic catheter or male external or intermittent catheter in appropriate patients is preferable to an indwelling urethral catheter [14]	2b	B
To insert a catheter only for the convenience of the nursing personnel is irresponsible	4	C

GR, grade of recommendation; LE, level of evidence.

4.2 Indications for urethral catheterisation

Indication	Details	References
Urinary retention	• Acute • Chronic	[15, 16, 19, 24, 26-28]
Voiding difficulties	• As a result of neurological disorders that cause paralysis or loss of sensation affecting urination (coma) • Due to bladder outlet obstruction • Urethral stricture • Enlarged prostate gland in men	[15, 16, 24, 26]
Measurement of urinary output	• In critically ill patients • Intraoperative monitoring	[15, 16, 19, 24, 26-28]
Intravesical therapy	• Bladder irrigation • Lavage	[29]
Surgery	• In selected surgical procedures • Urological surgery, e.g.: urethrotomy, TURP, HoLEP, Rezume, etc. • In case of spinal/epidural anaesthesia, e.g., prolonged labour • Surgery on contiguous structures of the genitourinary tract • When bladder emptiness is needed	[15, 16, 19, 24, 26, 27, 28]
To assist in incontinent patients	• In healing of open sacral or perineal wounds • To maintain skin integrity • Intractable incontinence • When conservative treatment methods have been unsuccessful	[16, 24, 26, 27] [15, 16, 19, 26-28]
Prolonged immobilisation	• Potentially unstable thoracic or lumbar spine • Multiple traumatic injuries such as pelvic fractures	[24, 30]
Bladder decompression	• Gradual or rapid	[31]
To improve comfort at end-of-life care		[15, 16, 24, 26-28]

Recommendation	LE	GR
Insert a catheter only when it is justified by one of the indications mentioned in the table in Section 4.2.	4	A

4.3 Relative contraindications for urethral catheterisation

- Acute [32] or symptomatic chronic prostatitis
- Suspicion of urethral trauma [33]
- Traumatic hypospadias secondary to previous long-term indwelling urethral catheterisation

4.4 Indications for suprapubic catheterisation

In addition to the indications of the urethral catheterisation the following indications apply:

- Acute and chronic urine retention that cannot be adequately drained with a urethral catheter. [27, 32]
- Preferred by patient due to their needs, e.g., user of a wheelchair, sexual issues. [15, 27]
- Acute prostatitis [32]
- Fournier's gangrene
- Urethral stricture or obstruction, abnormal urethral anatomy
- Urethral or pelvic trauma [27]
- Complications to long-term urethral catheterisation
- When long-term catheterisation is used to manage incontinence
- Complex urethral or abdominal surgery
- Patients with faecal incontinence who are constantly soiling the urethral catheter
- To protect a perineal wound from urinary contamination

4.5 Absolute contraindications for suprapubic catheterisation

- Known or suspected carcinoma of the bladder [18, 27, 34-36]
- In the absence of an easily palpable or ultrasonographically localised distended urinary bladder [18, 27, 35]
- Visible (gross/frank) haematuria

4.6 Relative contraindications for suprapubic catheterisation

- Previous lower abdominal surgery [27]
- Prosthetic devices in lower abdomen; e.g., lower hernia mesh [36]
- Coagulopathy (until the abnormality is corrected) [18, 27] and anticoagulation therapy for blood clotting disorders [27]
- Ascites [27]
- Pregnancy [27]

4.7 Advantages of suprapubic catheterisation

There is little evidence-based research on the use of suprapubic catheters. However, experts believe that there may be several advantages to their use when compared with urethral catheterisation:

- Less risk of urethral trauma or necrosis, e.g., traumatic hypospadias in men or patulous urethra in female, or catheter-induced urethritis [18, 27, 35, 37]
- Reduced risk of catheter contamination with microorganisms commonly found in the bowel [18, 27, 34, 35, 37, 38]
- Greater comfort, particularly for patients who use a wheelchair [18, 27, 34, 35, 38]
- Easier access to the entry site for cleansing and catheter change [18, 27, 34, 35]
- More appropriate in respect of a person's sexual activity (intercourse) [27, 35]
- Can be blocked off and the ability to void urethrally assessed prior to removal of the suprapubic catheter [18, 27, 34, 35, 37, 38]
- Greater preservation of patient dignity
- Easier to maintain and care for

Limitations of suprapubic catheters:

- Insertion is an invasive procedure with the risk of bleeding, visceral injury, and peritoneal perforation [39]
- The patient may still leak urine via the urethra [39]
- Specialised training may be required for healthcare professionals and carers for changing a suprapubic catheter [39]
- Patients with artificial heart valves may require antibiotic therapy prior to initial insertion or routine catheter change; however, this depends on local healthcare management policy
- Patients on anticoagulant therapy require their coagulation levels to be checked prior to insertion of a suprapubic catheter. Anticoagulant therapy and coagulations levels depend on local healthcare management policy.

4.8 Short-term versus long-term catheterisation

Short-term catheterisation is mostly used:

- During surgical procedures, prolonged labour and post-operative care
- For a variable period of time following certain interventions, e.g., prostate artery embolisation
- For exact monitoring of urine output in acute illness
- For relief of acute urinary retention
- Instillation of medication directly in the bladder (intravesical)
- To facilitate bladder washout and irrigation

Long-term catheterisation can be necessary in:

1. Bladder outlet obstruction in patients who are unsuitable for surgical relief of the obstruction
2. Chronic retention; often as a result of neurological injury or disease where intermittent catheterisation is not possible [8]
3. Acontractile bladder in patients who are unable or unwilling to perform intermittent self-catheterisation
4. Debilitated, paralysed or comatose patients in presence of skin breakdown and infected pressure ulcers – only as a last resort when alternative non-invasive approaches are unsatisfactory or unsuccessful
5. Cases where a patient insists on this form of management after discussion of the risks [40]
6. Intractable incontinence when all other measures have been tried and proven to be ineffective or are contraindicated [41]

See Section 4.1 for alternatives
See Appendix A Decision flowchart on indwelling catheterisation

5. Equipment and products

5.1 Types of catheters

A catheter is a thin hollow tube that can be inserted in the bladder either through the urethra or suprapubically.

5.1.1 Balloon catheter or two-way catheter for suprapubic or transurethral catheterisation

Fig. 1 Female transurethral catheter

(Courtesy of Coloplast A./S, see chapter 15)

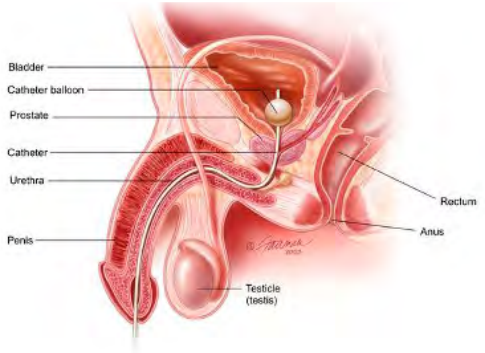


Fig. 2 Male transurethral catheter

(Courtesy of Urologyhealth.org, see chapter 15)

Fig. 4 Male suprapubic catheter

(Courtesy of Coloplast A./S, see chapter 15)

In 1853, Jean Francois Reybard developed the first indwelling catheter with an inflated balloon to secure its place in the bladder. One channel is used for urine and one for the balloon (Fig. 5). In 1932 Dr. Frederick Foley redesigned this catheter. The general name of the two-way urinary catheter is the Foley catheter.

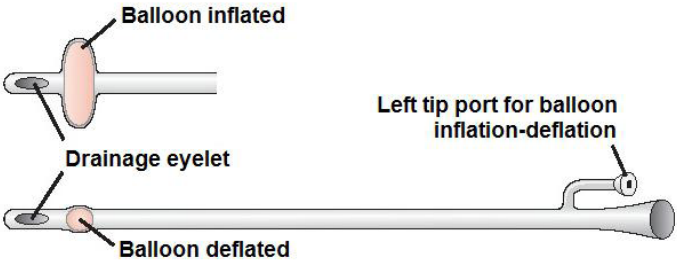


Fig. 5 Two-way catheter with an inflated and deflated balloon

(Courtesy of Essential Clinical Procedures, see chapter 15)

Indications for a two-way catheter:

- Standard transurethral catheterisation
- Standard suprapubic catheterisation

5.1.2 Integrated balloon catheter

The Fortune® integrated balloon catheter is designed to eliminate the uneven edge out of an ordinary balloon. The balloon is integrated into the catheter shaft to create a complete smooth surface with the aim to reduce friction, trauma, discomfort and accumulation of urine sediment. It can be used transurethral and suprapubic (2-way catheter).

Fig. 6 Balloon catheters. Left: ordinary balloon; right: integrated balloon

(Courtesy of Fortune Medical, see chapter 15)

5.1.3 One-way suprapubic catheter

The one-way suprapubic catheter has no balloon and requires a suture to the skin to secure in place.

Indications for a suprapubic one-way catheter:

- Alternative to the suprapubic catheter with balloon

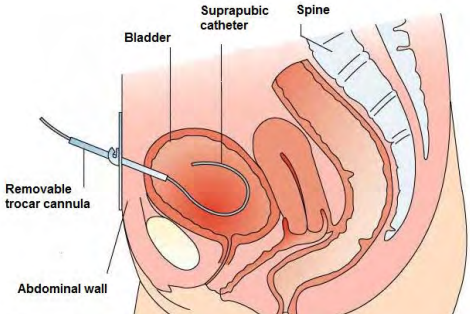


Fig. 3 Suprapubic catheter without a balloon

(Courtesy of Hospital Santa Maria Lleida)

Catheter with open-end tip

A catheter with an open end has no “eyes” but an open-end tip and is referred to as a “council” tip. This type of catheter can be used when changing a fine-bore suprapubic catheter to a suprapubic long-term catheter and when changing a long-term suprapubic catheter – usually performed using a guide wire.

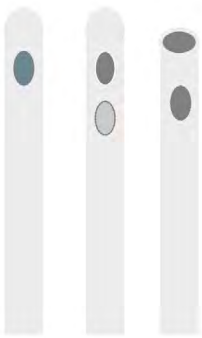


Fig. 7 From left to right: Straight catheter with rounded tip with one eye, rounded tip with two eyes, open end tip

(Courtesy of V. Geng)

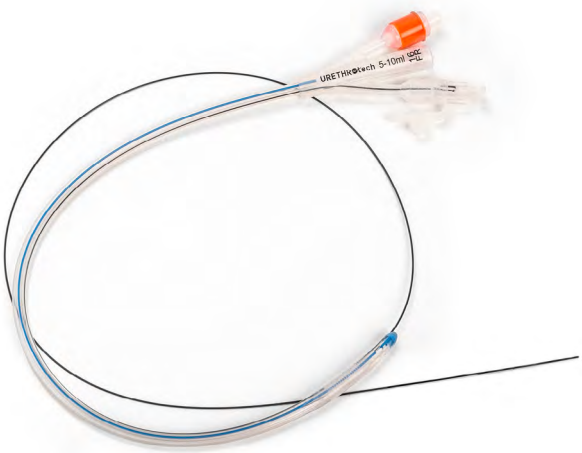


Fig. 8 Transurethral catheter with guidewire for difficult catheterisation

Urethral catheterisation device (UCD)

(Courtesy of Urethrotech, see chapter 15)

Fig. 9 Open-end catheter with a guide wire (close-up picture where the guide wire enters the catheter)

(Photo courtesy of T. Schwennesen)

5.1.4 Three-way catheter

Three-way catheters are available with a third channel to facilitate continuous bladder irrigation.

Fig. 10 Three-way catheter with irrigation channel

(Courtesy of: Essential Clinical Procedures, see chapter 15)

Indications for three-way catheterisation:

- Following urological surgery to perform continuous irrigation
- Bladder washout/irrigation to clear blood clots or debris

5.2 Catheter material characteristics

Catheters are available in various materials. Some aspects that should be considered when choosing a catheter are indication, allergy (latex), tissue compatibility, tendency for encrustation and biofilm formation, patient comfort and ease of use. Some manufacturers produce catheters without phthalates and polyvinyl chloride (PVC) because PVC includes chlorine and plasticisers, which are environmentally hazardous.

5.2.1 Types of material and coating

Catheter material/coating	Advantages	Disadvantages	Recommended use
Latex	Flexible Cheap	Not suitable for people with latex allergy More risk of irritation	Short-term < 14 days
Silicone	Wider lumen than latex Less encrustation Suitable for people with latex allergy May reduce mucosal encrustation	Less flexible Balloon may shrink due to fluid loss through diffusion	Long-term > 14 days
Hydrogel-coated latex	May reduce friction during insertion May reduce encrustation	Not suitable for people with latex allergy	Long-term > 14 days
Silicone-coated latex	Flexibility between latex and pure silicone Biocompatibility of silicone and flexibility of latex	Not suitable for people with latex allergy	Long-term > 14 days
PTFE (Teflon)-coated latex	Prevents encrustation and irritation	Not suitable for people with latex allergy	Long-term > 14 days
Nobel alloy-coated	Reduces biofilm-formation	May be more expensive	Short-term < 14 days
Nitrofurazone-coated	Antimicrobial	No clear statement about antibiotic resistance identified	Short-term < 14 days

Latex

Latex made from natural rubber is a flexible material, but it has some disadvantages. The use of latex catheters is restricted to short-term indwelling catheterisation and is avoided if possible because of the potential discomfort due to high surface friction, vulnerability to rapid encrustation by mineral deposits from the urine, and the implication of latex allergic reactions in the development of urethritis and urethral stricture or anaphylaxis. [8]

Silicone

The silicone catheter (100% silicone) is gentle on tissue and is hypoallergenic, because it is uncoated. Catheters formed of silicone material have a relatively large lumen that reduces the tendency to encrustation.

While silicone catheters cause less tissue irritation and potential damage than latex or latex-coated catheters, the catheter balloon tends to lose fluid. A scoping review of urinary catheter induced complications reported, that the tendency to lose fluid increases the risk of displacement.

Silicone catheters also have a greater risk for developing a cuff when deflated that can result in uncomfortable catheter removal or urethral trauma. [42]

Fig. 11 Removed catheter with a cuff (folded due to incorrect deflation)
(Photo courtesy of S. Vahr Lauridsen)

A Cochrane review from 2012 did not find sufficient evidence to determine the best type of indwelling urinary catheter for long-term bladder drainage in adults. [43] However, silicone might be preferable to other catheter materials to reduce the risk of encrustation in long-term catheterised patients.

Latex with silicone or silicone elastomer-coating
Silicone elastomer-coated catheters are latex catheters coated inside and out with silicone. The catheter has the strength and flexibility of latex and the durability and reduced encrustation typical of 100% silicone catheters. [44]

Latex with polytetrafluoroethylene (PTFE)-coating
PTFE-coated latex (commonly known as Teflon) catheters have been developed to protect the urethra against latex. The absorption of water is reduced due to the Teflon coating. It is smoother than plain latex, which helps to prevent encrustation and irritation. These catheters should not be used for patients who are latex sensitive. [45, 46]

Hydrogel-coating
Hydrogel-coated catheters are soft and biocompatible. Because they are hydrophilic, they absorb fluid to form a soft cushion around the catheter, and reduce friction and urethral irritation. [44]

Nobel alloy-coating
- Silver alloy / silver alloy layer/ silver oxide layer
- Palladium
- Gold

The nobel alloy-coated catheters are not antiseptic-coated, but the metal in the coating creates a galvanic effect which reduces biofilm-formation.

Silver alloy-coated catheters significantly reduce the incidence of asymptomatic bacteriuria, but only for < 1 week. There is some evidence of reduced risk for symptomatic urinary tract infection (UTI). Therefore, they may be useful in some settings. [6, 18, 47]

Silver oxide-coated catheters are not associated with a significant reduction in bacteriuria. [8, 39, 43]

Nitrofurazone-coating
Catheters coated with nitrofurazone are also available. Nitrofurazone should be distinguished from the drug nitrofurantoin. Nitrofurazone is a bactericidal compound that is used as an antibiotic.

Comparisons

Antimicrobial-impregnated (nitrofurazone-coated) versus antiseptic-coated (silver alloy) or standard PTFE-coated latex indwelling urethral catheters

The evidence suggests that antimicrobial-impregnated catheters do slightly reduce CAUTI in hospitalised adults catheterised short-term. They also reduce bacteriuria to a significant degree. However, they are associated with greater patient-reported discomfort. Whilst these catheters may be cost-effective, it remains unclear if the marginal benefits are clinically important. Some uncertainties also remain over how beneficial the catheters are beyond one week of catheterisation. [6]

Antiseptic-coated and standard PTFE-coated latex show no significant difference in symptomatic CAUTI. [43]

Potential toxicity and antibiotic resistance using antimicrobial catheters are unknown. [8]

Silicone versus silicone-coated catheters
After 5 days of indwelling catheterisation, pure silicone catheters have significantly less bacterial colonisation than silicone-coated latex catheters have ($p = 0.03$) and the biofilm formation of colonising bacteria is also significantly less with the pure silicone catheter ($p = 0.02$). [48]

For selection of the most suitable material, the specifications of the supplier can be helpful.

Recommendations	LE	GR
Use silicone catheter material for long-term catheter use. [49]	1a	A
Use latex catheter material for short-term catheter use, unless the patient has a latex allergy. [49]	1a	A
Silver alloy-coated catheters may slightly reduce the risk of catheter-associated bacteriuria in hospitalised patients during short-term catheterisation (< 1 week) [6, 18]	1a	B
Antibiotic-impregnated catheters slightly decrease the frequency of CAUTI and significantly decrease asymptomatic bacteriuria in hospitalised patients within 1 week compared to silver alloy-coated (antiseptic-coated) catheters. [6]	1a	B

5.2.2 Diameter and length

Catheter diameter is measured in Charrière (Ch or CH) also known as French Gauge (F, Fr or FG) and indicates the external diameter. 1 mm = 3 Ch and the sizes range from Ch 6 to 30.

Patient group	Urine characteristics	Catheter size
Paediatric		6–10
Adult, with very small body size	Clear urine, no debris, no grit (encrustation)	10
Adult	Clear urine, no debris, no grit, no haematuria	12-14
Adult	Slightly cloudy urine, light haematuria with or without small clots, none or mild grit, none or mild debris.	16
Adult	Moderate to heavy grit, moderate to heavy debris.	18
	Haematuria with moderate clots.	18
Adult	Heavy haematuria, need for flushing [50]	20-24

The size of the catheter is marked at the inflation channel as well as with an (international) colour code. (Fig. 12)

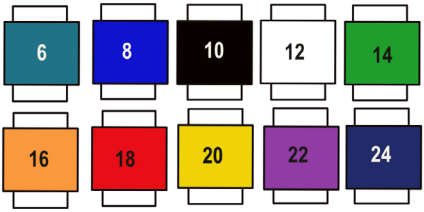


Fig. 12 International colours of catheter size

(Courtesy of V. Geng)

The inner lumen of the catheter varies between different catheter materials; e.g., latex and silicone, so inserting a larger Charrière catheter does not necessarily ensure a wider drainage channel. [51] (Fig. 13)

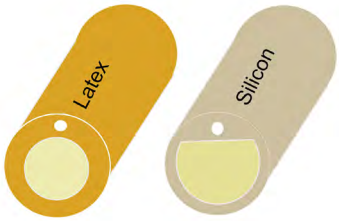


Fig. 13 Examples of silicon and latex catheter lumen

(Courtesy of V. Geng)

The standard male catheter length of 41–45 cm can be used for men and women, but a shorter female length of 25 cm can be more comfortable and discrete for some women. However, a female catheter can be too short if the woman is severely obese and thus a male length is preferable.

The female length catheter should not be used for men as inflation of the balloon within the urethra can result in severe trauma. Paediatric catheters are normally about 30 cm long. [8]

Recommendations	LE	GR
Use the smallest bore catheter possible consistent with good drainage, to minimise bladder neck and urethral trauma, unless otherwise clinically indicated [24]	1b	B
Use male standard length for female patients who are bedbound, immobile, clinically obese with fat thighs, critically ill and postoperative and in emergency situations [16]	4	C
Do not use the female length catheter for males in urethral catheterisation as inflation of the balloon within the urethra will result in severe trauma. [8]	4	A

5.2.3 Tip design

There is a wide variety of catheter tips. The two main tips are the straight tip and coudé tip. Coudé is French and means a catheter which is bended slightly at the tip.

Straight tip (Nelaton tip)

A catheter with a standard round tip with drainage eyes is called a Nelaton catheter. (Fig. 14) For routine catheterisation, a straight-tipped catheter should be used. [44]

Bended tip (coudé tip)
There are three different coudé tip designs:

Tiemann
The Tiemann catheter with the curved tip is designed to negotiate the male prostatic curve and can be helpful for difficult insertions. [44]

Olive tip
The olive tip is a little larger than a standard tip but the circular shape allows to widen narrow urethras. The rounded end helps to avoid to get stuck in any obstruction.

Tapered tip
The tapered tip catheter has a curved tip just like the Tiemann catheter but has one, two or three drainage eyes situated in the curved tip.

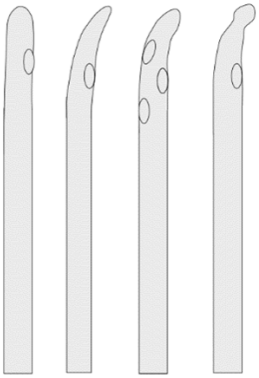


Fig. 14 From left to right: Nelaton tip, Tiemann tip, tapered tip and olive tip
(Courtesy of V. Geng)

Recommendations	LE	GR
For routine catheterisation, a straight-tipped catheter should be used	4	C
The coudé tip catheter can be used where male catheterisation is complicated and should be inserted with the tip pointed upward (dorsally)	4	C

5.2.4 Balloon size and filling

When the catheter has been placed in the bladder, the balloon can be inflated according to the instructions of the manufacturer. To make sure the catheter is not inflated in the urethra, insert the catheter until the hub/bifurcation before filling the balloon, especially in men.

Sterile water or sodium chloride can be used for latex catheters. Inflation of silicone catheters with water can lead to water loss from the balloon over time, with an associated risk of the catheter falling out. Some manufacturers recommend filling the balloon with a 10% aqueous glycerine solution. [8]

Huang et al. demonstrated in an *in vitro* equivalence study that there was no difference in filling the balloon with water, glycerine or saline in the rates of balloon deflation failure. [52]

Some catheter manufacturers provide sterile pre-filled syringes with sterile water or 10% glycerine inside the packaging.

The balloon volume is indicated at the catheter connection behind the size of the catheter as a minimum and maximum; e.g., Charrière 12/5–10 ml or cc (cm^3).

In special situations, special catheter designs are available e.g., haematuria catheter. The volume of the catheter balloon can differ and the manufacturer's instructions should be followed. [44]

A catheter with a 30 ml balloon is designed specifically as a haemostat post urological procedure, and should not be used for routine catheterisation.

The purpose of the retention balloon is to keep the catheter in place in the bladder. The use of a larger balloon size is mistakenly believed to be a solution to bypassing urine. [51] However, increasing the amount of fluid in the balloon may increase the risk of pressure ulcer at the bladder neck and will not solve the problem of leak of urine around the outside of the catheter. *(see Section 7.5 Catheter bypassing)*.

Under- or overinflation can cause occlusion of drainage eyes, irritate the bladder wall, and lead to bladder spasms. [44]

Large balloons tend to sit high in the bladder, with potential for increased residual urine volumes to collect below the catheter eyes. [8]

Some manufacturers have catheters with an integrated balloon, which means that the balloon is at the same level as the catheter when it is deflated. It can be an advantage when removing a catheter with encrustations because the encrustations are gathered around the deflated balloon cuff.

Recommendation	LE	GR
Always inflate the balloon according to the manufacturer's instructions	4	C

5.3 Catheter sets

Different types of catheter sets are available for indwelling and suprapubic catheterisation (refer to local policy). There is no standard list of materials for a catheterisation set/pack. A catheter set could contain gloves, underlay, cotton balls and gauzes, forceps, and aperture drape for the preparatory stage of catheterisation. It also provides the lubricating gel for the introduction of the urinary catheter and sterile water for inflating the balloon of a self-retaining Foley catheter. One should check individual packs for required contents; the catheter and drainage bag are usually separate from the catheterisation packs.

Fig. 15 Catheter set with Foley catheter

(Photo courtesy of P. Wenig)

Also sets for suprapubic application are available; for example, a catheter with insertion trocar and plug (spigot) (Fig. 16).

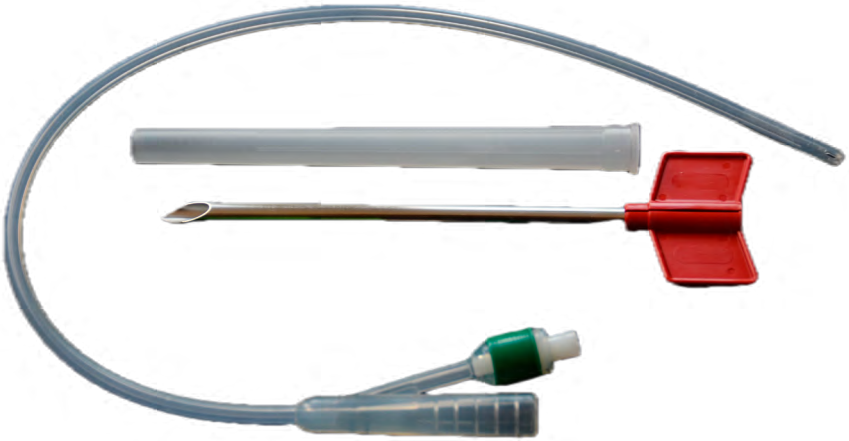


Fig. 16 Catheter set to insert a suprapubic catheter

(Photo courtesy of T. Schwennesen)

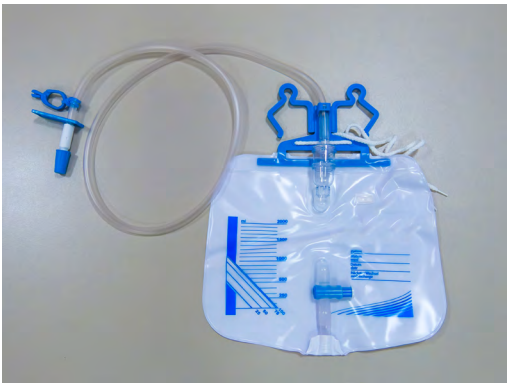
The purpose of using catheter sets is to prevent unwanted variation in clinical practice and to save time finding all the items used for catheterisation. Two quality improvement studies have evaluated the effect of implementing urinary catheter sets together with an education and training programme and found an 80% reduction in CAUTI after 1 year. [53, 54] (LE 4)

5.4 Drainage bags

5.4.1 Closed drainage system

When a catheter is inserted using aseptic technique, it is directly connected to the sterile bag, because an aseptic closed drainage system minimises the risk of catheter-associated urinary tract infection. [55] Unnecessary disconnection of a closed drainage system should be avoided [56], but if it occurs, the catheter and collecting system must be replaced using aseptic technique and sterile equipment. [24]

There are several different bags available; selection of the bag depends on whether it is for short-term drainage at the hospital or for long-term use, the patient's mobility, cognitive function, daily life etc. The bags can have a variety of special features.



Figs. 17 and 18 Examples of urinary bags

(Photo courtesy of P. Wenig)

Pre-connected drainage systems are available in which the drainage bag is already connected to a catheter in a sterile pack and a tamper-evident seal protects the connection. The use of urinary systems with pre-connected, sealed catheter–tubing junctions may reduce the occurrence of disconnection. [19, 24]

Anti-reflux valve drainage bags are designed with either an anti-reflux valve or chamber to prevent reflux of contaminated urine from the bag into the tubing. [44] However, complex urinary drainage systems (utilising mechanisms for reducing bacterial entry such as antiseptic-release cartridges in the drain port) are not necessary for routine use. [24]

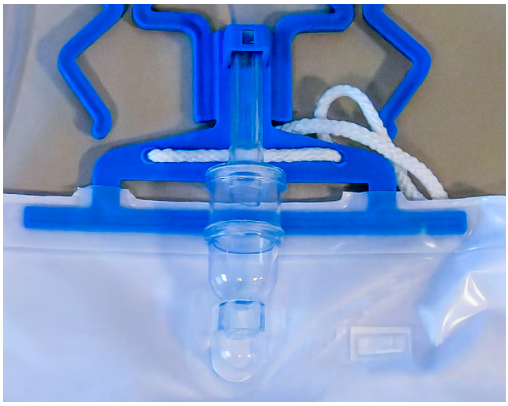


Fig. 19 Drainage bag with anti reflux dome

(Photo courtesy of P. Wenig)

Sampling port: most drainage bags have a special sampling port designed to obtain urine specimens while maintaining a closed system. (Fig. 20) Some companies produce bags with a needle-free sampling port to avoid sharp injury.

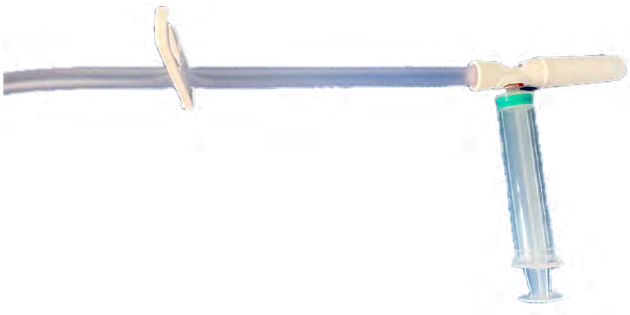


Fig. 20 Collection of a catheter specimen of urine – needle free

(Photo courtesy of S. Vahr Lauridsen)

5.4.2 Large capacity bag

Large capacity bags (2–4 l) can be used postoperatively, if the patient is confined to bed or if the use of a leg bag is not appropriate. Some of the large-capacity bags are provided with a urometer which allows accurate measurement of urine in intensive care patients.

Fig. 21 Drainage bed bag with urine meter

(Dover Precision Urine Meter, Courtesy of Cardinal Health, see chapter 15)

Different outlet taps and tube lengths are available as for leg bags (*see Section 5.4.3*).

5.4.3 Leg bag/body worn urine collection bag

If the patient is mobile a leg bag can be preferable. A leg bag allows maximum freedom and movement and can be concealed beneath the clothes.

Leg bags are available in different sizes (120–1000 ml), designs and qualities and it is important to select a bag and a bag length according to the patient's preference and mobility and the intended duration of use. (Fig. 22)

Fig. 22 Different types of leg bags

(Photo courtesy of T. Schwennesen)

Another discreet bag that allows mobility is the body-worn bag; e.g., the Belly Bag® (Fig. 23). The bag can be used with either a suprapubic, urethral or nephrostomy catheter, but is not intended to be used with a male external catheter (condom or urosheath) in men. An anti-reflux valve behind the catheter port prevents reflux urine flow, which allows positioning of the bag above the level of the bladder, contrary to other bags. It is not intended to be used permanently, but for short-term use; e.g., during sports or when visiting a sauna.

Fig. 23 Body worn bag

(Courtesy of Teleflex Europe Ltd., see chapter 15)

Capacity: ranges from 120 to 1000 ml and the size depends on how often the bag has to be emptied, according to the patient's daily routines.

Chamber: the bags are available with a single or several chambers. Several chambers flatten the bag's profile and are therefore more discreet.

Materials: bags are produced in different materials with different backings and comfort. Some of the bags are PVC free as well.

Tube: ranges from 4 to 45 cm and some can have an individual length by cutting the tube. Some tubes are kink free, which reduces the risk of obstruction.

Fig. 24 Anti-kinking collection bag tubing

(Courtesy of Continence Product Advisor, see chapter 15)

Suspension system: leg bags can be attached to the leg with straps (elasticated), nets, bags/pockets of cotton, etc. (Fig. 25)

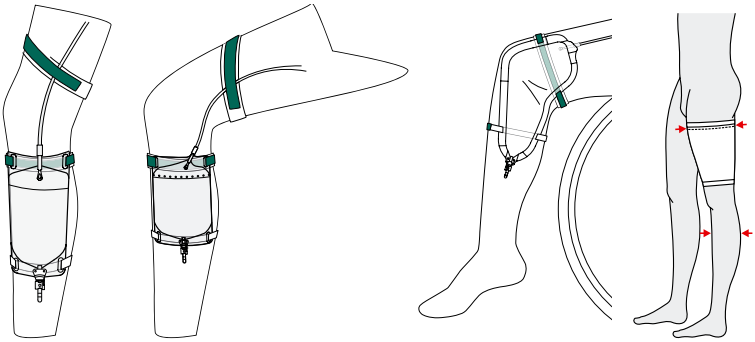


Fig. 25 Urinary leg bags - different ways of fixation

(Courtesy of Manfred Sauer GmbH, see chapter 15)

Outlet tap: is available in different designs: barrel tap, lever tap and push–pull tap. [51] It is important to choose a bag with a tap that the patient can manage, especially in patients with reduced hand function. (Figs. 26, 27)

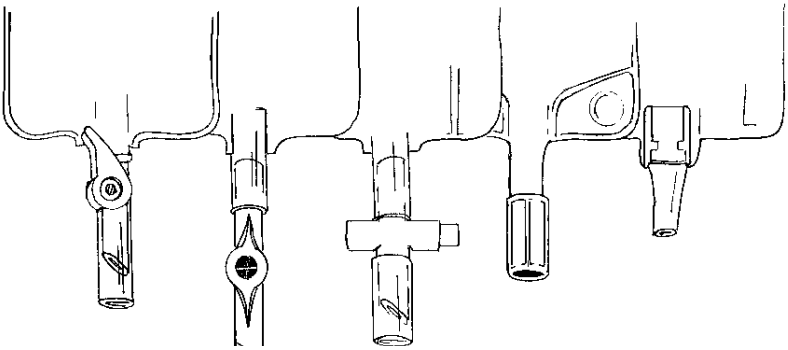


Fig. 26 Examples of bag taps

(Courtesy of ICUD, see Chapter 15)

Fig. 27 Quadriplegic patient with poor manual dexterity

(Courtesy of T. Schwennesen)

(Please note that the bag is being held above the level of the bladder for photographic purposes only)

5.4.4 Combination of leg bag and overnight/bedside bag

Large capacity bags can also be used as overnight bags. Patients normally require a 2 l drainage bag that is connected to the leg bag at night or if they are immobile/bedbound.

The outlet tap on the leg bag is left open so that the urine collects in the larger bag without breaking the closed drainage system. [57] (Fig. 28)

The night bag requires a stand for support, to reduce the risk of dislodging the link system and is available in different designs and materials. [51]

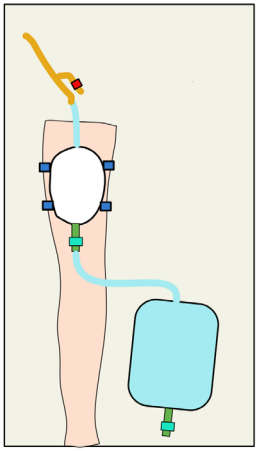


Fig. 28 Overnight drainage system

(Courtesy of V. Geng)

5.4.5 Single use urinary bag

It is common practice to use a sterile technique for short-term use and a clean technique for long-term use in the home care setting.

In some countries clean, single-use, non-drainable night bags are used, which means that when the bag is full, it has to be changed since the bag cannot be emptied. In other countries, night bags are cleaned and reused for long-term catheters at home. More research is needed to ensure that guidelines and resultant care are based on existing evidence rather than on custom and common practice. [10]

Recommendations	LE	GR
A closed drainage system should be maintained to reduce risk of CAUTI [18, 24]	3	A
Unnecessary disconnection of a closed drainage system should be avoided, but if it occurs the catheter and collecting system have to be replaced using aseptic technique and sterile equipment [10, 24]	3	A
Complex urinary drainage systems (utilising mechanisms for reducing bacterial entry such as antiseptic-release cartridges in the drain port) are not necessary for routine use [24]	3	B
In selecting urinary drainage bags, attention should be focused on: the ability of the user to operate the tap, comfort, freedom from leakage, and discretion [8]	4	C
Using a catheter set could reduce the risk of CAUTI [53, 54]	3	C
The patient's individual needs and personal preferences should determine the kind of leg bag/suspension/ attachments and position of where the bag is worn [8]	4	C
Consult national policies for working with medical devices – and reuse of single-use material	4	C

5.5 Valves

Valves are small devices connected to the catheter outlet instead of a bag and are available in a variety of designs. (Fig. 29)

Fig. 29 Different catheter valves

(Photo courtesy of T. Schwennesen)

The catheter valves are an alternative to leg bags/body-worn bags that give the patient more freedom to move and more discreet drainage. Most valves are designed to fit with linked systems so it is possible to connect to a drainage bag. For example, at night-time and for journeys. [51]

The valves provide a well-accepted system of bladder emptying for suitable patients who are able to manipulate the valve mechanism and empty the bladder regularly to avoid overfilling. An in vitro bladder model showed that using a catheter valve with a 2-4-hourly release was associated with reduced catheter blockage. [58] A randomised controlled trial from 2015 showed that the incidence of bacteriuria was not significantly lower in the non-return catheter valve group than in the simple urine bag group. [59]

Use of this urinary catheter valve increases patient satisfaction without affecting the postoperative UTI rate. This easy and inexpensive device could help patients have a better catheter experience and should be considered in women being discharged home with a urinary catheter. [60]

The valve is not an optimal solution for all patients, especially those with poor bladder compliance due to possible upper tract deterioration, and nurse specialists need to assess the suitability for each patient. However, in some countries the use of catheter valves is not approved.

The catheter valve is contraindicated in patients with:

- Urological surgery requiring an empty bladder postoperatively (prostatectomy, nephrectomy with removal of ureter and in case of bladder perforation)
- Short time catheter use postoperatively (to relieve pressure on the bladder)
- A risk of upper tract deterioration (patients with poor bladder compliance)
- Severe cognitive impairment (the patient must be able to recognise the need to empty the bladder through sensation or on a timed schedule)
- Overactive bladder syndrome; might cause urinary leakage
- Ureteral reflux or renal impairment
- Small or limited bladder capacity; the valve would have to be opened often
- UTI
- Poor manual dexterity [61]

Transurethral catheter safety valve

0.3-0.7% of hospitalised patients with an indwelling catheter will suffer a catheter balloon injury. [62]

The transurethral catheter safety valve prevents the risk of urethral catheter balloon injury. The device is designed to prevent inadvertent inflation of the catheter's anchoring balloon in the urethra during urethral catheter insertion. The safety valve allows fluid in the catheter system to vent through a pressure relief valve if attempted intraurethral inflation of the catheter's anchoring balloon occurs. [63]

Fig. 30 Transurethral catheterisation safety valve (TUCSV)

(Courtesy of Class Medical, see chapter 15)

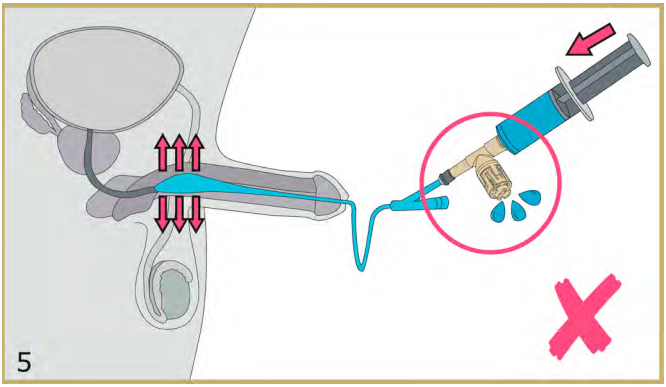


Fig. 31 Transurethral catheterisation safety valve venting (fluid leak) and signaling the user when the balloon has been inadvertently inflated in the urethra

(Courtesy of Class Medical, see chapter 15)

Recommendations	LE	GR
Suitability for catheter valves should be assessed by a health care professional	4	C
Catheter valves are non-inferior for bladder emptying for suitable patients who are able to manipulate the valve mechanism and empty the bladder regularly [60]	1b	A
Combination of a valve during the day and free drainage at night through an open valve connected to a drainage bag could be an appropriate management strategy [8]	4	C
Implement a 2-4-hourly release if catheter valve is used [58]	2a	B

5.6 Securement devices

Catheter securement devices are designed to prevent excessive traction of the catheter against the bladder neck or inadvertent catheter removal. There are different kinds of securement devices such as tape, Velcro™. (Figs. 32, 33)

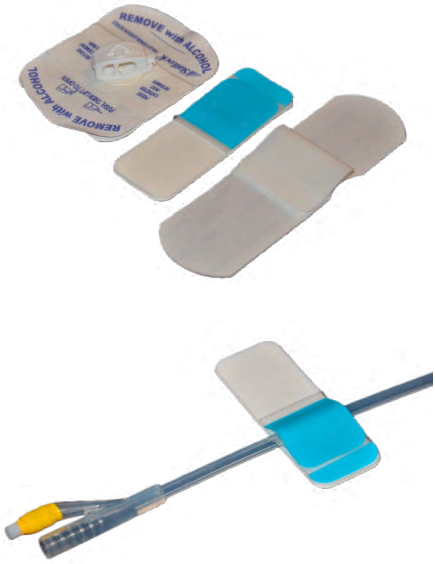


Fig. 32 and 33 Different types of catheter securement devices with Velcro fastening

(Photo courtesy of T. Schwennesen)

For more information about catheter securement see Section 6.5.3 Stabilising of the urethral catheter.

5.7 Lubricating gel

The lubricant dilates and lubricates the urethra. The lubricant does not need to be antiseptic or anaesthetic. [64]

Four types of lubricants can be distinguished:

1. Water soluble
2. Water soluble with chlorhexidine (antiseptic)
3. Water soluble with anaesthetic lignocaine/lidocaine
4. Water soluble with anaesthetic lignocaine/lidocaine and chlorhexidine

6. Principles of management of nursing intervention

6.1 Patient preparation

Consent

Catheterisation is an invasive procedure that can cause embarrassment and physical and psychological discomfort and have a negative impact on the patient's self-image. To ensure the patient is fully prepared for catheterisation, it is the responsibility of the health care professional to inform the patient of the reasons and necessity for the procedure, and obtain the patient's permission. [65] In many areas of medicine, patients are required to sign a consent form that indicates agreement for the practitioner to undertake a procedure. It also implies an understanding of the event and the associated potential complications/problems. At present, it is not common practice within Europe for patients to provide written consent for catheterisation; it is however a necessity that verbal consent and agreement is reached and the relevant information is recorded in the patient's medical and/or nursing notes. [66]

Information and support

Explaining the procedure and providing the reason for catheterisation to the patient will help reduce patient anxiety and embarrassment and help the patient to report any problems that may occur while the catheter is in situ. [67] Relaxing the patient by offering reassurance and support will help smoother insertion of the catheter and avoid unnecessary discomfort and the potential for urethral trauma during insertion. [68, 69]

Preparing the procedure

Even if catheterisation is a prescription by a medical doctor, health care professionals should take a brief medical history, especially about urological conditions, before the procedure.

Catheterisation is a sterile procedure to prevent pathogenic bacteria from entering the urinary tract. It is imperative that health care professionals have a good understanding of the principles of the aseptic procedure as this will help to reduce the risk of UTI. [70]

Lubricating gel

Catheterisation can be painful in men and women. The use of anaesthetic lubricating gels is well known for male catheterisation. An appropriate sterile single-use syringe with lubricant should be used before catheter insertion of a non-lubricated catheter to minimise urethral trauma, discomfort and infection. [12] However, it is essential

to ask patients if they have any sensitivity to lignocaine/lidocaine, chlorhexidine or latex before commencing the procedure. There have been reports of anaphylaxis attributed to the chlorhexidine component in lubricating gel [71], and in some institutions chlorhexidine is now banned because of this. Ten to fifteen millilitres of the gel is instilled directly into the urethra until this volume reaches the sphincter/bladder neck region. [72-76] Blandy [77] and Colley [78] recommend a 3–5-minute gap before starting catheterisation after instilling the gel, but it is important to follow the manufacturer's guidance. A maximised anaesthetic effect will help the patient to relax and insertion of the catheter should be easier. [79]

If the lubricant contains lignocaine/lidocaine or chlorhexidine, care should be taken if the patient has an open wound, or severe damaged mucous membranes and/or infections in the regions where the lubricant will be used. In patients with severe disorders of the impulse conduction system or epilepsy, as well as women in the first 3 months of pregnancy, or breastfeeding (Package instruction leaflets Instillagel® and Xylocaine®), urologists should seek permission to use a lignocaine/lidocaine-containing lubricant. [72-76]

Rare but serious allergic reactions (anaphylaxis) have been reported with widely used skin antiseptic products and lubricants containing chlorhexidine gluconate. These reactions can occur within a few minutes of exposure. Symptoms include wheezing or difficulty breathing; swelling of the face; hives that can quickly progress to more serious symptoms; severe rash; or shock, which is a life-threatening condition that occurs when the body is not getting enough blood flow. Lubricants which contain chlorhexidine have been reported to trigger anaphylaxis in a small number of patients during catheter insertion and consequently a careful history is required to screen for sensitivities. [80]

Recommendations	LE	GR
Obtain verbal consent from patients for indwelling catheterisation before starting the procedure	4	C
Ask patients if they have any sensitivity to chlorhexidine [71], lignocaine/lidocaine or latex before commencing the procedure	4	A
Educate and train health care professionals to have a good understanding of the principles of the aseptic procedure as this will help reduce the risk of UTI [24, 70]	1b	B

6.2 Urethral catheter – female and male insertion procedure

For practical guidelines on how to insert a male or female urethral catheter see Appendices B and C.

The recommendations below are for catheterisation in men; recommendations with * are also relevant for women.

Recommendations	LE	GR
If resistance is felt at the external sphincter, increase the traction on the penis slightly and apply steady, gentle pressure on the catheter. Ask the patient to strain gently as if passing urine	4	C
In case of inability to negotiate the catheter past the U-shaped bulbar urethra use a curved tip (Tiemann) catheter, or hold the penis in an upright position to straighten out the curves, or ask the patient to cough	4	C
Special catheters, such as Tiemann, need a special technique and should be attempted by those with experience and training [69, 81-83]	4	C
During insertion, a Tiemann tip must point upward in the 12 o'clock position to facilitate passage around the prostate gland [44]	4	C
When inserting the urethral catheter use a sterile single-use packet of lubricant jelly [24] *	4	C
Routine use of antiseptic lubricants for inserting the catheter is not necessary [24] *	4	C
A small lumen catheter can buckle/kink in the urethra; in some instance a slightly larger Charrière size might help [83] *	4	C
Further research is needed for using the non-touch technique for indwelling urethral catheterisation *	Unresolved issue	
Connect the catheter to the sterile bag and then insert the catheter using aseptic technique, because an aseptic closed drainage system minimises the risk of CAUTI *[18]	4	A

** Recommendation also relevant for females*

6.3 Suprapubic catheter insertion procedure

A distinction should be made between initial insertion and changing of the catheter. For initial insertion sterile technique is used and the procedure is normally carried out by a urologist.

Advanced Practice Nurses can do initial insertion of a suprapubic catheter if this falls within their scope of practice. An experienced urology nurse should do the first suprapubic catheter change. Thereafter a competent health care professional can do the insertion.

If the patient does not have a readily palpable bladder, then the bladder should be filled with at least 300 ml of 0.9% saline prior to insertion of a suprapubic catheter. A bedside ultrasound should be used in high-risk patients (previous abdominal surgeries and colostomy, obese, hernias or in those with previous indwelling catheters and small capacity bladder such as some neurogenic patients, as an adjunct to suprapubic catheter insertion. The purpose is to ensure that the needle used to make the suprapubic catheter tract can be visualised entering the bladder at an appropriate point on the anterior bladder wall.

In patients with a history of lower abdominal surgery or in whom the bladder cannot be distended, an open procedure may have to be performed for insertion of the suprapubic catheter. [84] (LE 3)

For practical guidelines on how to insert a suprapubic balloon catheter *see Appendix D.*

Recommendation	LE	GR
Further research is needed for using the non-touch technique for suprapubic catheters	Unresolved issue	

6.4 Difficulties that may occur during insertion

Difficulty in catheterising the patient can be caused by a variety of reasons. Medical advice and support should be sought if problems during or after the insertion occur. Complications associated with insertion of transurethral or suprapubic catheters include UTI, trauma and inflammatory reactions, and possibly carcinoma of the bladder [85], and for transurethral catheterisation, also via falsa (accidental passage made when inserting the catheter) and urethral strictures. These can result in one or more of the following symptoms occurring: pain, bypassing of urine, blockage, catheter expulsion and bleeding.

Urethral trauma can be caused by any catheter size or by forced insertion of the catheter or incorrect position of the catheter tip. Urethral trauma should be minimised by the use of adequate lubricant, the smallest possible catheter size, or a special catheter for difficult catheterisation and the correct insertion technique. [14] (LE: 1b) [86-88]

6.5 Catheter care/maintenance

6.5.1a Meatal cleansing before insertion

In a meta-analysis about meatal cleansing before insertion and for catheter care, there was no significant difference in CAUTI rates for cleansing with water/water and soap versus use of antiseptic solutions. [89]

In another meta-analysis, Huang et al. [90] compared cleansing with water versus antiseptic before catheter insertion. They found no significant difference between water versus povidone iodine and water versus chlorhexidine gluconate. They concluded that use of water for cleansing the meatus was not associated with increased risk of UTIs. [90]

One cross-sectional, stepped-wedge, open-label, randomised controlled trial (RCT Fasugba, 2019) found, after adjusting for age, sex, and clustering by hospital, that the use of chlorhexidine was associated with a significantly reduced risk of catheter-associated asymptomatic bacteriuria and CAUTI. [91] However, a new systematic review that included this study found no significant difference between cleansing with water versus chlorhexidine. [92]

6.5.1b Meatal cleansing when catheter is in place

Routine daily personal hygiene is all that is needed to maintain meatal hygiene. [24, 89, 92]

Trials of various cleansing agents, e.g. chlorhexidine and saline, have failed to demonstrate a reduction in bacterial growth rate [93], meaning soap and water is sufficient to achieve effective meatal cleansing. [13, 69, 94] However, attention must be given to educating non-circumcised patients to clean underneath their foreskin daily to remove smegma, as this may increase the patient's risk of developing a UTI, in addition to causing trauma and ulceration to the meatus and glans penis. [95, 96]

There is no evidence that routine application of antimicrobial preparations around the meatus will prevent infections. [13, 69, 97]

6.5.2 Care of urethral catheters

Whichever bag is chosen, extensive measures should also be taken to maintain unobstructed flow. [24] To prevent obstruction, the catheter and collecting tube should be kept free from kinking and the collecting bag has to be kept below the level of the bladder at all times (to allow urine to drain by gravity) and must never be rested on the floor. [24]

When emptying the collecting bag, regularly use a separate, clean collecting container for each patient; avoid splashing, and prevent contact of the drainage spigot with the non-sterile collecting container. [24]

Recommendations	LE	GR
Perform hand hygiene immediately before and after any manipulation of the catheter and system. Wear disposable gloves when handling the system	1b	B
Maintain unobstructed urine flow [24]	1b	B
Keep the catheter and collecting tube free from kinking [24]	1b	B
Keep the collecting bag below the level of the bladder at all times. Do not rest the bag on the floor [24]	1b	B
Empty the collecting bag regularly using a separate container for each patient; avoid splashing, and prevent contact of the drainage spigot with the non-sterile collecting container [24]	1b	B

6.5.3 Care of the suprapubic catheter site

Recommendations	LE	GR
Always ensure good hand hygiene is performed prior to any intervention [97] and use protective equipment; e.g., gloves	1b	B
Suprapubic catheter site should be cleaned daily with soap and water. Excess cleansing is not required [13, 69] and may increase the risk of infection	1b	B
Observe the cystostomy site for signs of infection and over-granulation	4	C
Antimicrobial agents should not routinely, or as prophylactic treatment be applied to the cystostomy site to prevent infection [97]	1b	A
Dressings are best avoided. If a dressing is used to contain a discharge this should be undertaken with strict aseptic technique to protect against infection	4	C
Wherever possible, patients should be encouraged to change their own dressings [98]	4	C

6.5.3.1 Observation and management of catheter drainage

The observations relate to the indication for catheterisation. Postoperative catheterisation is often performed to monitor urine output. The monitoring of urine output is vital to ensure that the bladder continues to empty and that excessive diuresis does not occur. [99] In home settings, observations relate to common complications of long-term catheters such as blockage and UTIs.

For common problems with indwelling catheter equipment, see Appendix E.
For observation of urinary drainage, see Appendix F.

In case of problems with drainage due to blockage or encrustation, Mitchell, 2008 [100] developed an evidence-based long-term urinary catheter management flow chart. She reviewed the literature for evidence. As a result, for example, in this chart there is no recommendation about catheter maintenance solutions, because there is no evidence for this. It is a tool to be discussed with the patient and the clinical team on an individual patient basis. In case of blockage, the literature advises to look back over at least the last 3 catheter changes (the catheter change record can be used for this).

Decision flow chart on catheter drainage (adapted from Mitchell 2008) [100], see Appendix R

Indwelling catheters with open-drainage systems result in bacteriuria in almost all cases within 3–4 days. [14, 55] By using closed urinary drainage systems bacteriuria cannot be prevented, but it can be delayed. Almost all patients will develop bacteriuria within ~ 4 weeks. [14] Breaking a closed drainage system to obtain urine samples increases the risk of CAUTI. [101] If the closed drainage system is broken, aseptic technique should be used to reconnect the system. [102]

Recommendations	LE	GR
Keep the catheter and collecting tube free from kinking and maintain unobstructed urine flow [24]	1b	B
Keep the collecting bag below the level of the bladder at all times	1b	B
When emptying the collecting bag regularly, use a separate, clean collecting container for each patient; avoid splashing, and prevent contact of the drainage spigot with the non-sterile collecting container	1b	B
Unnecessary disconnection of a sealed (pre-connected) drainage system should be avoided but if it occurs, the catheter and collecting system have to be replaced using aseptic technique and sterile equipment	1b	B
Catheter and drainage tubes should never be disconnected unless for good clinical reason	2b	B
Disinfect the catheter/collecting tube junction before connecting	4	C
Use of a urometer that allows accurate measurement is recommended in intensive care patients [103]	2b	B
Complex urinary drainage systems are not necessary for routine use	2b	B
Catheters and drainage bags should be changed based on clinical indications such as infection, obstruction, or when the closed system is compromised and not routinely [24]	1b	B

6.5.3.2 Fixation and stabilisation of the urethral catheter

Stabilisation of urethral catheters can reduce adverse events such as dislodgment, tissue trauma (necrosis), inflammation and UTI. [103-105] The use of a securement device also reduces physical and psychological trauma by decreasing the need for re-insertion [24, 106] and can give patients more comfort and confidence. [107]

Securement devices should place no tension on the urethral or abdominal tissue. [107, 108] If the catheter bag becomes too heavy with urine, and it is not supported properly, the bag can pull on the catheter. [24, 106]

To avoid necrosis at the external urethral meatus continuing down the ventral surface of the penile shaft to the penoscrotal junction caused by prolonged catheter pressure, or cleavage of the urethra or penis, although rare, it is recommended to secure the urinary urethral catheter to the abdomen. [103] The catheter has to be positioned in a soft curve towards the femur (Fig. 34) and can be fixed with a securing device, tape, Velcro™ and a pocket for the bag (Figs. 37, 38, 39).

Although the references are only for urethral catheterisation, the same principles of stabilisation apply to suprapubic catheters. [109]

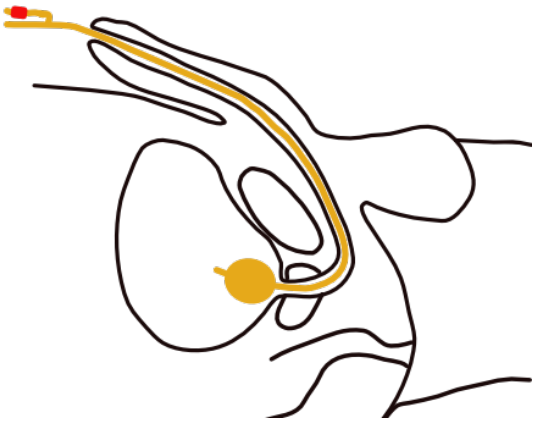


Fig. 34 Correct fixation of the indwelling urethral catheter to the abdomen in males, especially spinal cord injured patients

(Courtesy of V. Geng)

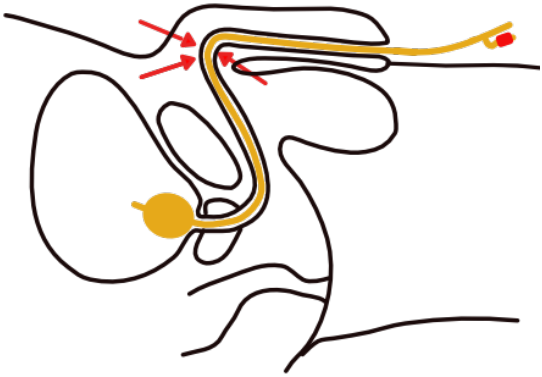


Fig. 35 Wrong fixation of the indwelling urethral catheter in males

(Courtesy of V. Geng)

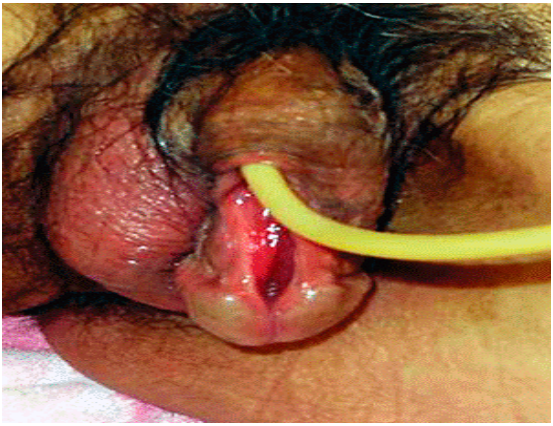


Fig. 36 Iatrogenic hypospadias developed after indwelling urethral catheterisation

(Courtesy of Wiley.com)

Fig. 37 Fixation of a urethral catheter

(Photo courtesy of C. Vandewinkel)

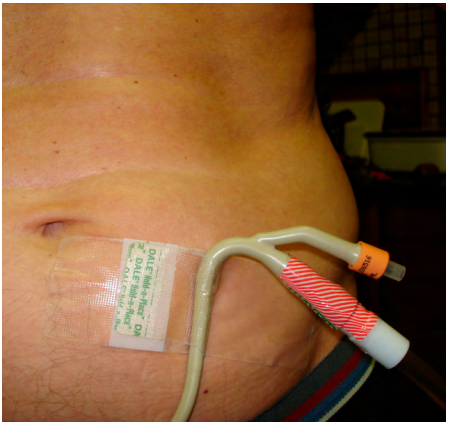


Fig. 38 Fixation of the urethral catheter/leg bag

(Photo courtesy of C. Vandewinkel)

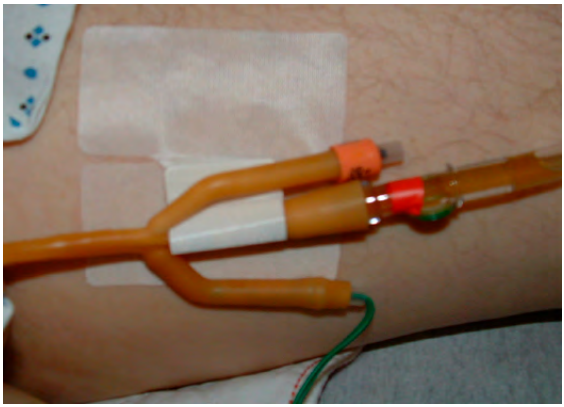


Fig. 39 Fixation of the catheter with a securement device

(Photo courtesy of D.K. Newman)

Recommendations	LE	GR
Secure and stabilise the catheter after insertion to prevent movement and urethral traction [24]	1b	B
In men, secure the urinary catheter to the abdomen and in women, to the leg	4	C

6.5.3.3 Clamping or not

Bladder dysfunction and postoperative voiding impairment have been documented following catheterisation and these can lead to UTI. Intermittent clamping of the indwelling urethral catheter draining tube prior to withdrawal has been suggested on the basis that this simulates normal filling and emptying of the bladder. While clamping catheters might minimise postoperative neurogenic urinary dysfunction, it could also result in bladder infection or distension. A Cochrane review compared clamping the indwelling urethral catheter prior to removal with free drainage in patients with a short term indwelling catheter and found that there may be little to no difference between clamping and free drainage on the risk of needing the catheter to be reinserted. There is uncertainty if there is any difference in the risk of UTIs or painful urination. [110] Another review included adults who required an indwelling catheter concluded that clamping urinary catheters increases the incidence of UTI and lengthen the hours to first void in patients with indwelling urinary catheters for ≤ 7 days compared with the free drainage. The effect of clamping training on the duration of indwelling urinary catheters for > 7 days is uncertain. Therefore, bladder training with clamping before catheter removal is not recommended as a routine method [111]

The pooled results of the meta-analysis showed that the clamping group had a significantly higher risk of urinary tract infections ($p < 0.00001$) and a longer hour to first void ($p = 0.0004$) compared with the free drainage group in catheter use duration ≤ 7 days. [111]

Recommendation	LE	GR
It is uncertain whether there is a benefit in clamping before urinary catheter removal. [111-113]	1a	A

6.6 Changes in urine due to food and medication

The presence of an appliance for collecting urine increases patients' awareness of odour and colour changes affecting the urine caused by some drugs and food products (*Appendix G*). Patients and carers should be told that these changes are not harmful and do not necessarily occur in all patients. Normal urine is clear, straw-coloured with almost no odour. A pungent odour, due to the production of ammonia, is typical of most bacterial urinary tract infection, whereas there is often a sweet or fruity odour with ketones in the urine. Some rare conditions confer a characteristic odour to the urine. [109]

See table Possible colour and odour changes in urine due to food or medication, Appendix G.

Purple urine bag syndrome

Purple urine bag syndrome (PUBS) is a rare condition and is characterised by purple discolouration of the urine bag, appliances and catheter tubing. The urine itself may be dark in colour and not necessarily purple. The condition appears to have a significantly higher incidence in women and chronically debilitated patients with long-term indwelling urinary catheters. [114-116] The major risk factors for PUBS are female gender, severe constipation, chronic indwelling urinary catheterisation and increased tryptophan dietary content. [102,103] The purple colour is caused by bacterial metabolism of tryptophan to indole and later converted to indican in the liver. Indican passes through the kidney giving urine a purple/blue/grey colour. [116, 117]

Although studies have shown certain factors like constipation and UTI may be present, these factors are not found consistently. [115, 118] PUBS is generally found to be harmless, but there have been case reports describing PUBS progressing to Fournier's gangrene. [119] The discolouration of urine and the urine bag can be distressing for patients, family and health care workers; therefore, they should be educated to

manage this syndrome. [120] The incidence is reduced by avoiding constipation and proper care of the urinary catheter. [115, 118]

Recommendation	LE	GR
If urine changes odour or colour, check what could be the reason for this change	4	C

6.7 Constipation

Constipation may cause pressure on the drainage lumen that prevents the catheter from draining adequately, which can cause ureteric reflux and back pressure on the kidneys. [121-123] Chronic constipation may also cause leaking of urine and bladder spasms. [124] Maintaining regular bowel function with a high-fibre and high-fluid intake helps prevent constipation. [124, 125]

Recommendations	LE	GR
Bowel assessment should be made routinely in case of catheter problems	4	C
Educate the patient regarding the link between constipation and bypassing urine and constipation and UTI [121-125]	4	C

6.8 Urethral and suprapubic catheter change

- There are two techniques to change a urethral or suprapubic catheter. The classic method is with the use of sterile gloves. The second method is the "non-touch technique" without sterile gloves. Instead, the sterile package of the catheter is used to touch the catheter. There is still no evidence for the non-touch technique and attention should be on reducing the risk of cross-contamination.
- Catheter change depends on the material of the catheter. A latex catheter is changed after 2 weeks to a hydrogel or silicone catheter and a silicone catheter is changed after 12 weeks unless any catheter-related problems such as catheter blockage and catheter damage are identified.
- For both urethral and suprapubic the frequency of catheter change is instructed by a medical doctor.
- Long-term catheters can be changed on an individual basis to try to avoid problems. However, the catheter must be changed within the timeframe recommended in the manufacturer's instructions, which may be up to a maximum of 12 weeks.
- Check the catheter for encrustation after removal. Use a catheter diary to recognise when the catheter gets encrusted and plan changing the catheter before encrustation happens.

- If the catheter change is uneventful, a classic catheter with open eyes at the side and a closed eye at the end is preferred. In case of severe problems with changing the catheter, a changing set (with guide wire) and a catheter with an open end should be used.

Antibiotics are not routinely given prior to catheter change but may be prescribed for patients deemed at risk of infection at the physician's discretion.

Following initial insertion of a suprapubic catheter, the tract will take between 10 days and 4 weeks to become established, after which time the catheter can be changed safely.

Comply with local protocols and procedures with regard to change of catheter (male and female).

For Preparation and procedure for changing suprapubic catheter, see Appendix H.

The procedure for changing a urethral catheter can be found in Appendix J and Appendix B and C where the insertion procedure is described.

6.9 Removal of urethral and suprapubic catheters

Nurses must monitor the need for a catheter carefully.
If removal is considered, it should be discussed with the medical team. Catheter removal should be performed as instructed by a doctor.

In an in vitro study, the complication of balloon cuffing was observed and passive deflation was the best way to empty the balloon. [126] This is done by allowing the catheter balloon to passively dispel the water. The plunger will move on its own as the syringe fills with water. Do not pull back on the plunger.

Fig. 40 Active deflation
(Photo courtesy of C. Vandewinkel)

Fig. 41 Passive deflation
(Photo courtesy of C. Vandewinkel)

Pain is frequently encountered during removal of urethral and suprapubic catheters and is often a consequence of ridge formation on the catheter balloon. This can be minimised by allowing passive deflation of the balloon rather than applying active suction to the deflating channel. [127]

In a RCT, Mills et al. compared catheter removal with active versus passive void trial. Active void trial (AVT) means that the bladder was filled with saline before removal. Passive void trial means that nothing was done before removing the catheter. The AVT group showed a 3–6-hour reduction in time to void and a 63% reduction in UTI. They concluded that the data suggest that AVT should be considered as a recommended technique. [112]

Du et al (2013) found no significant difference in bladder filling prior to void trial in a small prospective multicentre RCT regarding the time to discharge. [113]

When the catheter has been removed, and advice on lifestyle has been given (e.g., drinking), make sure that the patient understands that they can contact a health care professional at any time if or when problems occur.

The available evidence (in the Cochrane review Ellahi 2021) suggests that the removal of short-term indwelling urethral catheters late at night, in comparison to early in the morning, may reduce the risk of requiring recatheterisation and the risk of dysuria. [110]

The same evidence was uncertain about the effect on the risk of symptomatic CAUTI. [110]

Some evidence revealed that early removal of indwelling urinary catheters after pelvic organ prolapse surgery was associated with a reduced incidence of UTI (RR 0.46, 95% CI 0.24 to 0.9). Compared with catheter removal later than 2 days after surgery, catheter removal within 2 days post-operatively significantly reduced the incidence of UTI. [128]

See Appendix I Removal of an indwelling urethral catheter - protocol, Appendix J Removal of the urethral catheter – procedure and Appendix K Removal of suprapubic catheter – procedure

Recommendations	LE	GR
Minimise pain by allowing passive deflation of the balloon rather than applying active suction to the deflating channel [127]	3	B
Based on 2 RCTs, it is uncertain whether there is a benefit in clamping before urinary catheter removal. [112, 113]	1b	C
Remove the catheter late at night in patients with short-term catheters [110]	1a	A
More studies are needed regarding the use of active void trial versus doing nothing before catheter removal in patients with a suprapubic catheter [112, 113]	Unresolved issue	

6.10 Potential problems during and following catheter removal

There are several problems that might arise during removal of a urethral catheter and it is vital that health care professionals are aware of the actions required to overcome them.

Problems and management are listed in:

Appendix L *Troubleshooting for indwelling catheters (problem management)*
Appendix M *Potential problems during catheter removal*
Appendix N *Potential problems following catheter removal*

7. Catheter complications

7.1 Catheter-associated urinary tract infection (CAUTI)

The urinary tract is the most common source of nosocomial infection, particularly when the bladder is catheterised [14, 129], accounting for nearly 40% of all hospital-acquired infections [18, 130-133], with the duration of catheterisation being a significant risk factor. [130, 132-135]. Other risk factors are female sex and neurological issues such as paraplegia. [136, 137] The risk of CAUTI can be reduced with greater access to nurses with specialist knowledge, skills and experience in catheter care, and infection avoidance. [138]

CAUTI is present when patients have: (1) had an indwelling urinary catheter for > 2 days, with day 1 being the day of catheter insertion; (2) one sign or symptom including fever, suprapubic tenderness, costovertebral angle tenderness, urinary frequency or urgency or dysuria; and (3) urine culture with > 105 CFU/ml of one bacterial species.

It is estimated that 69% of CAUTI events are avoidable by following guidelines. [136]

It is accepted that bacterial colonisation with catheterisation is inevitable, with some reports estimating the risk of asymptomatic bacteriuria to be around 5% per day, with almost 100% colonisation risk at 7–10 days of catheterisation. Bacteriuria is therefore an almost universal feature of urinalysis and does not require therapy in asymptomatic individuals. [13, 14]

A large cohort study estimated that 12% of patients who have a catheter inserted for 30 days will develop a CAUTI. [136]

Prolonged urinary catheterisation is common among people in long-term care and this carries a high risk of developing CAUTI and associated problems. [43, 137, 139] Suprapubic catheters are less prone to cause symptomatic infection compared to urethral catheters and are preferable in appropriate patients. [49]

Urinary drainage systems are often reservoirs for multidrug-resistant bacteria, a source of transmission to other patients, and the main risk factor for nosocomial UTI, because they allow microorganisms to bypass host defences and reach the bladder. Extra-luminal contamination may occur when the catheter is inserted, or later by microorganisms ascending from the perineum. Intra-luminal contamination occurs by reflux, which is prevented when closed urinary systems are used. [18, 55, 140]

Antibiotic prophylaxis when changing catheters should only be used for patients with a history of CAUTI following catheter change. There is limited evidence that receiving prophylactic antibiotics reduced the rate of bacteriuria and other signs of infection, such as pyuria, febrile morbidity and gram-negative isolates in patients' urine, in surgical patients who undergo bladder drainage for at least 24 hours post-operatively.

There was also limited evidence that prophylactic antibiotics reduced bacteriuria in non-surgical patients. [141]

The following have been shown to reduce the risk of CAUTI:

Recommendations	LE	GR
Avoid unnecessary catheterisation	1a	A
Use suprapubic instead of transurethral catheters in appropriate patients [49]	1a	A
Remove the catheter as soon as possible [136, 142]	1a	A
Use urinary catheters in surgical patients only if necessary, not routinely, and remove the catheter as soon as possible [143]	1b	B
Use closed urinary drainage systems [24, 55, 144, 145]	1a	A
Adhere to commonplace hand washing policy [24, 146]	3	B
Use stop orders and assess daily the need for urethral catheterisation [147] (decrease by 52%)	1a	A
Use small-lumen catheters [24]	1 b	B

There is now good evidence that the following **do not** reduce the risk of developing CAUTI and therefore such practices are **not recommended** but may be utilised according to local policy and protocol:

Not recommended	LE
Cleansing with 0.05% chlorhexidine gluconate [89, 93, 148, 149]	1a
Addition of chlorhexidine to drainage bags [93, 150]	1a
Utilising povidone iodine to wash the genital area [151]	3
Regular bladder washouts [93, 150]	1a
Regular catheter bag changing [93, 152]	1a
Regular meatal cleansing beyond normal hygiene [88, 92, 93, 151, 153]	1a
Systemic antimicrobial prophylaxis. This should not be routinely used in patients with short-term or long-term catheterisation to reduce catheter-associated bacteriuria or UTI because of concern about antimicrobial resistance. [39]	4
Antibiotic prophylaxis when changing catheters should only be used for patients with a history of CAUTI following catheter change. [141]	4
Do not routinely use silver alloy-coated catheters in long-term catheterisation as they are not associated with a significant reduction in CAUTI, and are more expensive. [43]	1a

Infection may also occur at the site of suprapubic catheter insertion which may present as cellulitis, requiring oral or intravenous antimicrobial pharmacotherapy depending upon severity, or a subcutaneous abscess requiring formal incision and drainage. Such infections are more common in patients who are immunocompromised.

Prevention

The best way to prevent CAUTI is to remove the catheter as soon as possible and to use alternative methods of bladder drainage, see Section 4.1.

Treatment

Only patients with symptoms and a positive urine culture should receive treatment for CAUTI. [154]

A urine specimen for culture should be obtained prior to initiating antimicrobial therapy for presumed CAUTI due to the wide spectrum of potential infecting organisms and the increased likelihood of antimicrobial resistance. The urine culture should be obtained from the freshly placed catheter prior to the initiation of antimicrobial therapy. [39] If an indwelling catheter has been in place for two weeks at the onset of CAUTI and is still indicated, the catheter should be replaced to hasten resolution of symptoms and to reduce the risk of subsequent catheter-associated bacteriuria and CAUTI.

If use of the catheter can be discontinued, a culture of a voided mid-stream urine specimen should be obtained prior to the initiation of antimicrobial therapy to help guide treatment. [39] Long-term indwelling catheters should not be changed routinely. Follow appropriate practices for catheter insertion and care. [39]

7.2 Epididymitis

Epididymitis is inflammation of the epididymis. The condition causes pain and swelling and is almost always unilateral and acute in onset. In older patients, epididymitis is usually due to common urinary pathogens. [14] Epididymitis as a complication of urethral catheterisation is seen significantly more often in patients with indwelling compared to intermittent catheterisation. One study observed epididymitis in almost 5% of spinal cord injury patients with long-term indwelling catheters. The author of the study points out that patient-related factors such as personal hygiene, fluid intake and catheter care should be remembered.[155] (LE: 2a)

7.3 Prostatitis

Prostatitis is a common diagnosis and can be induced with manipulation of the lower urinary tract, such as urethral catheterisation. However, acute bacterial prostatitis is a rare condition and comprises only 5% of all prostatitis. The aetiology of acute bacterial prostatitis includes ascending urethral infection and intraprostatic reflux. Risk factors for the development of acute bacterial prostatitis include unprotected sexual intercourse, phimosis, indwelling urethral catheters, and urinary tract instrumentation; all of which can provide a source for ascending infection. [156] Urethral catheterisation also increases the risk of developing chronic prostatitis. In patients with prostatitis, use of suprapubic catheters can reduce this risk and reduce discomfort compared to urethral catheterisation. [14, 156]

7.4 Catheter blockage

People requiring long-term bladder drainage with an indwelling catheter can experience catheter blockage. The most common problem of long-term indwelling catheters is the formation of encrustations on the luminal and outer surfaces, with consequent blockage and bypassing of urine resulting in urinary leakage. [157]

Around 40–50% of patients with indwelling catheters experience problems with lumen blockage [154, 158-160] (LE: 2b) because of debris or encrustation, due to kinks in a tube or adhesion of catheter to bladder wall.

Catheter encrustation

Encrustation is a result of bacteria in the urine, most commonly *Proteus mirabilis*, that produce an enzyme called urease, which splits urinary urea into ammonia and carbon

dioxide. This results in an increase in alkalinity, providing ideal conditions for the development of crystals; e.g. magnesium ammonium phosphate (struvite) or calcium phosphate. The crystals develop around the eyelets, balloon and internal lumen of the catheter. [157] About 50% of long-term catheterised patients develop encrustations. [161, 162]

Debris

Debris are accumulated tiny pieces of biological matter that originates from urothelial cells from the bladder or tumours shedding cells, blood from infection, disease, urological surgery or trauma, or from mucus.

Biofilm

A thin layer of microorganisms adhering to the surface of a structure, which may be organic or inorganic, together with the polymers that they secrete. [163-165]

Over 70% of blocked catheters are encrusted, and of these, > 60% are associated with bladder stones. [159, 166, 167] The time it takes for catheters to block can vary from 2 to 98 days. [13]

Therefore, it is important to diagnose the exact reason for the blockage to decide the correct course of treatment. Understanding the causes of blockage, and awareness of appropriate management may reduce frequency of blockage and reduce unnecessary washouts that interrupt the closed urinary drainage system.

Prevention and treatment

The evidence base for prevention of catheter blockage is weak with some studies suggesting that potassium citrate supplementation, increased fluid intake and lemon juice supplements all reduce the incidence and severity of catheter encrustation [168] (LE: 2a) Wilde has tested the effect of an educational intervention focusing on optimal fluid intake to decrease blockage, and found that educating the patient resulted in lower frequency of catheter blockage. [169] A Cochrane review based on different washout methods compared saline versus acidic solutions and found no high-level evidence studies on prevention. [157] (LE: 1a)

Bladder washout and instillation seem to be more frequent in clinical practice than other solutions are, despite limited evidence of their effectiveness and concern that washout can damage the bladder mucosa and increase infection due to opening the closed catheter system. [101, 157] *(See Chapter 8: Bladder washout)*

Further studies have shown that intermittent drainage every 2–4 hours reduces the rate of catheter blockage compared to continuous flow. [58] (LE: 2b)

A dependent-free draining catheter bag may exert significant syphoning pressure, resulting in severe catheter reaction within the bladder urothelium. This polypoidal inflammation in turn may block the catheter holes and result in blockage. (LE: 4) Elevation of the catheter bag to eliminate such pressure may alleviate this risk.

Larger catheter lumina also reduce blockage. Silicone catheters appear to be affected by blockage less often than other catheters, which may be explained by the larger lumen, but the material may also be a contributing factor. [39, 154, 159] (LE: 3)

For Bladder washout – procedure and troubleshooting, see Appendix O

Recommendations	LE	GR
Educate the patient to optimise fluid intake and self-management in fluid intake to reduce the incidence and severity of catheter encrustation [169]	4	A
Advise to increase fluid intake and use potassium citrate or lemon juice supplements to reduce catheter encrustation [168]	2a	A
Use larger catheter lumen to reduce blockage	3	A
Patients with regular catheter blockage should be investigated for possible bladder stones and CAUTI	2b	B
Intermittent drainage every 2–4 hours reduces the rate of catheter blockage compared with continuous flow	2b	B
Elevation of the catheter bag to eliminate pressure within the bladder urothelium may alleviate the risk of polypoidal inflammation with blockage as a result	4	C
It is not recommended to perform bladder washouts as a prevention for blockage	1b	A

7.5 Catheter bypassing

Catheter bypassing (sometimes called peri-catheter leakage), occurs in 40–67% of patients with indwelling catheters [160, 162], and may have several causes including catheter blockage (*see Section 7.4 above*), bladder spasm (*see Section 7.8 below*), constipation, pulling on the catheter, or a too large catheter diameter. Catheter bypassing is not a diagnosis but rather a symptom, and treatment should be aimed at the underlying cause.

7.6 Iatrogenic trauma in indwelling catheterisation

Iatrogenic trauma during urethral catheterisation may, besides causing pain, result in either the formation of a false passage, usually at the level of the prostate or bladder neck, urethral stricture, or traumatic cleaving in men [170, 171] and sphincteric disruption in women. (LE: 3) Such trauma prompting an intervention, accounts for as great a proportion (0.5%) as did symptomatic UTI (0.3%). [172, 173] Iatrogenic trauma can be decreased by medical and nursing personnel education by up to 78%. [174] (LE: 3)

Traumatic cleaving and sphincteric disruption can be avoided by preventing catheter traction [175] or preferably conversion to suprapubic catheterisation. (LE: 4) Paraphimosis may occur when an uncircumcised man is catheterised and the prepuce is not replaced. Care and continued patient and carer education will reduce the incidence of such a complication. (LE: 4)

Eleven percent of urethral strictures requiring urethroplasty arise following urethral catheterisation. [176] (LE: 3)

Suprapubic catheterisation has the potential to cause visceral injury, which although difficult to reliably quantify due to under-reporting, is in the region of 2.5% risk of bowel injury with a 30-day mortality rate of around 1.3% [177-179] (LE: 3) A meta-analysis (Hall et al, 2019) showed a bowel injury rate of 0.7% (11/1490). [180] Visceral trauma is more common among patients with previous lower abdominal surgery and in those with neurological disease. [177] (LE: 3)

Prevention

The incidence of visceral trauma during suprapubic catheter insertion may be reduced by the use of ultrasound to ensure an unhindered route from the skin into the bladder. With training it is possible to detect bowel interposed in the intended path of insertion. (LE: 4) Trauma is also prevented by promoting adequate hydration prior to catheter change, ensuring that there is adequate urine (300 ml) in the bladder. If in doubt, check with bladder scan. If there is insufficient urine in the bladder, try to enlarge the volume in the bladder with saline 0.9% via the transurethral or oral route. [181] (LE: 3)

7.7 Urinary extravasation

Extravasation of urine refers to the condition where an interruption of the urethra or injury of the bladder leads to a collection of urine in other cavities. Injury of the urethra leads to extravasation of urine into the scrotum or penis in males.

Bladder rupture with resultant urinary extravasation can be caused when catheterising

with the aid of a catheter introducer although it is almost exclusively related to suprapubic catheter. (LE4)

If the extravasation is intraperitoneal, i.e., the bladder perforation is in a location that causes urine leakage into the peritoneal cavity -- this happens when the injury is in the dome, then laparotomy and primary bladder repair is necessary.

If the leakage is extraperitoneal, i.e., in the pelvic cavity surrounding the bladder but outside the peritoneum, maintaining a urinary catheter that is draining well and insertion of a pelvic drain is sufficient.

Recommendations	LE	GR
To prevent bowel trauma during suprapubic catheter insertion it is essential to ensure that there is adequate urine (preferably 300 ml) in the bladder	4	C
Traumatic cleaving and sphincteric disruption can be avoided by preventing catheter traction or preferably conversion to suprapubic catheterisation	4	C
Training and use of ultrasound could make it possible to detect bowel interposed in the intended path of the suprapubic catheter insertion	4	C
Use lubrication before catheterisation or a hydrophilic catheter in urethral catheterisation to avoid trauma to the urethra	4	C

7.8 Bladder spasm

Bladder spasm is common in patients with indwelling catheters and is best managed with anticholinergic medication that may be given orally, transdermally or intravesically. Bladder spasms can be related to CAUTI and chronic constipation. Maintaining regular bowel function with a high-fibre and high-fluid intake helps prevent constipation. [124, 125, 162] Sometimes a different catheter (smaller lumen and balloon size) can reduce the spasm caused by constipation. (LE: 4)

Should this fail, intradetrusor injections of botulinum toxin A may be administered. [182] (LE: 3)

Recommendations	LE	GR
Educate the patient regarding the link between constipation and CAUTI and bladder spasm	4	C
Bladder spasm is best managed with anticholinergic medication [183]	3	B
Intradetrusor injections of botulinum toxin A may be administered if anticholinergic medication fails or are not tolerated due to the side effects [184]	3	B

7.9 Bladder pain

Bladder pain is experienced in about 25% of patients [185] and may be an extreme form of urgency as a consequence of detrusor spasm, or may be a distinct entity without an associated urge to void.

Catheter-associated bladder pain is exacerbated by constipation, which therefore should be treated as a priority in affected individuals. [186] (LE: 3). Catheter-associated bladder pain is mentioned here as a possible complication of catheterisation. Other aspects of bladder pain and painful bladder syndrome fall outside the remit of these guidelines.

Recommendation	LE	GR
Various studies have shown success in treating catheter-associated bladder pain with anticholinergic medication, which reduces both the incidence and severity of such pain [186, 187]	1b	A

7.10 Haematuria

Haematuria may occur following catheterisation and is usually self-limiting. During urethral catheterisation, prostatic trauma may be the underlying cause, although decompression of high-pressure chronic retention may also result in haematuria.

If such haematuria fails to settle, irrigation through a 3-way catheter may be required or in more severe cases, formal bladder washout under general anaesthesia may be necessary. (LE: 4)

Haematuria following suprapubic catheterisation may be resolved by irrigation through the catheter or via an additional, urethral catheter. (LE: 4)

The frequency of gross haematuria is significantly higher with a longer duration of catheterisation and is seen in about 40% of patients. [188] In neuro-urological

patients, gross haematuria was one of the presenting symptoms in 31.6% of patients diagnosed with squamous cell carcinoma of the bladder. [189]

Recommendations	LE	GR
If haematuria fails to settle, irrigation through a 3-way catheter may be required, or in more severe cases, formal bladder washout under general anaesthesia may be necessary	4	C
Haematuria following suprapubic catheterisation may be resolved by irrigation through the catheter or via an additional, urethral catheter	4	C
Use securement devices to make sure the catheter is not dislodged/ causes microlesions in the urethra	4	C

7.11 Granuloma formation

This complication is limited to suprapubic catheterisation and merely requires application of silver nitrate in most cases. Rarely, if this is ineffective, surgical excision of the granuloma may be required with or without re-siting the catheter. (LE: 4)

7.12 Inability to remove catheter

Catheters may occasionally prove impossible to remove via balloon deflation. This may be as a consequence of balloon calcific encrustation or a faulty deflation mechanism.

Cutting the catheter below the bifurcation may result in deflation and allow catheter removal but if this fails, ultrasound-guided transabdominal balloon puncture may be required. (LE: 4)

Please be aware that cutting the catheter will invalidate product liability.

An alternative method in the event of being unable to remove a suprapubic catheter is to utilise a flexible cystoscope and attempt balloon perforation with a metal guide wire of fine-gauge needle. Evacuation of all catheter matter is essential. (LE: 4)

Transrectal perforation of catheter balloons should be avoided because of the risk of sepsis. (LE: 4) Formation of a catheter knot in the bladder is a rare cause of catheter retention, and usually requires endoscopic removal. [190]

Recommendations	LE	GR
In case of inability to remove the catheter, use a flexible cystoscope and attempt balloon perforation with a metal guide wire of fine-gauge needle	4	C
Transrectal perforation of catheter balloons should be avoided because of the risk of sepsis	4	C

7.13 Squamous cell carcinoma

Long-term catheterisation, in common with other forms of long-term urothelial irritation, may increase the risk of squamous cell carcinoma formation.

Long-term catheterisation in patients with spinal cord injury is the greatest predisposing factor for the development of non-schistosomiasis-induced squamous cell carcinoma of the bladder. [191] The only potential way of reducing this risk is to promote intermittent catheterisation as first choice for patients with neuro-urological disease. [189] (LE: 3)

Recommendation	LE	GR
Gross haematuria without apparent cause should be further investigated	1a	A

8. Bladder washout, irrigation and instillation

In clinical practice, the most extensively used terms are "manual washout or bladder lavage" defined as the washing out of the bladder with sterile fluid, and "bladder irrigation" as the continuous washing out of the bladder with sterile fluid. [192-194] Bladder instillations appear to have several indications; one of which is to prevent or treat catheter blockages.

Indications for bladder washout / irrigation:
- Urinary sediment
- Debris in the bladder
- Haematuria
- Catheter blockage
- Catheter not draining correctly

Indication for bladder instillation
- Introduction of medication

Instillations are not limited to saline or citric acid solutions. There are others such as chemotherapeutic drugs (e.g., mitomycin C or epirubicin) or anti-inflammatory drugs (e.g., hyaluronic acid), or drugs to reduce toxicity of brachytherapy, [195] or vesicoureteral reflux. [196]

8.1 Washout policies/catheter maintenance in long-term urethral catheterisation

In some cases, bladder irrigation with solutions containing citric acid or polyhexanide are used for catheter blockage. Solutions with citric acid are supposed to dissolve encrustations, while polyhexanide is a disinfectant and antiseptic solution that has been developed as an improved, second-generation chlorhexidine. It is a broad-spectrum biocide that is not only effective against bacteria, but also against some fungi and protozoa. [161] Polyhexanide is supposed to help minimise biofilm formation by preventing microorganisms attaching to surfaces and forming colonies, and in this way, reduce bacterial load in catheters. [197] The effect of polyhexanide is still to be proved. [161]

Routine use of acidic washouts to reduce catheter encrustations cannot be recommended according to an Cochrane review comparing washout versus no washout; different washout solutions; frequency, duration, volume and concentration of washouts; and method of administration in any setting with an indwelling urethral

or suprapubic catheter for > 28 days. [157] They found 7 relevant articles and conclude that the evidence is not adequate to show whether washouts are beneficial or harmful.

Despite this conclusion, in daily practice, bladder washouts are still often recommended in special circumstances, such as removal of encrustation in some long-term indwelling catheters, removal of blood clots after urological surgery, or in palliative treatment of intractable haematuria. [198, 199] From a patient perspective, use of a maintenance solution has been reported to improve health-related quality of life. [200] As stated in the Cochrane review [39, 157] there is no evidence of what kind of solutions should be given and for how long.

Bladder washout and catheter maintenance are options to be discussed with patients and their clinical teams on an individual basis. [100] Based on the evidence, the Working Group cannot recommend routine bladder washout except in patients with bleeding and undergoing certain urological surgical procedures.

Recommendation	LE	GR
Bladder irrigation and instillation of maintenance solutions do not prevent catheter-associated infections. However, they may be recommended in special circumstances, such as management of blood clots [39, 157]	1b	A

9. Urinalysis

Urinalysis should not be routinely performed on all long-term catheterised patients, as nearly all patients will have bacteria present in their urine. [201] Unjustified ordering or improper collection of urine for urinalysis or culture from catheterised patients often leads to adverse health care events, including over-treatment of patients with antimicrobial agents and thus predisposing to the development of multidrug-resistant organisms. [202]

Indications

Urinalysis/catheter specimen of urine should be undertaken when:

1. Patients are systemically unwell
2. Patients have a high temperature
3. After lack of response to treatment
4. Admitted/transferred to hospital to ascertain the presence of hospital- or community-acquired infection. [98]

Technique

A urine specimen for culture should be obtained prior to initiating antimicrobial therapy for presumed CAUTI due to the wide spectrum of potential infecting organisms and the increased likelihood of antimicrobial resistance. The urine culture should be obtained from the freshly placed catheter prior to initiation of antimicrobial therapy. [39]

Urine samples from a catheter must be obtained using aseptic technique from the needle-free sampling port by syringe aspiration. [24]

The sampling port has been specially designed to re-seal after aspiration of the urine sample. [203]

Obtain large volumes of urine for special analyses (not culture) aseptically from the drainage bag. [24] (LE: 1b)

If the indwelling catheter has been in place for > 14 days, the catheter should be changed, and the urine should be collected from the new catheter so that the sample is representative of the microorganisms really present in the bladder and not the microorganisms that have adhered to the interior wall of the catheter. [39]

For the procedure of Obtaining urine sample from an indwelling catheter, see Appendix P.

Dipstick

Bacterial colonisation during catheterisation is inevitable and does not require therapy in asymptomatic individuals; therefore, the use of a dipstick to detect UTI is not recommended. If a dipstick is used to detect glucose in the urine, it should be noted that uric acid and vitamin C can cause false-negative results. [204]

Recommendations	LE	GR
For urinalysis, aspirate the urine from the needleless sampling port with a sterile syringe/cannula adapter after cleansing the port with a disinfectant [24]	1b	B
Obtain large volumes of urine for special analyses (not culture) aseptically from the drainage bag [24]	1b	B
Do not use the presence or absence of odorous or cloudy urine alone to differentiate catheter-associated asymptomatic bacteriuria from CAUTI. [14]	3a	B

10. Infection prevention

10.1 Fluid intake

Drinking sufficient fluid dilutes the urine and helps reduce the risk of catheter encrustation and blockage. Good fluid intake also ensures a constant downward drainage and flushing effect. There is no recommended standard amount of fluid intake and the type of fluid consumed is not important as long as the volume is sufficient to prevent concentration of urine. The amount of fluid needed varies and depends on the patient's weight (25–35 ml/kg/day), amount of fluid loss, food intake and circulatory and renal status. Regular fluid intake maintains the urinary flow and reduces the risk of infection and catheter blockage. Patients should be given sufficient fluid to maintain an output of 50–100 ml/h. [18, 122, 123, 205] However, one study by Wilde in 2016 showed that fluid intake self-management was not significantly correlated with the frequency and presence of catheter-associated urinary tract infection (UTI). [169]

Recommendations	LE	GR
Advise good fluid intake to all catheter users to maintain a urine output of 50-100 ml/h [18, 122, 123, 205]	4	C
Advise good fluid intake to prevent blockage of the catheter [169]	2b	A

10.2 Cranberries

Cranberries have been used for several decades for the prevention and treatment of UTIs. An in-vitro study by De Llano et al. in 2015 proved the anti-adhesive activity of some cranberry-derived phenolic metabolites against uropathogenic Escherichia coli, suggesting that their presence in the urine could reduce bacterial colonisation and progression of UTI. [206]

The preventive use of cranberry preparations may be useful in women with uncomplicated recurrent cystitis. This is because a comparison with placebo treatment based on several randomized controlled trials indicates that the infection then does not recur or recurs only later, but these women had no indwelling catheter. [207]

The Cochrane review by Jepson et al. studied participants needing catheterisation (intermittent or indwelling). No studies assessing cranberries for the treatment of UTIs which met the inclusion criteria were found. Based on this review this is an unsolved issue. [208]

Further properly designed studies with relevant outcomes are needed.

Attention should be paid to the interaction between cranberries and warfarin. Cranberries may potentiate the effect of warfarin (anticoagulant medication). [209]

Recommendation	LE	GR
Cranberry products are not effective in preventing UTIs in people with indwelling catheters [208]	1a	B

10.3 Hand hygiene

Hand-mediated transmission is a major factor in increasing the risk of infection in patients, which emphasises the vital importance of hand hygiene and use of personal protective equipment such as aprons and gloves. [101]

Recommendations	LE	GR
Perform hand hygiene immediately before and after insertion or any manipulation of the catheter device or site [24]	1b	A
Carers and patients managing their own catheters must wash their hands before and after manipulation of the catheter [12]	1b	A
Healthcare professionals should observe protocols on hand washing and the need to use disposable gloves between catheterised patients [14, 18]	1b	B

11. Patient quality of life

11.1 Impact of the catheter on the patient

An indwelling urinary catheter is often placed at the outpatient clinic or emergency room in patients who are in a stress situation. Patients may be referred because of urinary retention. Or the indwelling catheter may be the last alternative after all other treatments have failed; for example, clean intermittent catheterisation, medication, use of pads or male external catheters.

Urinary catheters may be commonplace to health care professionals but wearing one may not be that easy because living with an indwelling urethral catheter or with someone who has one creates a strain in terms of managing the physical, psychological and social consequences, leading to restrictions in activities of daily living. [210-212]

A questionnaire sent to 14,268 multiple sclerosis patients showed equal positive or negative impact on health-related quality of life (HRQoL) in those wearing an indwelling catheter (169 patients). [213] Despite the fact that patients and carers acknowledge that urinary catheters are necessary, many patients feel that urethral catheter management can be a source of anxiety and pain that reduces their QoL. [214] Patients can be faced with different issues, such as urinary catheter equipment, how to deal with sexual activities, UTIs or even sepsis, emptying bags, catheter changes, clothing adjustments, positioning of tubing, (hand) hygiene, meatal cleansing, falling out of the catheter, odour, and kinking of catheter. [51, 212, 215, 216] Wilde *et al*. [217] investigated the effect of a self-management intervention on health outcomes and HRQoL consisting of 3 home visits and a telephone call. The participants in the intervention group were taught how to conduct self-monitoring using a 3-day urinary diary to record observations and measurements of fluid intake and output, urine characteristics, and sensations of flow and how to react to the observations. They found that the intervention group had less catheter blockage during the first 6 months, but after 12 months they were comparable to the control group. (LE 1b)

11.2 Sexuality and body image

There is a lack of research on how sexual intercourse is affected by catheter use. Patients with indwelling catheters can experience not only physical problems but also emotional problems. [218]

Several constraints may impair teaching/counselling about sexuality, including lack of privacy because of several carers in the home, insufficient information about a patient's neurological status, cultural taboos, or views that chronically ill people do

not have sexual needs and desires. Making adjustments in sexual activities can be a challenge for patients, requiring support, open communication, and sensitivity of nurses. However, by not bringing up this sensitive subject, nurses put their patients in the uncomfortable position of having to introduce the topic themselves. It should be a part of the routine teaching. [212, 214]

Advice which can be given:

- Discuss with the patient that sexual behaviour encompasses a range of activities from caressing, kissing and masturbation to penetration of the vagina by the penis. [219]
- Patients (or partners) can be taught to remove the catheter and replace it after intercourse.
- Women can tape the catheter on to the abdomen.
- Men can tape the catheter along the erect penis and secure it under a condom. [166]
- The drainage bag, once emptied, can be positioned out of the way in the bed.
- Alternatively, the drainage bag can be disconnected from the catheter and a valve attached during intercourse.
- A water-based lubricant can be used to facilitate insertion (oil-based lubrication can damage the catheter).
- A suprapubic catheter, whenever possible, rather than a urethral catheter should be used.
- A different position during intercourse can be discussed. The position should be comfortable for the patient, so they can relax. Some positions can cause increased traction on the catheter in women, such as a face-to-face position with the partner on top. Traction can be reduced by placing a pillow under the woman's bottom to raise the pelvis.

Recommendations	LE	GR
Discuss sexual issues in an early stage of catheterisation before relationship issues occur	4	C
A sexual counsellor is a good option to give advice and practical suggestions [51]	4	C

11.3 Social support

Patients living with an indwelling catheter want more information about managing a social life. [220] Wearing a catheter is often not a choice, and the experience leads to a time of embodied change, altering one's view of self within the world. [216] Many

urological patients live with chronic illness and require ongoing care. It is generally argued that those with low levels of social support experience poorer QoL and adjustment to illness.

When patients are not offered social support they try to solve problems through trial and error or they go to the internet for information; therefore, nurses should provide patients with contact details to reliable websites or patient organisations. [220] In some countries there are foundations for patients, such as the Bladder and Bowel Foundation in the United Kingdom or the PelvicFloor4All Foundation in The Netherlands. On the internet, there are possibilities to meet other patients.

Recommendation	LE	GR
Inform patients that joining a support organisation could be helpful	4	C

11.4 Patient and carer instruction on dismissal

Living with a long-term indwelling catheter can be a challenge, but with support and information about the best practice, individuals can adapt to this change. [210] The extra time required to carry out daily tasks is frequently reported, and while older patients seem to prefer to travel to familiar places or skip travelling, younger patients are often determined not to let the catheter restrict activities. [221]

Many patients develop special skills in observing their bodies in relation to the catheter, such as the use of their hands to check periodically for leg-bag filling, or they feel the weight on their leg increasing. Most participants empty the bag on a schedule similar to most people's daily micturition pattern. Other skills include awareness of changes of urine flow through the catheter, checking the tube for kinks, and especially for spinal cord injury patients, symptoms of triggering of autonomic dysreflexia. [124, 212]

Patients and carers should be provided with written and verbal information to support the following:

- Knowledge about simple anatomy of the urinary tract
- What is a catheter, and position of the catheter in the bladder in relation to function?
- Hygiene and hand washing
- Care of the drainage system and obtaining further supplies
- How to set up a link system and care for a free-standing bag
- Frequency of catheter and bag changes
- Information on who will change their catheter
- Avoiding constipation, fluid intake advice

- How to recognise the onset of problems such as blockage and infection
- How to deal with specific problems, where and when to seek further advice (nurse specialist, urologist or urology department), date of re-catheterisation and who will do this
- Contact numbers to access advice and support [35, 51, 217, 221]

Recommendations	LE	GR
On dismissal, patients should receive written and oral information about living with an indwelling catheter and its possible issues	4	C
On dismissal, patients should be informed about reimbursement for catheter equipment	4	C

11.5 Supply and reimbursement of catheter equipment

It is recommended that patients receive catheter packs from the hospital pharmacy or other medical suppliers, to ensure that the patient can start at home immediately. Equipment may vary, but consists mostly of a new catheter, leg bags, night bags, straps/stockinet holder, bed holder and/or a catheter valve. For a suprapubic catheter, sometimes a dressing may be required if secretions soil clothing, but this is not essential. [51]

Reimbursement differs in European countries as each country has its own health care insurance system and the personal insurance schemes also vary.

12. Documentation

Careful documentation of date of catheter insertion and implementation of a protocol, to ensure evidence-based guidelines such as this one are followed, form the basis for prevention of CAUTI and other complications as well as prevention of unnecessary catheter days. [222, 223] Carers can convert these guidelines into local policies and procedures.

There are still a lot of issues that patients with long-term indwelling catheters can experience. [224] Without an ongoing catheter care protocol for patients with indwelling urinary catheters, important issues are likely to be neglected. [225]

There are different rules and experiences of documentation in different countries. [226] Written catheter care protocols are necessary to secure details of the procedure in the appropriate place. [18, 27, 69] The following issues should be recorded in the medical/nurse record:

1. Indication
2. Catheter type/balloon/Ch/length
3. Date of insertion
4. Reason for catheterisation or changing catheter
5. Patient reaction to catheterisation and any complaints due to catheter *in situ*
6. Issues with catheter insertion and type of problem
7. Description of urine, colour and volume drained
8. Specimen collected
9. Identity of catheteriser

In addition, printed booklets for this purpose can be useful to involve patients and carers in self-care. [217]

Rew developed a form (catheter change record) in which the above issues are represented. [121] Patients with long-term indwelling urethral catheters may benefit from such a change record, because it may help detect and thus prevent potential problems such as encrustation.

Example – Catheter change record (adapted from Rew 2005 [121], *see Appendix Q*

Mitchell developed an evidence-based long-term urinary catheter management flow chart. [100] It is a tool to be discussed with the patient and the clinical team on an individual basis. In case of catheter blockage, the literature advises reviewing at least

the last 3 catheter changes (the catheter change record can be used for this). In Mitchell's chart, there is no recommendation about catheter maintenance solutions, because there is no evidence for this.

Decision flow chart – catheter drainage (adapted from Mitchell 2008) [100], see Appendix R

Recommendation	LE	GR
Implement care plans for all patients with indwelling catheters	4	C

13. Quality improvement

The term quality improvement is a collective term with different objectives. Thus, effectiveness of measures, avoidance of complications, as well as preventive aspects (e.g., avoidance of UTIs or incontinence) are understood under this term. Implementation, good clinical practice and evidence-based practice are also included in this topic, as well as quality improvement programmes or studies and projects.

The identified studies and articles about quality improvement took place in different settings and studied different interventions. In the table in Appendix T, an overview of the relevant articles is found to give some recommendations.

The focus of the articles includes:

- How to manage stop orders
- How to reduce inappropriate indwelling catheter use
- How to reduce catheter time and remove catheters that are no longer needed
- How to reduce CAUTIs
- How to follow evidence-based practice
- Education
- Quality improvement

Examples of programmes that have been demonstrated to be effective include:

1. A system of alerts or reminders to identify all patients with urinary catheters and assess the need for continued catheterisation
2. Guidelines and protocols for nurse-directed removal of unnecessary urinary catheters
3. Education and performance feedback regarding appropriate use, hand hygiene, and catheter care [227, 228]
4. Guidelines and algorithms for appropriate perioperative catheter management, such as:
   a. Procedure-specific guidelines for catheter placement and postoperative catheter removal
   b. Protocols for management of postoperative urinary retention, such as nurse-directed use of intermittent catheterisation and use of bladder ultrasound scanner [24]

Stop order or reminder

In an integrative review which is also a meta-analysis [229] (LE: 1b), different aspects to prevent CAUTIs are described. Stop order interventions include prompting/requiring removal of the catheter based on time or clinical criteria. Reminder interventions that

a urinary catheter is still present could be directed at either physicians or nurses. There are also interventions to avoid unnecessary catheter placement (e.g., restricted indications of use, and bladder scanning protocols). Catheter placement restrictions and urinary retention protocols result in decreased use of urinary catheters as well as reduction in appropriate indications.

The result of this meta-analysis shows that stop orders can result in prevention of many CAUTIs. Using reminders shows some effect in comparison with the control group but this is not significant. [229]

Recommendations	LE	GR
Use a catheter magnet on the patient's discharge board to remind staff to review the catheter, with the aim of trial without catheter [230]	4	C
Implement a stop order [229, 231, 232]	1b	B
Implement a catheter protocol for the insertion procedure to prevent CAUTI and avoid unnecessary catheterisation [233, 234]	4	C
Offer education with focus on CAUTI prevention to healthcare professionals [227, 235, 236]	4	C

14. Abbreviations

AVT	active void trial
CAUTI	catheter-associated urinary tract infection
Ch	Charrière
EAU	European Association of Urology
EAUN	European Association of Urology Nurses
FG, f, Fr	French Gauge
GR	grade of recommendation
HRQoL	health-related quality of life
LE	level of evidence
PTFE	polytetrafluoroethylene
PUBS	purple urine bag syndrome
PVC	polyvinylchloride
RCT	randomised controlled trial
TUCSV	Transurethral catheterisation safety valve
UTI	urinary tract infection

15. Figure reference list

Cover pictures: Left and right picture: see Fig. 1 and Fig. 4

Fig. 1 **Urethral catheter in female**: Source: Mediafarm ApS, reproduced with kind permission of Coloplast A/S, Denmark, https://www.coloplast.com/

Fig. 2 **Urethral catheter in male:** Provided by the American Urological Association Foundation, http://www.urologyhealth.org/

Fig. 3 **Suprapubic catheter without balloon**: Courtesy of Hospital Santa Maria Lleida, Spain

Fig. 4 **Suprapubic catheter with balloon:** Source: Mediafarm ApS, reproduced with kind permission of Coloplast A/S, Denmark, https://www.coloplast.com/

Fig. 5 **Two-way catheter with an inflated and deflated balloon**: This illustration was published in Essential Clinical Procedures, Richard W. Dehn, David P. Asprey, Vol. 1, 2nd ed., 2007: 205, Chapter 16, Urinary Bladder Catheterization by Dan Vetrosky. Copyright Saunders Elsevier (2011).

Fig. 6 **Balloon catheters**. Left: ordinary balloon; right: integrated balloon: Provided by Fortune Medical Instrument Corp., Taiwan, www.fortunemed.com

Fig. 7 **Straight catheters**: Courtesy of V. Geng, Germany

Fig. 8 **Transurethral catheter with guidewire for difficult catheterisation Urethral catheterisation device (UCD)**: Provided by Urethrotech, https://urethrotech.com/

Fig. 9 **Open-end catheter with a guide wire**: Photo courtesy of T. Schwennesen

Fig. 10 **Three-way catheter with irrigation channel:** This illustration was published in Essential Clinical Procedures, Richard W. Dehn, David P. Asprey, Vol. 1, 2nd ed., 2007: 205, Chapter 16, Urinary Bladder Catheterization by Dan Vetrosky. Copyright Saunders Elsevier (2011).

Fig. 11 **Removed catheter with a cuff**: Photo courtesy of S. Vahr Lauridsen, Denmark

Fig. 12 **International colours of catheter size**: Courtesy of V. Geng, Germany

Fig. 13 **Examples of silicon and latex catheter lumen**: Courtesy of V. Geng, Germany

Fig. 14 **Nelaton tip, Tiemann tip, tapered tip and olive tip**: Courtesy of V. Geng, Germany

Fig. 15 **Catheter set with foley catheter**: Photo courtesy of P. Wenig, Germany

Fig. 16 **Catheter set to insert a suprapubic catheter**: Photo courtesy of T. Schwennesen, Denmark

Figs. 17 and 18 **Examples of urinary bags**: Photo courtesy of P. Wenig, Germany

Fig. 19 **Drainage bag with anti reflux dome**: Photo courtesy of P. Wenig, Germany

Fig. 20 **Collection of a catheter specimen of urine – needle free**: Photo courtesy of S. Vahr Lauridsen, Denmark

Fig. 21 **Drainage bed bag with urine meter**: Dover Precision Urine Meter, Courtesy of Cardinal Health, https://www.cardinalhealth.co.uk/

Fig. 22 **Different types of leg bags**: Photo courtesy of T. Schwennesen, Denmark

Fig. 23 **Body worn bag**: Reproduced with kind permission of Teleflex Headquarters EMEA, Ireland, Teleflex Medical Europe Ltd., IDA Business Park, Athlone, Co. Westmeath, www.teleflex.com

Fig. 24 **Anti-kinking collection bag tubing**: Courtesy of Continence Product Advisor https://www.continenceproductadvisor.org/urinecollectionbags/bodywornurinecollectionbags/antikinking

Fig. 25 **Urinary leg bags - different ways of fixation**: Courtesy of Manfred Sauer GmbH, https://manfred-sauer.co.uk/

Fig. 26 **Examples of bag taps**: Source: Abrams, P. A variety of urine drainage bag tap designs. In: Incontinence, 4th International Consultation on Incontinence, Paris, 2008, 4th ed. 2009, page 1563.

Fig. 27 **Quadriplegic patient with poor manual dexterity:** Photo courtesy of T. Schwennesen, Denmark

Fig. 28 **Overnight drainage system**: Courtesy of V. Geng, Germany

Fig. 29 **Different catheter valves:** Photo courtesy of T. Schwennesen, Denmark

Fig. 30 **Transurethral catheterisation safety valve (TUCSV)**: Courtesy of Class Medical, https://www.classmedical.ie/

Fig. 31 **Transurethral catheterisation safety valve venting (fluid leak) and signaling the user when the balloon has been inadvertently inflated in the urethra**: Courtesy of Class Medical, https://www.classmedical.ie/

Fig. 32 and 33 **Different types of catheter securement devices with Velcro fastening**: Photo courtesy of T. Schwennesen, Denmark

Fig. 34 **Correct fixation of the indwelling urethral catheter to the abdomen in males, especially spinal cord injured patients**: Courtesy of V. Geng, Germany

Fig. 35 **Wrong fixation of the indwelling urethral catheter in males**: Courtesy of V. Geng, Germany

Fig. 36 **Iatrogenic hypospadias developed after indwelling urethral catheterisation**: From: Igawa, Y. et al. Catheterization: Possible complications and their prevention and treatment. Int. J Urol. 2008 (15-6): 481-485. https://onlinelibrary.wiley.com/doi/full/10.1111/j.1442-2042.2008.02075.x Republished with permission from Wiley.com.

Fig. 37 **Fixation of a urethral catheter**: Photo courtesy of C. Vandewinkel, Belgium

Fig. 38 **Fixation of the urethral catheter/leg bag**: Photo courtesy of C. Vandewinkel, Belgium

Fig. 39 **Fixation of the catheter with a securement device**: Photo courtesy of D.K. Newman, United States of America

Fig. 40 **Active deflation**: Photo courtesy of C. Vandewinkel, Belgium

Fig. 41 **Passive deflation**: Photo courtesy of C. Vandewinkel, Belgium

Fig. 42 **Urine Colour Chart – example**: Adapted from Urine Colours Chart Sherry Haynes 2008, From: https://youmemindbody.com/disease-illness/Urine-Colors-Charts-Medications-Food-Can-Change-Urine-Color

Fig. 43 **Non-touch technique**: Courtesy of C. Vandewinkel, Belgium

Fig. 44 **Three lumen catheter for continuous bladder irrigation**: Courtesy of M. Gea-Sánchez, Spain

Fig. 45 **Syringe (60 ml) and sterile saline to remove clots**: Courtesy of M. Gea-Sánchez, Spain

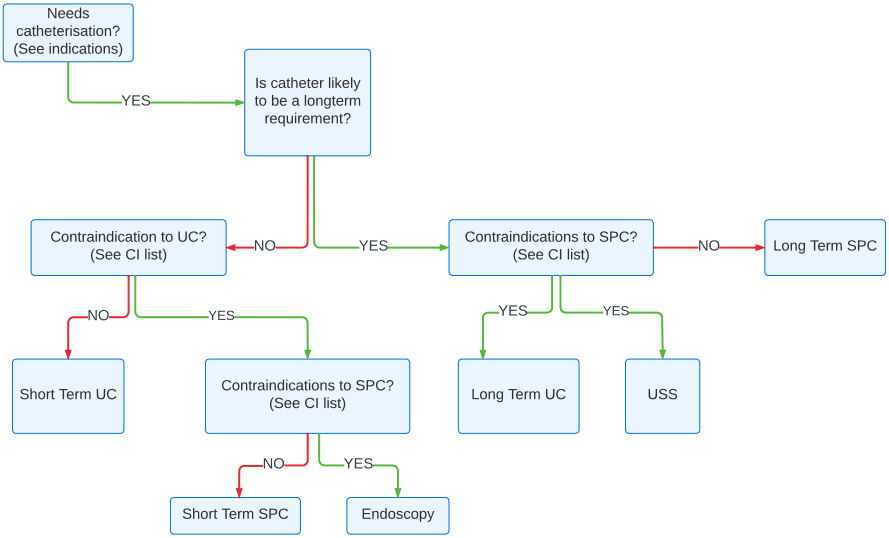
16. Appendices

The appendices describe a number of procedures that do not have a high level of evidence, but they are based on the experience of the Working Group as well as protocols and care standards of various hospitals. Subsequently the evidence level for these documents is 4C.

Appendix A	Decision flow chart on indwelling catheterisation
Appendix B	Male urethral catheterisation – insertion procedure
Appendix C	Female urethral catheterisation – insertion procedure
Appendix D	Insertion of a suprapubic balloon catheter
Appendix E	Patient information about common problems with indwelling catheter equipment
Appendix F	Observation of urinary drainage
Appendix G	Possible colour and odour changes in urine due to food or medication
Appendix H	Preparation and procedure for changing a suprapubic catheter
Appendix I	Removal of an indwelling urethral catheter – protocol
Appendix J	Removal of a urethral catheter – procedure
Appendix K	Removal of a suprapubic catheter – procedure
Appendix L	Troubleshooting for indwelling catheters (problem management)
Appendix M	Potential problems during catheter removal
Appendix N	Potential problems following catheter removal
Appendix O	Bladder washout – procedure and troubleshooting
Appendix P	Obtaining urine sample from an indwelling catheter – procedure
Appendix Q	Catheter change record - example
Appendix R	Catheter drainage - decision flow chart
Appendix S	PICO questions
Appendix T	Quality improvement projects

Appendix A

Decision flow chart on indwelling catheterisation



SPC = supra pubic catheter, UC = urethral catheter, USS = ultrasound scan

Appendix B

Male urethral catheterisation – insertion procedure

Checklist equipment:

1. Sterile catheterisation pack containing specimen containers, kidney shaped dish, low-linting swabs, and disposable towels
2. Disposable pad for bed protection
3. 2 pairs of gloves; one of which must be sterile for handling catheter
4. Selection of appropriate catheters; it is advisable to take a spare catheter in addition to the one you want, and one of a different/smaller size
5. Sterile anaesthetic lubricating jelly (1 or 2 tubes)
6. Universal specimen container, if required
7. Cleansing solution
8. Bactericidal alcohol hand disinfectant
9. 10 ml sterile water (for inflation of balloon), or as recommended by manufacturer
10. Syringe and needle to draw up sterile water and inflate balloon
11. Disposable plastic apron/protective clothing
12. A closed urinary drainage system, e.g., a night bag, leg bag or catheter valve
13. A catheter drainage bag stand, if required

Action	Rationale
1. Check patient file for past problems and allergies etc.	To ensure the patient understands the procedure
2. During the procedure, explain the process to the patient	Consent
3 a) Undertake procedure on the patient's bed or in clinical treatment area using screens/ curtains b) Assist the patient to get into the supine position to ensure the penis is accessible c) Do not expose the patient at this stage of the procedure	To ensure patient's privacy To maintain patient's dignity and comfort
4. Wash hands using soap and water or bactericidal alcohol hand rub	To reduce risk of infection
5. Clean and prepare the trolley, placing all equipment required on the bottom shelf	Top shelf acts as a clean working surface
6. Take the trolley to the patient's bedside	

7. Open the outer cover of the catheterisation pack and slide the pack onto the top shelf of the trolley	To prepare equipment
8. Using aseptic technique, connect the bag to the catheter	To reduce the risk of cross-infection
9. Remove cover that is maintaining the patient's privacy and position a disposable pad under the patient's buttocks and thighs	To ensure urine does not leak onto the bed
10. Clean hands with a bactericidal alcohol hand rub	Hands may have become contaminated by handling the outer packs
11. Put on gloves	To reduce risk of cross-infection
12. Place dressing/protective towel across the patient's thighs and under penis	To create a protective field
13. Lift the penis and retract the foreskin if present using a gauze swab and clean the glans penis with the solution. Beginning with the foreskin, the glans and urethral meatus at the end. Use a new swab for each part.	Lifting the penis straightens the penile urethra and facilitates catheterisation. To reduce the risk of introducing infection. [237]
14. Replace existing gloves with a sterile pair	To prevent infection
15. Slowly instil 10–15 ml of the (anaesthetic) lubricating gel into the urethra holding the penis firmly below the glans with thumb and fingers and the tip of the syringe firmly in the meatus to prevent the gel from leaking out	Adequate lubrication helps to prevent urethral trauma. Use of a local anaesthetic minimises the discomfort experienced by the patient and can aid success of the procedure.
16. Remove the syringe tip from the urethra and keep the urethra closed. Alternatively, a penile clamp may be used.	To ensure that the gel stays in the urethra
17. Wait as recommended on the product (3–5 min)	To ensure a maximised anaesthetic effect [69, 77, 78, 81]
18. Advance the catheter gently to the bifurcation. Hold the penis all the time upright with traction of the other hand (if no urine drains gently apply pressure over the symphysis pubis area.	Advancing the catheter ensures that it is correctly positioned in the bladder [85, 238, 239]
19. Slowly inflate the balloon according to the manufacturer's direction, having ensured that the catheter is draining urine beforehand	Inadvertent inflation of the balloon in the urethra causes pain and urethral trauma [67, 238]
20. Withdraw the catheter slightly	Withdrawing the catheter ensures the balloon sits at the bladder base ensuring optimal urine drainage

21. Secure the catheter using a support strap. Ensure that the catheter does not become taut when the patient is mobilising or when the penis becomes erect. (for stabilisation of urethral catheter, see 6.5.3.2)	To maintain patient comfort and to reduce the risk of urethral and bladder neck trauma
22. Ensure that the glans penis is cleansed after the procedure and reposition the foreskin if present	Retraction and constriction of the foreskin behind the glans penis; paraphimosis may occur if this is not done [69]
23. Help the patient into a comfortable position. Ensure that the patient's skin and the bed are both dry.	If the area is left wet or moist, secondary infection and skin irritation may occur
24. Measure the amount of urine	To be aware of bladder capacity for patients with previous occurrences of urinary retention. To monitor renal function and fluid balance. It is not necessary to measure the amount of urine if the patient is having the urinary catheter routinely changed.
25. Take a urine specimen for laboratory examination, if required	To rule out urinary tract infection
26. Dispose of equipment in a plastic clinical waste bag and seal the bag before moving the trolley	To prevent environmental contamination
27. Record information in relevant documents, this should include: • reasons for catheterisation • date and time of catheterisation • catheter type, length and size • amount of water instilled into the balloon • batch number and manufacturer • drainage system used • problems negotiated during the procedure • review date to assess the need for continued • catheterisation or date of change of catheter	To provide a point of reference or comparison in the event of later queries
28. Record patient experience and any problems. *See Chapter 12*	To provide a point of reference or comparison in the event of later queries

Appendix C

Female urethral catheterisation – insertion procedure

The equipment needed is the same as for male catheterisation (Appendix B)

Action	Rationale
1–12. Same as for male catheterisation	
13. Place dressing/protective towel under the patient	To create a protective field
14. Put on gloves	To reduce risk of cross-infection
15. Clean the meatus: labia majora, then the labia minor and finally the urethral meatus. One swab – one wipe anterior to posterior.	To avoid wiping any bacteria from the perineum and anus forwards towards the urethra
16. Put on sterile gloves	To prevent infection
17. Separate the labia with one hand and give traction upwards	To have a good view of the meatus and minimise the risk of contamination of the urethra
18. Apply a little lubrication to the meatus and then insert the conus of the syringe with (anaesthetic) lubrication in the meatus and slowly instil 6 ml gel into the urethra. Then remove the nozzle from the urethra.	Adequate lubrication helps to prevent urethral trauma. Use of a local anaesthetic minimises the discomfort experienced by the patient and can add to the success of the procedure.
19. Pick up the catheter with the hand in the sterile glove. Insert the catheter in the meatus and gently advance the catheter along the urethra until it reaches the bladder and urine flows out. Then insert the catheter 2 cm deeper.	Inadvertent inflation of the balloon in the urethra causes pain and urethral trauma [67, 238] To ensure that the balloon is in the bladder
20. Slowly inflate the balloon according to the manufacturer´s direction, having ensured that the catheter is draining urine beforehand.	Inadvertent inflation of the balloon in the urethra causes pain and urethral trauma [67, 238]
21. Withdraw the catheter slightly	To ensure that the balloon sits at the bladder base, ensuring optimal urine drainage
22. If the patient desires, secure the catheter using a support strap. Ensure that the catheter does not become too tight when the patient is mobilising.	To maintain patient comfort and to reduce the risk of urethral and bladder neck trauma

23. Ensure that the labia are cleaned after the procedure	To avoid skin irritation
24. Help the patient into a comfortable position. Ensure that the patient's skin and the bed are both dry.	If the area is left wet or moist, secondary infection and skin irritation may occur
25–29. Same as in male catheterisation (Appendix B) point 24-28	

Appendix D

Insertion of a suprapubic balloon catheter

Action	Rationale
1. Any practitioner (medical or nursing) who undertakes initial suprapubic catheter insertion or suprapubic re-catheterisation should have undergone a programme of training and clinical supervision and be assessed as competent to undertake this procedure [98]	To comply with the correct protocols and procedures and minimise risk
2. Patients should have the procedure performed in a controlled environment	To minimise short- and long-term risks of complications of suprapubic catheterisation
3. An indwelling catheter is inserted into the bladder midline above the symphysis pubis	Correct anatomical position
4. Aseptic technique should be used to minimise the risk of infection at the time of initial insertion	To minimise short- and long-term risk
5. Insertion can be performed by using local anaesthetic injected into the subcutaneous tissue at the site of anatomical entry, followed by a Seldinger or traditional trocar technique	Use of local anaesthetic minimises the discomfort experienced by the patient
6. Insertion of a suprapubic catheter may also be performed under general anaesthesia or under cystoscopy	Use of general anaesthetic minimises the discomfort experienced by the patient and aids insertion of the suprapubic catheter
7. Once a tract into the bladder has been made then ideally a catheter no smaller than 12-14 Ch (in adults) should be used to drain the bladder	To maintain a patent tract, and aid drainage and future catheter changes
8. Using a size 12–14 Ch or above catheter with a 10-ml balloon allows for a patent and maintained tract to form between the bladder and skin [101]	To maintain a patent tract, and aid drainage and future catheter changes

Appendix E

Patient information about common problems with indwelling catheter equipment

Observation	Management
1. Emptying bag problem	Check whether there are other systems with different taps
2. Incorrect position of the drainage bag above the level of the bladder	Teach patient to check regularly position of drainage bag
3. Over-full drainage bag	Clockwise emptying of drainage bag or write a protocol to see over time, when over-filling of the bag occurs. Mobile phone or alarm watch can be used. Ensure drainage bag is supported/stabilised correctly, advise patient/carer regarding catheter stabilisation devices.
4. Clothing problem	There are different clothes on the market such as underwear for catheterised patients (e.g. CathWear).
5. Occlusion of catheter lumen by tight clothing	Teach patients about occlusion by tight clothing. Teach patients to check if necessary.
6. Catheter straps occluding the non-return valve of the drainage bag	Try different straps or catheter bag support products; e.g., leg pockets/sporrans to support drainage bag
7. Incorrect position of tubing	Should be correctly positioned and secured to allow free drainage and patient mobility
8. Change in odour or colour of urine	See Appendix G: Possible colour and odour changes in urine. Inform patient about possible reasons for odour/colour change. Change in odour may be caused by UTI but this is not a reliable indicator of bacteriuria or infection. [109]
9. Kinking of catheter	Try non-kinking catheter tubes. Check the positioning of the drainage bag. Tube can be stabilised with tape.
10. No flow of urine	Check whether the drainage bag is full, there is a kink in the catheter or drainage conduit, the catheter is still in the bladder, and there is sufficient fluid intake.

[51, 100, 212, 215, 216]

Appendix F

Observation of urinary drainage

Observation	Management
1. Is the drainage bag full?	Empty the drainage bag
2. Is there a bend in the catheter or drainage conduit?	Make sure that the catheter and drainage tubing are not kinked or trapped
3. Is the catheter blocked?	Lower the drainage system to aid gravity to see if urine then flows
4. Is the catheter still in the bladder?	Check position of the catheter, is the balloon visible?
5. Is the catheter balloon in the urethra?	Check if the patient experiences any pain, check if the balloon is visible. If so, remove the catheter after deflating the balloon.

Appendix G

Possible colour and odour changes in urine due to food or medication

Medication	Colour or odour of urine
Amitriptyline	Blue-green
Anthraquinones	Red-brown (in alkaline urine)
Antibiotics (not all)	Offensive smell
Chloroquine	Rusty brown, yellow
Danthron	Orange
Ferrous salts	Black
Ibuprofen	Red
Imipenem-cilastatin	Darkening on standing
Indomethacin	Green
Levodopa	Darkens
Methylene blue	Blue
Methyldopa and metronidazole	Darkens (red-black on standing)
Nitrofurantoin	Pink (alkaline) - brown
Phenothiazines	Pink to red-brown
Phenytoin	Red
Rifampicin	Yellow-orange to red to brown
Senna	Yellow-brown (acid urine); yellow-pink (alkaline urine) darkens on standing
Sulphonamides	Greenish blue
Triamterene	Green-blue
Uropyrine	Orange
Vitamin B complex	Dark yellow
Warfarin	Orange

Caused by food and drink	
Asparagus	Green colour and offensive smell (not in all patients)
Beetroot	Pink to dark red
Carotene	Brown
Red fruit drinks	Pink to dark red
Oily fish	Fishy
Senna and rhubarb	Yellow to brown or red
Total parenteral nutrition	Offensive
Certain food smells appear to pass through into the urine, e.g. onions, garlic, asparagus, some spices.	

Adapted from Landowski (2008) [240], Wallach (1992) [241] and Watson (1987) [242], [109]

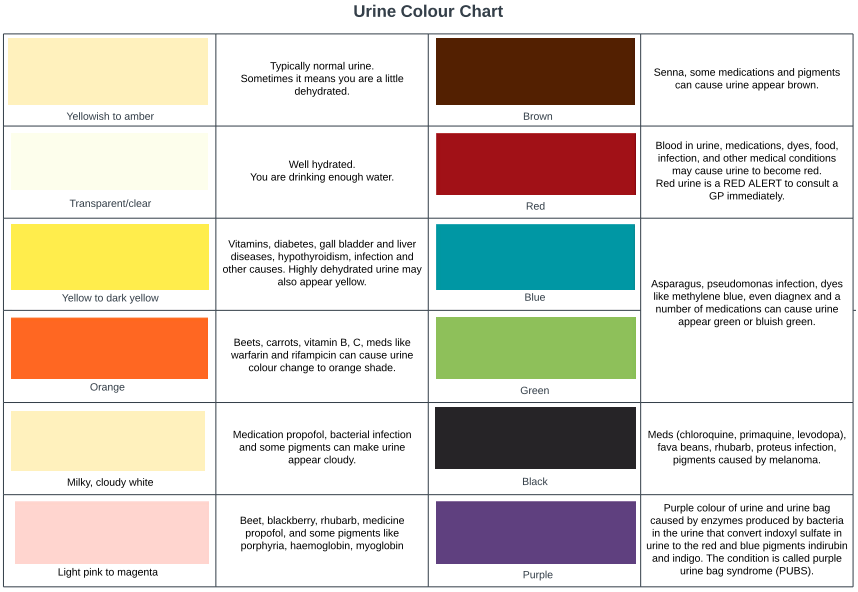


Fig. 42 Urine Colour Chart - example

Adapted from Urine Colours Chart Sherry Haynes 2008

From: https://youmemindbody.com/disease-illness/Urine-Colors-Charts-Medications-Food-Can-Change-Urine-Color

Appendix H

Preparation and procedure for changing a suprapubic catheter
Comply with local protocols and procedures with regard to change of suprapubic catheter (male and female).

Checklist equipment:
1. Sterile catheterisation pack containing specimen containers, kidney shaped dish, low-linting swabs, and disposable towels
2. Disposable pad for bed protection
3. 2 pairs of gloves; one of which must be sterile for handling catheter
4. Selection of appropriate catheters; it is advisable to take a spare catheter in addition to the one you want, and one of a different/smaller size
5. Sterile anaesthetic lubricating jelly (1 or 2 tubes)
6. Universal specimen container, if required
7. Cleansing solution
8. Bactericidal alcohol hand disinfectant
9. 10 ml sterile water (inflation of balloon), or as recommended by manufacturer
10. Syringe and needle to draw up sterile water and inflate balloon
11. Disposable plastic apron/protective clothing
12. A closed urinary drainage system; e.g., a night bag, leg bag or catheter valve
13. A catheter drainage bag stand, if required
14. Dressing and wound care set (supplementary pack)

Action	Rationale
1. Check patient file for past problems and allergies etc. During the procedure explain the process to the patient.	To ensure the patient understands the procedure
2 a) Undertake procedure on the patient's bed or in clinical treatment area using screens/ curtains b) Assist the patient to get into the supine position to ensure the suprapubic tract is accessible	To ensure patient's privacy
c) Do not expose the patient at this stage of the procedure	To maintain patient's dignity procedure and comfort
3. Wash hands using soap and water or bactericidal alcohol hand rub	To reduce risk of infection
4. Put on a disposable plastic apron or protective clothing	To reduce risk of cross-infection from microorganisms on uniform

5. Clean and prepare the trolley, placing all equipment required on the bottom shelf. Assemble all of the necessary equipment. The catheter size and amount of water instilled in the balloon should be the same as the existing suprapubic catheter.	The top shelf acts as a clean working surface. To ensure you have all required equipment.
6. Take the trolley to the patient's bedside	Equipment easily to hand to perform procedure
7. Open the outer cover of the catheterisation pack and slide the pack onto the top shelf of the trolley	To prepare equipment
8. Using aseptic technique, connect the bag to the catheter	To reduce the risk of cross-infection
9. Using aseptic technique, open the supplementary packs	To reduce the risk of cross-infection
10. Remove cover that is maintaining the patient's privacy and position a disposable pad under the patient's buttocks and thighs	To ensure urine does not leak onto bed
11. Clean hands with a bactericidal alcohol hand rub	Hands may have become contaminated by handling the outer packs
12. Put on gloves	To reduce risk of cross-infection
13. Observe the current suprapubic site for the lie of the catheter, angle of insertion and how much of the catheter length is visible outside the body, as this information will be a useful guide for insertion of the new catheter	To aid removal and re-insertion of suprapubic catheter
14. Place dressing/protective towel across the patient's abdomen	To create a protective field
15. Lift the present catheter using a gauze swab and clean the cystostomy site with the solution	To reduce the risk of introducing infection
16. Replace existing gloves with a sterile pair and place new sterile towel at the cystostomy site	It is too early for the sterile gloves when preparing for an aseptic catheterisation procedure. They must be put on just before placing the new catheter.

17. Deflate balloon without suction of existing catheter and remove catheter. Ensure you have sterile gauze at hand, to put on the cystostomy site to prevent leakage. After this has been carried out it is advisable to put on sterile gloves and insert the new catheter immediately.	To prevent a cuff or wrinkles at the balloon; it will aid success of the procedure. A 2-person technique can be used, 1 removes the catheter while the "aseptic" person inserts the new catheter.
18. Insert 5–10 ml water-soluble lubricant or local anaesthetic gel into the suprapubic tract. Advance the catheter into the tract 3 cm deeper than it was before and not more to prevent the catheter tip irritating the bladder wall and to prevent the catheter passing the urethra. If no urine drains, gently apply pressure over the symphysis pubis area. Once urine drains, insert the catheter ~5 cm further to ensure the catheter is in the bladder and not the suprapubic tract.	Adequate lubrication helps to prevent trauma. Use of a local anaesthetic minimises the discomfort.
19. Slowly inflate the balloon according to the manufacturer's instructions, having ensured that the catheter is draining urine beforehand	Inadvertent inflation of the balloon in the suprapubic tract causes pain and trauma
20. Withdraw the catheter slightly and attach the drainage bag/system if this has not already been done	Withdrawing the catheter ensures the balloon sits in the bladder, ensuring optimal urine drainage
21. Secure the catheter using a support strap. Ensure that the catheter does not become taut when patient is mobilising	To maintain patient comfort and to reduce trauma/traction being applied to the stoma
22. Help the patient into a comfortable position. Ensure that the patient's skin and the bed are both dry. Assist the patient with dressing into own clothing.	If the area is left wet or moist, secondary infection and skin irritation may occur. Maintain privacy and dignity.
23. Measure the amount of urine	To be aware of bladder capacity for patients with previous urinary retention. To monitor renal function and fluid balance. It is not necessary to measure the amount of urine if the patient is having the urinary catheter routinely changed.
24. Take a urine specimen for laboratory examination, if required	To rule out urinary tract infection

25. Dispose of equipment in a plastic clinical waste bag and seal the bag before moving the trolley	To prevent environmental contamination
26. • Record information in relevant documents; this should include: • residual volume • date and time of catheterisation • catheter type, length and size • amount of water instilled into the balloon • batch number and manufacturer • drainage system used • problems negotiated during the procedure • review date to assess the need for continued • catheterisation or date of change of catheter • observation of cystostomy site *See Chapter 12.*	To provide a point of reference or comparison in the event of later queries
27. Record patient experience and any problems. *See Catheter change record (Appendix Q).*	To provide a point of reference or comparison in the event of later queries

Non-touch technique for changing a suprapubic catheter

Use the internal package of the indwelling catheter to place the catheter in the bladder. Do not touch the catheter itself.

Action	Rationale
1 – 14. The same as above	
15. Place the receiver containing the catheter on the sterile field. Remove the exterior package of the indwelling catheter. Open the package of the urinary bag and remove the pre-perforated part of the interior package at the end of the indwelling catheter and connect the urinary bag.	To prevent contamination of the catheter
16. Deflate balloon (without suction) of existing catheter and remove catheter	To prevent a cuff or wrinkles at the balloon

17. Insert 5–10 ml water-soluble lubricant or local anaesthetic gel into the suprapubic tract	Adequate lubrication helps to prevent trauma. Use of a local anaesthetic minimises the discomfort experienced by the patient and can aid success of the procedure.
18. Remove the pre-perforated front part of the internal package so that the first 5 cm of the catheter is free. Advance the catheter into the tract no more than 3 cm deeper than it was before, to prevent the catheter tip irritating the bladder wall and the catheter passing the urethra. When no urine drains, gently apply pressure over the symphysis pubis area. Once urine returns, insert the catheter ~5 cm further to ensure that it is in the bladder and not the suprapubic tract.	Advancing the catheter ensures that it is correctly positioned in the bladder  *Fig. 43 Non-touch technique* (Courtesy of C. Vandewinkel)
19. Slowly inflate the balloon according to the manufacturer's instructions, having ensured that the catheter is draining urine beforehand	Inadvertent inflation of the balloon in the suprapubic tract causes pain and trauma
20. Open the rest of the package by the pre-perforated part and remove the package	
21. Withdraw the catheter slightly	Withdrawing the catheter ensures that the balloon sits in the bladder, ensuring optimal urine drainage
22. Secure the catheter using a support strap. Ensure that the catheter does not become taut when the patient is mobilising.	To maintain patient comfort and reduce trauma/traction being applied to the stoma
23. Help the patient into a comfortable position. Ensure that the patient's skin and the bed are both dry. Assist the patient with dressing into own clothing.	If the area is left wet or moist, secondary infection and skin irritation may occur. Maintain privacy and dignity.
24. Measure the amount of urine	To be aware of bladder capacity for patients with previous occurrences of urinary retention. To monitor renal function and fluid balance. It is not necessary to measure the amount of urine if the patient is having the urinary catheter routinely changed.
25. Take a urine specimen for laboratory examination, if required	To rule out urinary tract infection
26. Dispose of equipment in a plastic clinical waste bag and seal the bag before moving the trolley	To prevent environmental contamination

27. Record information in relevant documents, including: a. reasons for catheterisation b. residual volume c. date and time of catheterisation d. catheter type, length and size e. amount of water instilled into the balloon f. batch number and manufacturer g. drainage system used h. problems negotiated during the procedure i. review date to assess the need for continued catheterisation or date of change of catheter j. observation of cystostomy site *See Chapter 12*	To provide a point of reference or comparison in the event of later queries
28. Record patient experience and any problems. *See Catheter change record (Appendix Q).*	To provide a point of reference or comparison in the event of later queries

Changing a suprapubic catheter with a Seldinger technique

An open-end catheter is used. Special changing sets are available. (*see Section 5.3*)

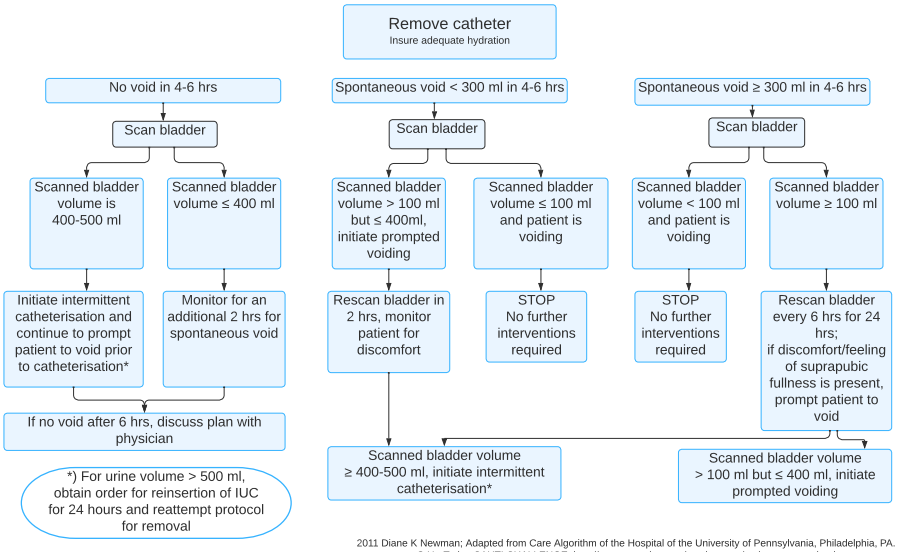
Action	Rationale
1 – 14. The same as above	
15. Place the receiver containing the catheter on the sterile field. Connect the collecting bag/the catheter system. Disconnect the catheter.	To prevent contamination of the catheter
16. Pull the catheter straight upwards and keep it in this position. Insert the mandrain through the catheter 3 cm further than the length of the catheter. Deflate balloon (without suction) of existing catheter and remove catheter. Remove the old catheter over the mandrain and keep the mandrain in the same position. After this has been carried out it is advisable to put on sterile gloves and insert the new catheter immediately.	To prevent a cuff or wrinkles at the balloon A 2-person technique can be used: 1 person removes the catheter while the "aseptic" person inserts the new catheter

17. Insert 5–10 ml water-soluble lubricant or local anaesthetic gel into the suprapubic tract. Bring the new catheter over the mandrain. Advance the new catheter into the tract no more than 3 cm deeper than it was before. When no urine drains gently apply pressure over the symphysis pubis area. Once urine returns, insert the catheter ~5 cm further to ensure the catheter is in the bladder and not the suprapubic tract. Remove the mandrain	Adequate lubrication helps to prevent trauma. Use of a local anaesthetic minimises the discomfort. Advancing the catheter ensures that it is correctly positioned in the bladder, to prevent the catheter tip irritating the bladder wall and the catheter passing the urethra
18. Slowly inflate the balloon according to the manufacturer's instructions, having ensured that the catheter is draining urine beforehand	Inadvertent inflation of the balloon in the suprapubic tract causes pain and trauma
19. Withdraw the catheter slightly and attach the drainage bag/system if this has not already been done	Withdrawing the catheter ensures the balloon sits in the bladder, ensuring optimal urine drainage
20. Secure the catheter using a support strap. Ensure that the catheter does not become taut when patient is mobilising.	To maintain patient comfort and to reduce trauma/traction being applied to the stoma
21. Help the patient into a comfortable position. Ensure that the patient's skin and the bed are both dry. Assist the patient with dressing into own clothing.	If the area is left wet or moist, secondary infection and skin irritation may occur. Maintain privacy and dignity.
22. Measure the amount of urine	To be aware of bladder capacity for patients with previous occurrences of urinary retention. To monitor renal function and fluid balance. It is not necessary to measure the amount of urine if the patient is having the urinary catheter routinely changed.
23. Take a urine specimen for laboratory examination, if required	To rule out urinary tract infection
24. Dispose of equipment in a plastic clinical waste bag and seal the bag before moving the trolley	To prevent environmental contamination

25. Record information in relevant documents, including: • reasons for catheterisation • residual volume • date and time of catheterisation • catheter type, length and size • amount of water instilled into the balloon • batch number and manufacturer • drainage system used • problems negotiated during the procedure • review date to assess the need for continued catheterisation or date of change of catheter • observation of cystostomy site *See Chapter 12*	To provide a point of reference or comparison in the event of later queries
26. Record patient experience and any problems *See Catheter change record (Appendix Q)*	To provide a point of reference or comparison in the event of later queries

Appendix I

Removal of an indwelling urethral catheter - protocol



2011 Diane K Newman; Adapted from Care Algorithm of the Hospital of the University of Pennsylvania, Philadelphia, PA.
© UroToday CAUTI CHALLENGE. http://www.urotoday.com/cauti_center/tools-resources.html

Appendix J

Removal of a urethral catheter – procedure

Checklist equipment:

1. Disposable gloves
2. Syringe for deflating balloon
3. Disposable pad (to protect bed)
4. Plastic disposable apron or protective clothing
5. Gauze swabs/disposable wipes

Action	Rationale
1. Catheters can be removed at night before 24 hours. Catheters are often removed early in the morning (refer to local policy).	Shorter hospital stay. So that any retention problems can be dealt with during the day.
2. Explain procedure to patient and inform them of the potential symptoms that may occur following removal; i.e., incontinence, urgency, frequency, dysuria, discomfort and retention Symptoms should resolve over the following 24–48 hours. If not, further investigation may be needed; e.g., mid-stream urine specimen taken for culture. Discuss the need for an adequate oral fluid intake of 2–3 l/day (30 ml/kg/day)	 For adequate flushing of the bladder, and to help dilute and expel debris or infected urine, if present
3. Check volume of water in balloon (refer to patient documentation), then use syringe to deflate balloon	To confirm how much water is in the balloon. To ensure balloon is completely deflated before removing catheter. [127, 243, 244]
4. Attach the syringe to catheter valve to deflate the balloon. Do not use suction on the syringe but allow the solution to come back spontaneously. [127]	
5. Ask patient to breathe in and then out: as patient exhales, gently remove the catheter. Male patients should be warned of discomfort as the deflated balloon passes through the prostatic urethra.	To relax pelvic floor muscles
6. Clean meatus using gauze/disposable wipe, clear away equipment, and make the patient comfortable	
7. Used equipment should be placed in clinical waste bag and disposed of in line with local policy	To reduce risk of cross-infection to others

Appendix K

Removal of a suprapubic catheter – procedure

Checklist equipment:

1. Disposable gloves
2. Syringe for deflating balloon
3. Disposable pad (to protect bed)
4. Plastic disposable apron or protective clothing
5. Gauze swabs/disposable wipes
6. Sterile absorbent dressing and tape

Action	Rationale
1. Patient dignity	
2. Explain procedure to patient and inform him of the potential symptoms that may occur following removal; i.e. incontinence, urgency, frequency, dysuria, discomfort and retention. Possibly also loss of urine through the suprapubic fistula. Symptoms should resolve over the following 24–48 hours. If not, further investigation may be needed; e.g., mid-stream urine specimen taken for culture. Discuss the need for an adequate oral fluid intake of 2–3 l/day (30 ml/kg/day)	For adequate flushing of the bladder, and to help dilute and expel debris or infected urine, if present
3. Check volume of water in balloon (refer to patient documentation), then use syringe to deflate balloon	To confirm how much water is in the balloon. To ensure balloon is completely deflated before removing catheter. [127, 243, 244]
4. Attach the syringe to catheter valve to deflate the balloon. Do not use suction on the syringe but allow the solution to come back spontaneously. [127]	To prevent cuff and wrinkles at the balloon
5. Ask patient to breathe in and then out: as patient exhales, gently remove the catheter	To relax pelvic floor muscles

6. Clean suprapubic fistula using gauze/ disposable wipe, clear away equipment, put on an occlusive absorbent dressing and make the patient comfortable	Large absorbent dressing is for the loss of urine that can be voluminous in the beginning
Ask the patient to sit or walk and not lie down	To prevent a voluminous loss of urine
Check whether the dressing is dry after 1 hour. If not, check regularly until it is dry.	Sometimes it takes 1 day before the fistula is dry
7. Used equipment should be placed in clinical waste bag and disposed of in line with local policy	To reduce risk of cross-infection to others
8. Document procedure and note any difficulties/problems experienced	To ensure any problems are documented for future reference
Commence fluid balance chart for monitoring patient's ability to void urine following removal of the catheter	To monitor for potential problems following removal of catheter; e.g., retention of urine. If patient does not void in the first 4–6 hours, or if they are experiencing suprapubic pain, a bladder scan and discussion with medical team are indicated. Re-catheterisation could be indicated in this event.

Appendix L

Troubleshooting for indwelling catheters (problem management)

Problem	Cause	Suggested action
1. UTI introduced during catheterisation	Inadequate aseptic technique and/or urethral cleansing. Contamination of catheter tip.	Manage and treat immediate symptoms, inform medical staff. Obtain a catheter specimen of urine.
2. UTI introduced via the drainage system	Inappropriate handling of equipment. Breaking the closed system.	As above
3. Urethral mucosal trauma	Incorrect size or positioning of catheter. Poor insertion technique.	Check the catheter support and apply or reapply as necessary. Re-catheterise the patient using the correct size catheter.
	Creation of false passage as a result of catheter insertion technique	Remove catheter if not draining urine. Seek medical advice.
4. Inability to tolerate indwelling catheter	Urethral and/or bladder mucosal irritation	Use catheter support strap to prevent unnecessary pulling. Discuss use of anticholinergic medication with medical staff. Consider use of 100% silicone catheter in cases of suspected latex hypersensitivity. [95, 96, 245]
	Impact on patient's self-image	Explain the need for and function of the catheter. Offer reassurance and support. Discuss alternative management options with the multidisciplinary healthcare team.
5. Inadequate drainage of urine	Kinked drainage tubing	Ensure free flow of urine
	Blocked tubing; e.g., blood clots or debris.	If a 3-way catheter is in place commence irrigation. If a standard indwelling catheter is in use, see Chapter 8, Bladder washout.
	Incorrect placement of a catheter; e.g., in bladder neck	Re-site the catheter

6. Leakage of urine around catheter (bypassing)	Bladder irritation	Ensure the catheter/drainage system is well supported. Discuss use of anticholinergic therapy with medical staff.
	Irritation from the catheter balloon	Ensure a 10-ml balloon catheter has been used for standard drainage
	Incorrect size of catheter	Replace with the correct size, usually ≤ 2 Ch
7. Catheter falls out	Incorrect filling of the balloon	Check whether the amount of water in the balloon was sufficient
	Incorrect fixation of a balloon-free catheter	Check fixation of the catheter
	Catheter balloon may have deflated, accidental trauma	Catheter needs to be replaced as soon as possible as the suprapubic tract may close. Contact catheter nurse specialist or health care professional immediately for re-insertion of new catheter.

Appendix M

Potential problems during catheter removal

Problem	Cause	Suggested action
1. Unable to deflate balloon	Damaged or faulty valve on inflation/ deflation arm of the catheter	Check the valve for evidence of damage. Try adding 2–3 ml sterile water into inflation channel to dislodge blockage. If unsuccessful, use a syringe and needle to aspirate the fluid from the inflation arm (above the valve).
	Channel obstruction	Attach syringe to the inflation arm and leave in place for 20–40 minutes. The effect of gravity will help with the deflation process.
		Squeeze the visible tubing to try and displace crystal formation in inflation channel. Snip the balloon tube and insert a small mandrain and perforate the balloon. It is necessary that the bladder is full and the balloon is retracted to the bladder neck.
		If the above are unsuccessful, refer to medical staff as the balloon will need to be punctured suprapubically using a needle under ultrasound visualisation. Following catheter removal, the balloon should be inspected to ensure that it is intact and there are no fragments left in the bladder.
2. Wrinkling of balloon following deflation resulting in formation of a cuff	Balloon unable to return to pre-inflation shape resulting in formation of a ridge	Withdraw catheter gently on deflation of balloon, but if resistance is experienced, stop the procedure. Using a syringe re-insert 1–2 ml saline back into the balloon; this action will prevent formation of a cuff. Withdrawal of the catheter should now be easier and patient discomfort and potential urethral trauma will be reduced.
3. Pain	Balloon cuffing (as above) or sensitivity experienced at the bladder neck or within the urethra from the catheter	Good patient preparation and support throughout the procedure is essential so that the patient is relaxed and fully aware of what to expect. Inserting anaesthetic (lignocaine/lidocaine) gel into the drainage port of the catheter 3–5 minutes prior to removal can reduce sensitivity at the bladder neck. It should be noted that > 2–3 ml will be needed as this volume will remain within the catheter.

Note: If you experience any product failure or difficulties, it is important that the manufacturer is contacted and informed of the problem.

Appendix N

Potential problems following catheter removal

Problem	Cause	Suggested action
1. Frequency and dysuria	Inflammation of the urethral mucosa	Ensure a fluid intake of 2-3 l/day (30 ml/kg/day). Advise the patient that frequency and dysuria are common but will usually be resolved once micturition has occurred at least 3 times. Inform medical staff if the problem persists.
2. Retention of urine	Inability of the bladder to empty. Patient anxiety.	Encourage the patient to increase fluid intake. Offer the patient a warm bath to promote relaxation. If Unsuccessful, perform manual palpation of the bladder or a bladder scan (if the equipment is available). Inform medical staff if the problem persists as the patient may require re-catheterisation.
3. Bacteriuria/ urinary tract infection (UTI)	Resulting in frequency and dysuria	Encourage a fluid intake of 2-3 l/day to promote flushing of the bladder. Collect a specimen of urine if symptoms persist and inform medical staff. Administer prescribed antibiotics.
4. Small amounts of blood at the start, throughout or at the end of the patient's urine stream	Minor damage of tissue in urethra	Encourage the patient to increase fluid intake. Reassure patient that the condition is harmless. Inform patient of signs of UTI.
5. Urge to urinate and not reach the container or bathroom in time		Explain to the patient this resolves mostly within the first 24–48 hours. If not, urinary culture to exclude UTI.
6. Dribbling. This problem should subside within several days.		Give patient pads. Teach patient pelvic floor exercises. Explain that this is mostly a short-term complication as result of the catheter.

[93]

Appendix O

Bladder washout – procedure and troubleshooting

Before starting the procedure you have to consider:

- Management and maintenance of 3-way Foley catheter (Fig. 44) involves a closed drainage system and sterile technique
- Saline solution for infusion should be stored and infused at room temperature to avoid bladder spasms
- Strict intake and output is recommended for all patients receiving continuous bladder irrigation. Special attention should be paid to frail older patients and/or patients with history of pelvic floor or bladder radiation. These patients are at high risk for bladder perforation.

Equipment

- Sterile 0.9% sodium chloride irrigation bags (3 l)*
- Irrigation tubing
- Foley (3-way)
- Large Foley drainage bag
- 60-ml syringe
- Sterile saline (50 ml)

*A Cochrane systematic review (2017) concluded that the evidence was not adequate to conclude if washouts were beneficial or harmful. Further rigorous, high quality trials that are adequately powered to detect benefits from washout being performed as opposed to no washout are needed. Trials comparing different washout solutions, washout volumes, and frequencies or timings are also needed. [157]

Implementation process

- Foley (3-way) insertion *(see Sections 5.1.4. and 6.2)*
- Connect the middle lumen to drainage bag (2 l)
- Connect the third lumen to sodium chloride irrigation bags. The speed of irrigation depends on haematuria and bladder characteristics.
- Use strict aseptic technique when handling any of the equipment to prevent introduction of microorganisms into the urinary tract

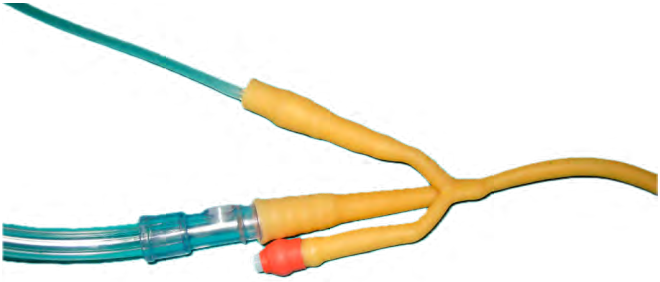


Fig. 44 Three lumen catheter for continuous bladder irrigation

(Courtesy of M. Gea-Sánchez)

Troubleshooting

1. Drainage out is less than irrigation infused
   - Stop irrigation (recalculate intake and output)
   - Ensure that tubing is not kinked or looped below bladder level
   - Palpate bladder for distention (use bladder scanner if available, to facilitate genitourinary assessment as per unit's routine)
   - If obstruction is suspected, gentle manual irrigation may be required as per physician's orders
   - Cleanse the catheter opening. Use nothing smaller than a 60-ml syringe and sterile saline (Fig. 45)
   - Use slow, even pressure to avoid damaging the bladder wall. Do not force if resistance is met
   - Allow irrigation to flow back freely

Fig. 45 Syringe (60 ml) and sterile saline to remove clots

(Courtesy of: M. Gea-Sánchez)

2. Increased bloody drainage or presence of clots
   - Increase rate of irrigation infusion as per physician's orders
   - Irrigation of catheter as outlined in 1 to aid in clot removal may be indicated
   - If large amount blood or clots persists, notify physician

3. Patient complains of pain (complete pain assessment using the 0–10 or visual analogue scale)
   - Palpate bladder to determine presence of distention
   - Check drainage tubing for kinks
   - Observe drainage for adequate amount, presence of clots that might be blocking drainage tube. Evaluate intake and output
   - Avoid cold irrigation solution as it may cause bladder spasm

4. The patient is confused/agitated
   - Assess if patient is orientated to time, place and person
   - Have relevant information ready to share (i.e., amount of opioids received, amount of CBI received, true urine output, time of onset of alteration in orientation, sodium level; in transurethral resection of the prostate syndrome an overload of fluid through the prostatic sinuses can lead to dilutional hyponatremia, confusion and hypertension)

5. Solution leaks around the Foley catheter
   - Assess for bladder spasms
   - Refer to 1 – assessing for obstruction
   - Consider administering antispasmatic; e.g., hyoscine butylbromide (Buscopan)

6. Catheter falls out
   - If recognised immediately, attempt re-insertion with a new catheter of the same size with liberal use of lubricating gel.
   - If delayed presentation of if immediate replacement is unsuccessful, catheterise urethrally if possible.
   - Fill the bladder with sterile water/saline via the urethral catheter.
   - If fluid is seen to leak from the SPC site, attempt guidewire insertion and re-catheterisation.
   - If this is unsuccessful or if no fluid emerges from the SPC site, appropriate and safe arrangements should be made for formal re-insertion.

Documentation

Documentation includes:

- Patient's comfort/pain level (how procedure is being tolerated)
- Colour and type of drainage, presence of clots/fragments
- Intake and output; use the following calculation:
  CBI infused – Foley output = True urine output
- Interventions required (manual irrigation, use of bladder scanner)
- Health teaching done with patient and family
- Patient concerns/adverse reactions (e.g., continued bladder spasms or decreased total urine output), the nursing actions taken and patient outcomes

Adapted from: Grey Bruce Health Network. Continuous Bladder Irrigation Clinical Protocol. 2007. [193]

Appendix P

Obtaining a urine sample from an indwelling catheter – procedure

1. Obtain consent and ensure the procedure is performed maintaining patient dignity
2. Wash your hands and put on an apron. Clean hands with alcohol hand rub.
3. If there is no urine visible in the catheter tubing, a clamp may be placed a few centimetres distal to the sampling port
4. Once there is sufficient urine visible in the drainage tube above the clamp, wipe the sampling port with an alcohol swab and allow to dry
5. Insert a sterile syringe into the needle-free sampling port. Aspirate the required amount of urine.
6. Remove the syringe and transfer specimen into sterile specimen pot
7. Wipe the sampling port with an alcohol swab and allow to dry
8. Unclamp the drainage tubing
9. Dispose of all waste materials
10. Wash hands
11. Complete documentation according to the organisational guidelines
12. Dispatch the specimen to the laboratory

Appendix Q

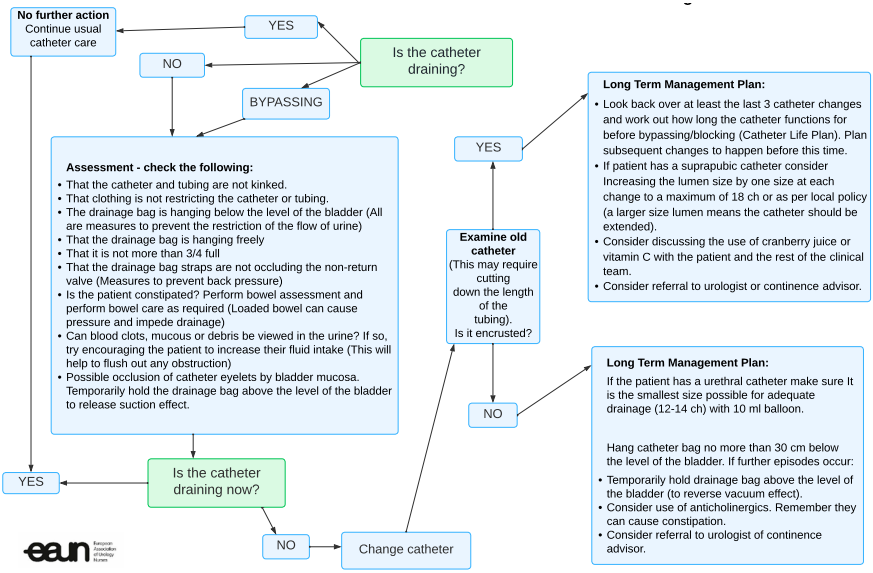
Catheter change record - example

Patient name:								
Date catheter changed	Reason for change	Days in situ	Urine pH on change	Visible encrustation seen – where?	Make, type, size	Batch No. Expiry date	ml in balloon	Next planned change

Example of catheter change record (adapted from Rew, 2005) [121]

Appendix R

Catheter drainage - decision flow chart
(Adapted from Mitchell 2008) [100]



Appendix S

PICO questions

PICO 1	Is there evidence that silicone catheters compared with other-material catheters	a) prevent encrustation in long-term catheterised patients? b) prevent infections in long-term catheterised patients? c) cause fewer complications such as strictures in long-term catheterised patients? d) cause fewer problems with flow?
PICO 2	Is there evidence that antibiotic-impregnated catheters compared with non-impregnated catheters	a) decrease symptomatic infections in short-term and long-term indwelling catheter patients?
PICO 3	Is there evidence that	over- or under inflation of the balloon causes occlusion of drainage eyes
PICO 4	Is there evidence that urinary bags	a) that are reused increase the risk of symptomatic UTI? b) that are unsterile increase the risk of symptomatic UTI? c) need a special change interval to influence symptomatic UTI? d) that are disconnected from the catheter have an influence on symptomatic UTI? e) that are connected to a bed drainage bag have an advantageous effect on symptomatic UTI?
PICO 5	Is there evidence that catheter valves compared with free drainage	a) increase the risk of symptomatic UTI? b) have any advantages?
PICO 6	What is the effect of using catheter securement devices compared with not using securement devices on	a) symptomatic UTI? b) urethral trauma? c) health-related quality of life?
PICO 7	What is the effect of using lubricating gel catheter compared with non-chlorhexidine lubrication and perhaps also silver or antibiotic lubrication	a) on patient comfort? b) symptomatic UTI?

PICO 8	What is the effect of meatal cleansing with various cleansing agents/ antiseptic products compared with water and soap	a) on symptomatic UTI?
PICO 9	What is the effect of using saline to inflate the balloon compared with 10% glycerin/glycerol	a) on water loss from the balloon?
PICO 10	What is the evidence on differences in symptomatic UTI when using the technique	a) ready to use versus catheter set? b) non-touch technique versus aseptic technique?
PICO 11	What is the effect of clamping	a) of the indwelling catheter before removal compared to free drainage on • symptomatic UTI? • spontaneous voiding? b) for bladder training or on bladder functioning?
PICO 12	What is the evidence that suprapubic balloon catheters compared with suprapubic catheters sewed on/stitched in place have advantages for	a) security? b) infections? c) comfort?
PICO 13	Is there evidence on complication rate or type in relation to the	a) change intervals of catheter, urinary drainage bag? b) profession of the person who inserted the catheter?
PICO 14	Is there evidence that cranberry capsules/juice compared with placebo	a) reduces the risk of UTI?
PICO 15	Is there evidence that excessive fluid intake compared with fluid intake of 1.5–2 l reduces	a) encrustation? b) UTI?
PICO 16	What is the effect of stop orders, protocols, reminder systems or following guidelines on	a) UTI?

Appendix T

Quality improvement projects

Overview of quality improvement projects, their objectives and the most relevant results of the projects.

Author	Project method / Study design	Aims of the project	Results
Baillie et al 2014 [231]	Retrospective cohort study	The usability and effectiveness of a computerised clinical decision support (CDS) intervention to reduce the duration of urinary tract catheterisation	Duration of catheterisation time was significant reduced and so did CAUTI
Bell et al 2016 [246]	Quality improvement project	To reduce unnecessary catheter use • Education • Mandatory prompts and reminders • Patient tracking and Urine retention protocol	Shows a reduction in indwelling catheter use but numbers don´t allow further statistically analysis
Blondal et al 2016 [235]	Prospective cohort study with a before and after design	• Aligning knowledge from doctors and nurses • Focus on inserted catheters • Catheters without indication • Days with catheter incidence of CAUTI	The study resulted in significant reduction in proportion of catheter days as well as catheters inserted without appropriate indication following short educational interventions.
Conner et al 2013 [247]	Prospective pilot study	Catheter discontinuation protocol and education to achieve this	The nurse driven protocol shows significant reduction on catheter days

Dawson et al 2017 [230]	Multimodal approach	• Reduction of CAUTI • Catheter care pathway • Houdini Checklist • Catheter magnets • Bladder ultrasound scanner	During the process a lot of discussion on clearing of questions were necessary. In the conclusion they mention two significant challenges to reduce CAUTI: Staff engagement and accountability
Dols et al 2016 [233]	Pilot Study	To reduce CAUTIs in intensive and transplantation care an CAUTI Education Fair was developed and a catheter protocol for insertion and maintenance was used	CAUTIs are reduced in the pilot, but information about significance is missing.
Fakih et al 2013 [248]	National programme	To reduce CAUTI	An ongoing project but barriers and solution when implementing CAUTI prevention are well explained.
Galiczewski et al 2017 [249]	Quasi experimental Study	To improve the CAUTI rate in a MICU due to observation in catheter insertion procedure	The study shows no changes in utilisation rates, CAUTIs are reduced but not significantly.
Jansen et al 2017 [250]	Components of care / Bundle for UTI Education and awareness campaign	To reduce the inappropriate use of IUCs	
Major-Joynes et al 2016 [251]	Nurse driven protocol for removal of indwelling catheters	• Create online education materials • Standard protocol • Create clinician awareness IUC order set clean up	No significant chance in IUC utilisation 19% reduction in CAUTI rate per 1000 days.

Marigliano et al 2012 [236]	Pre and post test	Knowledge and correct management on catheterised patients and a course for nurses and doctors	Statistically significant improvement in knowledge of catheterisation practice after an active educational intervention.
Meddings et al 2014 [229]	Systematic review	A broad systematic review of strategies to decrease UTI, CAUTI, and urinary catheter use that are anticipated to be helpful in the nursing home setting	While many studies reported decreased UTI, CAUTI, or urinary catheter use measures, few demonstrated statistically significant reductions perhaps because many were under-powered to assess statistical significance. Pooled analyses were not feasible to provide the expected impact of these inter-ventions in the nursing home setting.
Mody et al 2015 [252]	National initiative to prevent CAUTI	STOP CAUTI bundle with emphasis on professional development in catheter utilisation, catheter care and maintenance, and antimicrobial stewardship as well as promoting a patient safety culture, team building, and leadership engagement.	The effectiveness is evaluated by changes in CAUTI rates, catheter utilisation and improvement in staff knowledge. No results are shown in this article.

Mulcare et al 2015 [234]	Multiphase approach and a quasi experimental study design	Protocol for placement and management IUC in older adults in the emergency department	In a 6-month study period there was a reduction in the use of IUC and reduction on CAUTI. 81% of participants felt that the protocol has changed their practice.
Naik et al 2016 [253]	Algorithm	Fast and frugal algorithm to strengthen diagnosis and treatment decisions for catheter-associated bacteriuria	A fast and frugal algorithm improves diagnosis and treatment accuracy for CAUTI and reduces inappropriate treatment of -asymptomatic bacteria.
Nealon et al 2018 [232]	Pilot study	Patient Urinary Catheter Extraction (PURCE) Protocol After 48 hours with IC the urinary bag was marked with a yellow tag	Following the PURCE Protocol reduced CAUTI rate.

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17. About the authors

Veronika Geng (DE)

Registered Nurse, Infection Control Practitioner, Coach for Quality in Health Care, MSc in health science specialisation in nursing.

Veronika Geng currently works as a head of an advice centre for people with spinal cord injury especially for bowel and bladder problems for the Manfred Sauer Foundation in Lobbach, Germany. She has performed clinical studies on the incidence of hospital-acquired UTIs. Veronika previously contributed, as a panel member, to guidelines on male external catheters and also produced instructional videotapes on the topics Male external catheter and intermittent catheterisation.

Special interests: nutrition, bladder and bowel management in people with spinal cord injury.

Hanneke Lurvink (NL)

Hanneke Lurvink has worked for the European Association of Urology since 2006. She was appointed coordinator for all European Association of Urology Nurses (EAUN) activities in 2006. She has assisted the EAUN Working Groups for all eight EAUN Guidelines since 2007 with editorial work, finding the right illustrations, copyright, literature search, data extraction and retrieving full-text papers, contributing to the design of flowcharts, and playing an important role in the planning and keeping of deadlines. She is a member of the Guidelines International Network.

Ian Pearce (UK)

Ian has been a Consultant Urological Surgeon at Manchester Royal Infirmary, UK, since 2002 having trained in Nottingham, Stoke and Greater Manchester.

He is currently the Vice President and Honorary Secretary of the British Association of Urological Surgeons (BAUS).

Special interests: bladder dysfunction and andrology

Susanne Vahr Lauridsen (DK)

Susanne Vahr Lauridsen is a Clinical RN and Senior Researcher, working at the Surgical Department, Herlev-Gentofte, Copenhagen University Hospitals and at WHO-CC, the Parker Institute, Bispebjerg and Frederiksberg Hospitals, Copenhagen University Hospital, Denmark. She has a Master in HRD/Adult Learning and a PhD.
She has worked in the field of urology since 1992.
Susanne is doing research in clinical health promotion with special focus on modifiable lifestyle factors Smoking – Nutrition – Alcohol – Physical inactivity (SNAP) and prevention of catheter-associated UTIs and trauma to the urinary tract.

Susanne is a member of the Danish Association of Urology Nurses and of the Danish Nurses Research Council.

Special interests: The patient perspective in order to improve outcomes and implementation of current guidelines.

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If you have questions or comments regarding this publication,
please contact: EAUN Central Office
P.O. Box 30016
6803 AA Arnhem -The Netherlands E-mail: eaun@uroweb.org

You can also visit the EAUN website: www.eaun.org

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European Association of
Urology Nurses

PO Box 30016
6803 AA Arnhem
The Netherlands

T +31 (0)26 389 0680

eaun@uroweb.org
www.eaun.org