REVIEW ARTICLE

Interventional Radiology and Urology in Suprapubic Catheterization: Bridging Expertise and Practice

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ABSTRACT

Suprapubic catheterization (SPC) is a commonly undertaken procedure allowing direct access to the bladder with drainage. This is preferable when urethral catheterization is not feasible. IR or Urology can perform an SPC, with either specialty increasingly being approached to consider the procedure. The review will assess the expertise, procedural ease, and associated clinical outcomes with SPC insertion performed by either specialty. An extensive literature review was carried out using databases such as PubMed, Scopus, Web of Science, and Google Scholar. Search terms included "suprapubic catheterization," "urology," "interventional radiology," and "clinical outcomes." IR-related success rates have been reported as being 99.6% under image guidance. Complication rates of approximately 7.2% have been recorded. In contrast, urologists use blind or cystoscopic-guided techniques, and they report a 10% intraoperative complication rate, including a 2.4% risk of bowel injury, along with a 19% overall complication rate within 30 days post-procedure.

IR excels in image-guided techniques, particularly for patients with complex anatomical challenges, whereas urologists are more proficient in cases requiring surgical expertise and cystoscopic guidance. The key outcome is the safety of the procedure under respective specialties, and the ability to demonstrate comparable safety profiles when adhering to established protocols and to maintain and enhance patient outcomes. Both interventional radiologists and urologists bring their unique strengths to SPC. Patient-specific factors and defined clinical scenarios will dictate which specialty to approach for the insertion. Ultimately, the need to improve patient care requires fostering relationships between each specialty and enhanced interdisciplinary collaboration.

Keywords: *Suprapubic catheterization, interventional radiology, urology, procedural techniques, clinical outcomes.*

INTRODUCTION

In the absence of the ability to undertake safe urethral catheterization, Suprapubic Catheterization (SPC) becomes an essential alternative procedure, which is undertaken by both urology and interventional radiology to facilitate direct access and drainage of the bladder. SPC aims to establish a transabdominal route into the bladder. The advantages of SPC are a reduction in the injury profile to the urethra, a reduction in infection risk, and improved patient comfort in the long term with a reduced chance of catheter disruption [1]. Since its inception in the early 20th century, there have been continuous advancements in surgical techniques, with improved imaging technology, and catheter materials used such that SPC has become an established and reliable method for managing complex urinary conditions [2, 3].

SPC is commonly indicated for cases such as urethral strictures, neurogenic bladder disorders, urethral injuries, and urinary retention. Initially conducted through open surgery, SPC techniques have evolved with the advent of minimally invasive methods **(Table 1)**. Presently, interventional radiologists typically employ ultrasound or fluoroscopic guidance, while urologists often use direct cystoscopic visualization, enhancing procedural

Table 1: A comparison of urethral and suprapubic catheterization [16-18].

Aspect	Urethral Catheterization	Suprapubic Catheterization
Complications	Urethral trauma, strictures, discomfort, higher infection rates	Lower risk of urethral complications, potential for abdominal wall infection
Indications	Short-term drainage, postoperative management	Long-term drainage, urethral injury or obstruction, patient preference
Short-term Outcomes	Effective for temporary needs, but higher discomfort and infection risk	More comfortable for long-term use, lower risk of certain infections
Long-term Outcomes	Increased risk of urethral damage and strictures	Better suited for long-term use with fewer urethral complications
Antibiotic Use	May require antibiotics due to higher infection rates	Lower infection rates may reduce antibiotic necessity
Catheter Size	Typically, 14-16 French	Similar sizes used, but choice depends on patient-specific factors
Procedure Time	Generally quicker and less invasive	Slightly longer due to surgical nature
Other Considerations	May interfere with sexual activity, risk of urethral erosion with prolonged use	Preserves sexual function, requires surgical insertion and maintenance

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Received: December 19, 2024; Revised: February 25, 2025; Accepted: March 03, 2025
DOI: https://doi.org/10.37184/nrjp.3007-5181.1.21

 ISSN: 3007-519X (Online)

safety and optimizing recovery, especially in patients with challenging anatomy or multiple comorbidities [4].

Despite its widespread use, the question remains: Which specialty is best suited to perform SPC? Urologists, with their expertise in urinary tract anatomy and pathology, have historically led the procedure. However, interventional radiologists have increasingly adopted SPC, leveraging their imaging-guided skills to achieve high success rates in challenging cases [5, 6].

This review examines the roles of both specialties, comparing their approaches in terms of safety, efficacy, indications, contraindications, and clinical outcomes. Additionally, we explore the broader implications for healthcare systems, including training, resource allocation, and cost-effectiveness. As SPC remains a key procedure in urological care, clearly defining the roles of the specialists involved is essential. Bridging practice gaps and promoting interdisciplinary collaboration can significantly enhance patient outcomes and care delivery. This review underscores the importance of a multidisciplinary approach in modern medicine and highlights the need for evidence-based guidelines to support clinical decision-making in SPC [7, 8].

MATERIALS AND METHODS

A systematic search was conducted across PubMed, Scopus, Web of Science, and Google Scholar, using combinations of keywords such as "suprapubic catheterization," "urology," "interventional radiology," "procedure outcomes," and "SPC guidelines." Articles were included based on their relevance to the technical, clinical, and professional dimensions of SPC. Guidelines from key organizations—BSIR, SIR, CIRSE, BSUR, BAUS, NICE, and NHS—were reviewed to integrate the latest evidence-based practices.

DISCUSSION

In circumstances in which urethral catheterization is not a viable option, suprapubic catheterization (SPC) is a necessary intervention. The key to ensuring optimal safety for the patient is in the understanding of anatomical knowledge, physiology, and reasons for and against each procedure and ultimately the patient-specific needs and technical nuances [9, 10]. The procedure takes advantage of the bladder's anatomical positioning to establish a direct and minimally invasive pathway for catheter placement.

The bladder, a flexible pelvic organ, stores urine until voiding. Its base lies between the internal urethral and ureteral openings, with its apex extending toward the umbilicus when distended [9]. During SPC, sterile fluid is used to distend the bladder, elevating it above surrounding structures and enabling safe catheter insertion [10]. Anatomical landmarks such as the rectum or uterus posteriorly, the peritoneum superiorly, the pubic symphysis anteriorly, and lateral vascular structures guide the procedure and help reduce complications [11]. Compared to transurethral catheterization, SPC offers a more direct route for urinary drainage, utilizing gravity for continuous urine flow while reducing complications and enhancing patient comfort, making it suitable for long-term use [12].

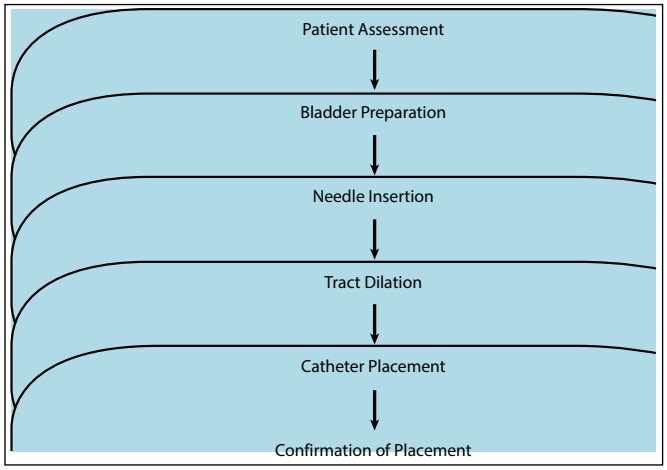

Fig. (1): Outlines the procedural steps for SPC. It begins with patient assessment and bladder preparation, followed by needle insertion, tract dilation, catheter placement, and confirmation of placement.

The route through the abdominal wall involves penetrating the skin, subcutaneous fat, rectus abdominis muscle, fascia, and the bladder wall. Careful manipulation and consideration of the proposed trajectory are needed to ensure a technique that minimizes bleeding and hematoma formation along the rectus abdominis and its fascia support **(Fig. 1)**. Body habitus dictates tissue thickness. Bladder wall thickness and the degree of associated bladder wall thickening such as trabeculation will determine the ease of puncture of the detrusor muscle. Accurate puncture ensures safe access to the bladder lumen while protecting surrounding structures [13]. SPC can be performed using open, percutaneous, or hybrid techniques [14].

In the open cystotomy approach, a small transverse incision is made approximately two fingerbreadths above the pubic symphysis, ideally after bladder distension for better identification. The rectus fascia is opened to access the preperitoneal space. Once the bladder is located, dissolvable stay sutures are placed around the planned cystotomy site. A small incision is made in the bladder, allowing catheter insertion, which is then secured using a purse-string suture. The skin and fascial layers are closed, and a temporary suture is used to secure the catheter externally [14].

The percutaneous Seldinger technique is a widely used minimally invasive alternative. It requires bladder distension, achieved either physiologically (*e.g.,* urinary retention) or *via* a cystoscope, which also allows direct visualization of the puncture needle. A large-bore needle is inserted approximately two fingerbreadths above the pubic symphysis until urine returns. If necessary, sterile saline or contrast can be added for better visualization. A guidewire (typically 0.035-inch) is introduced through an 18-gauge or larger needle, and the tract is mechanically dilated using dilators or balloon dilators to accommodate a pull-away sheath. After inflating the catheter balloon, the access sheath is removed, securing the suprapubic catheter in place.

Cystoscopic confirmation of placement is recommended when possible. A modified open technique utilizing the Lowsley prostatic retractor can facilitate SPC when urethral access is available [14]. This device is introduced into the bladder *via* the urethra, and upward pressure brings the bladder dome closer to the abdominal wall. In most patients, the tip of the retractor can be palpated through the lower abdominal skin, except in cases of extreme obesity. A suprapubic incision exposes the retractor tip, allowing a urinary catheter to be attached and guided into the bladder. Once the suprapubic tube's balloon is inflated, the retractor releases the catheter, ensuring secure placement. In some cases, the balloon may inflate just outside the bladder while the catheter tip remains inside, necessitating cystoscopic confirmation for proper alignment.

The percutaneous approach to suprapubic catheterization (SPC), often performed by interventional radiologists, is valued for its minimally invasive technique. This reduces the need for theatre time and the wider resources associated with surgical intervention and ultimately leads to reduced recovery times and reduced overall financial costs. Conversely, the open approach, typically undertaken by urologists, will involve longer planning times, more anesthetic staff, theatre booking, and longer post-procedural recovery times. Either technique is comparable and effective, but the percutaneous approach is considered more cost-efficient, especially in outpatient settings [13, 14].

Specialist procedural kits are available for IR, including trocar kits, allowing for safer direct bladder puncture, and overall reduced risk profile to the patient, given the Seldinger technique involved with such kits. The percutaneous method remains the most widely used, with various specialized kits available [14].

Successful SPC relies on adequate bladder distension, which displaces the bowel and peritoneum to create a clear surgical field. However, conditions such as bladder fibrosis, reduced bladder capacity, or previous abdominal surgeries can limit distension and necessitate imaging guidance, like ultrasound or fluoroscopy, for precise catheter placement [15].

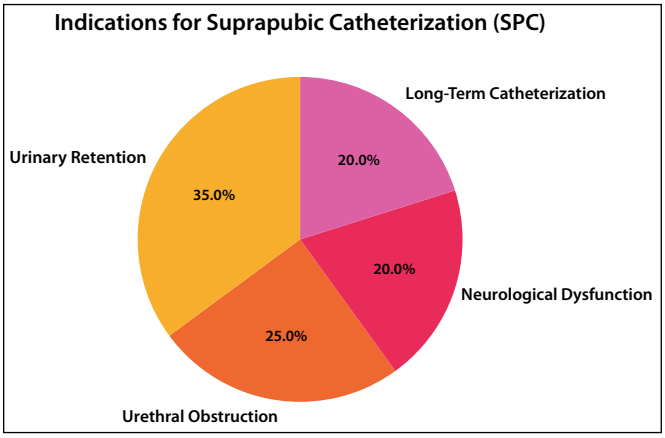

Fig. (2): Illustrates the proportions of clinical indications for SPC. The most common indication is urinary retention (35%), followed by urethral obstruction (25%), neurological bladder dysfunction (20%), and long-term catheterization needs (20%).

Open SPC is generally performed under general or spinal anesthesia to maximize patient comfort and provide optimal surgical conditions, while the percutaneous approach often uses local anesthesia with sedation, offering a less invasive alternative with quicker recovery, particularly for high-risk patients with comorbidities [15].

SPC is indicated in various clinical scenarios **(Fig. 2)**, including acute or chronic urinary retention when urethral catheterization is not possible due to trauma or anatomical blockage. It is preferred for long-term catheterization due to its benefits in patient comfort and reduced risk of urethral injury and infection. Additional indications include urethral obstruction, neurogenic bladder dysfunction, and perioperative urinary management, highlighting its broad clinical utility [16].

Studies show that interventional radiologists achieve high technical success rates of up to 99.6% using imaging guidance, such as ultrasound and fluoroscopy, with lower rates of major complications like bowel injury and hemorrhage. In contrast, urologists, who frequently employ blind or cystoscopic-guided techniques, report slightly higher complication rates, such as a 10% intraoperative complication rate, including a 2.4% risk of bowel injury. However, urologists demonstrate superior management of concurrent urological conditions, such as bladder stones or tumors, during the same procedure. Both approaches exhibit unique advantages, with interventional radiologists excelling in

minimally invasive methods for patients with complex anatomy and high surgical risks, while urologists offer comprehensive care in cases requiring surgical expertise [16].

Despite its advantages, SPC has absolute contraindications, including uncorrected coagulopathy, active infections at the insertion site, and anterior bladder wall malignancy. Relative contraindications—such as previous abdominal or pelvic surgeries, a collapsed bladder, or small bladder capacity—necessitate individualized procedural approaches [17]. Complications include bleeding, infection, and injury to adjacent organs. The most significant risks are related to catheter misplacement and potentially to catheter misplacement. This holds in patients with altered anatomy or insufficient bladder filling. Image guidance in such patients, with previous surgical intervention to the bladder or those with altered anatomy, makes for a safe procedure but requires enhanced technical knowledge [18].

Urologists *vs.* Interventional Radiologists in SPC

Urologists and interventional radiologists each bring their expertise, approaches, and techniques to suprapubic catheterization (SPC), and this involves leveraging their skills to allow for successful outcomes.

After-effect	Risk
Mild burning or bleeding when you pass urine, lasting for a few days	Almost all patients
Recurrent urinary infection requiring antibiotics	Between 1 in 2 & 1 in 10 patients
Blocking of your catheter by debris or blood clots requiring irrigation and unblocking	Between 1 in 2 & 1 in 10 patients
Bladder spasms or bladder pain	Between 1 in 2 & 1 in 10 patients
Persistent leakage from your urethra which may need a further procedure to treat it	Around 1 in 10 patients (10%)
Development of stones in your bladder, causing catheter blockage, and requiring a further procedure to remove or crush them	Between 1 in 10 & 1 in 50 patients
Inadvertent damage to adjacent structures (*e.g.* bowel, blood vessels) requiring further surgery	Between 1 in 50 & 1 in 250 patients
Anaesthetic or cardiovascular problems possibly requiring intensive care (including chest infection, pulmonary embolus, stroke, deep vein thrombosis, heart attack and death)	Between 1 in 50 & 1 in 250 patients (your anaesthetist can estimate your individual risk)

Fig. (3): Explains the after-effects possibility of the most frequent complications of SPC suggested by the British Associations of Urological Surgeons [29]. This figure is adopted from the British Association of Urological Surgeons.

Urologists, with extensive knowledge of urinary tract anatomy and pathology, often utilize cystoscopic guidance for direct visualization, and this in turn ensures precise catheter placement. The cystoscopic approach allows synchronous treatment and diagnosis of other conditions such as bladder lesions and stones. Direct visualization allows their surgical expertise to best manage complications like bleeding or indeed bladder perforation.

In contrast, interventional radiologists, perform procedures under image guidance and this allows for shorter intervention times requiring the need for ultrasound and/or fluoroscopy creating real-time visualization of the bladder and adjacent structures **(Fig. 3)**. Advantages of this approach include the reduced risk profile and enhanced safety afforded to patients, especially those with complex anatomy, previous surgeries, and those with elevated surgical or anesthetic risks, given the reduced tissue trauma and accelerated recovery [19].

Although urologists integrate SPC with other urological procedures, interventional radiologists are preferred for cases requiring precise imaging guidance, particularly in challenging anatomical settings [20, 21]. Studies highlight differing success and complication rates between specialties. One study reported a 99.6% technical success rate for image-guided SPC by interventional radiologists, with 7.2% experiencing minor complications [22]. In contrast, a study on blind SPC insertion, commonly performed by urologists, documented a 10% intraoperative complication rate, including a 2.4% risk of bowel injury and a 19% complication rate within 30 days. Among 219 patients who underwent percutaneous SPC with cystoscopic guidance, the mortality rate was 1.8% [11, 23, 24]. Fig. **(4)** presents a comparative analysis of success and complication rates between urologists and interventional radiologists [25].

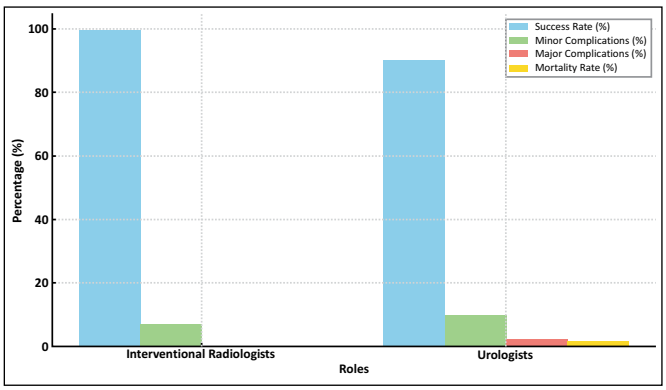

Fig. (4): Shows the performance comparison between the interventional radiologists and urologists.

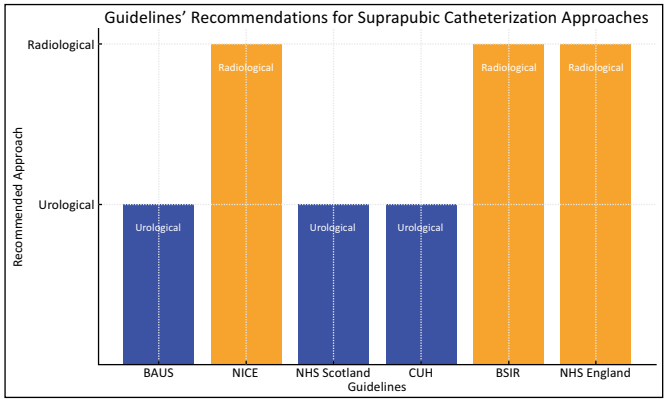

Fig. (5): Illustrates the recommended approach (urological or radiological) for suprapubic catheterization by each guideline. The y-axis represents the approach preference, while the x-axis lists the guidelines.

The British Association of Urological Surgeons (BAUS) recommends SPC for cases where urethral catheterization is contraindicated, such as urethral trauma, strictures, or post-urological surgeries. The procedure is typically performed under general or spinal anesthesia, with the bladder prefilled to aid accurate placement through a small suprapubic incision. Ultrasound guidance may be used to enhance safety. Post-insertion care includes an initial catheter change at six weeks, followed by three-monthly replacements, with patients advised to monitor for infection or blockage [18].

The National Institute for Health and Care Excellence (NICE) recommends ultrasound guidance as a standard practice to reduce complications such as bowel injury. NICE also endorses the Seldinger technique, which uses a guidewire for catheter placement, as a safer alternative to the traditional trocar method due to its lower insertion-related complication rates [26].

NHS Scotland emphasizes catheter selection and maintenance, advocating for the smallest appropriate catheter size to minimize trauma and infection risks. Regular reassessment of catheter necessity, timely removal when no longer needed, and adherence to aseptic techniques are key strategies to prevent complications [27]. Similarly, Cambridge University Hospitals (CUH) supports ultrasound guidance to improve accuracy and reduce risks, with aftercare focusing on infection monitoring and timely catheter changes [28].

The British Society of Interventional Radiology (BSIR) highlights the role of trained interventional radiologists and imaging techniques in ensuring safe SPC placement [29]. Meanwhile, NHS England provides extensive guidance on aseptic care, troubleshooting catheter issues (*e.g.,* blockages or dislodgement), and timely interventions to maintain catheter safety and efficacy [30]. Fig. **(5)** illustrates variations in guideline preferences.

SPC significantly improves healthcare outcomes by reducing urethral damage, lowering infection rates, and enhancing patient comfort, particularly for long-term catheterization [31]. Its success shortens hospital stays and reduces the need for follow-up interventions, generating cost savings for healthcare systems [32, 33]. Moreover, interdisciplinary collaboration between urologists and interventional radiologists allows tailored SPC approaches, optimizing patient outcomes through a combined expertise framework **(Fig. 6)**. This multidisciplinary approach ensures SPC remains a cornerstone of modern urological and interventional therapy [34, 35].

CONCLUSION

Suprapubic catheterization (SPC) is a crucial intervention for managing urinary retention and other urological conditions. A collaborative approach between

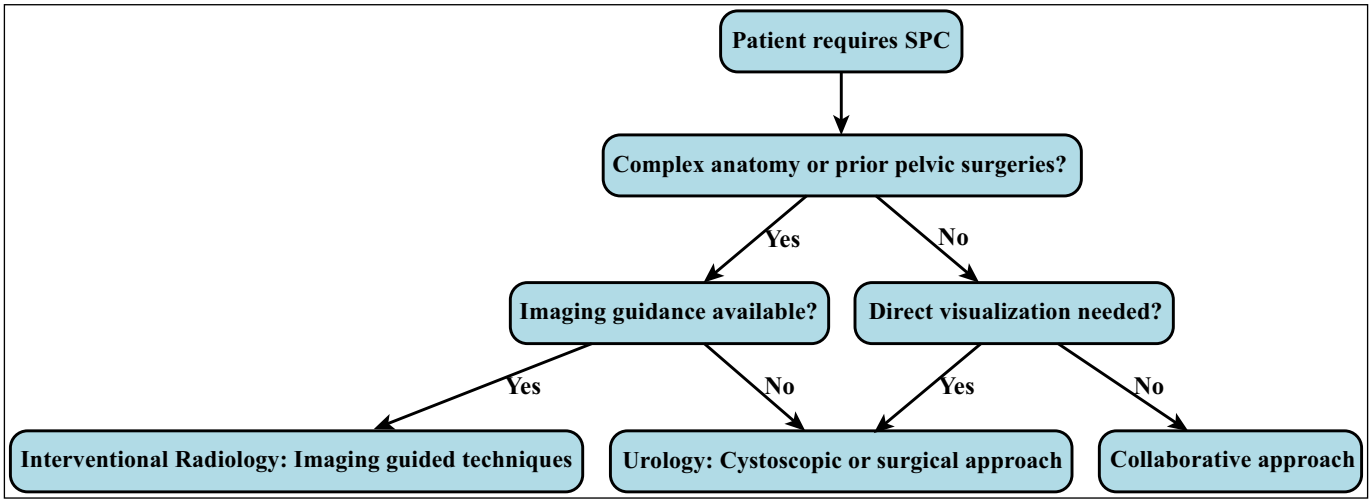

Fig. (6): Shows a simplified algorithm for decision-making in suprapubic catheterization (SPC).

urologists and interventional radiologists enhances patient care by leveraging their complementary expertise. Urologists excel in managing complex urological conditions, such as bladder stones or tumors, while interventional radiologists specialize in precise, imaging-guided, minimally invasive techniques, particularly for patients with challenging anatomy or high surgical risk. This multidisciplinary strategy ensures optimal patient outcomes, enhances safety, and reduces complications. However, further clinical trials are essential to better evaluate the effectiveness and safety of each approach.

LIST OF ABBREVIATIONS

BAUS British Association of Urological Surgeons

BSIR British Society of Interventional Radiology

BSUR British Society of Urological Radiology

CIRSE Cardiovascular and Interventional Radiological Society of Europe

CUH Cambridge University Hospitals

NICE National Institute for Health and Care Excellence

NHS National Health Service

SIR Society of Interventional Radiology

SPC Suprapubic Catheterization

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

1. McDuff HC. Suprapubic urinary drainage in gynecologic surgery. Am J Surg 1972; 123(4): 489-93. DOI: https://doi.org/10.1016/0002-9610(72)90220-0
2. Hebert DB, Mitchell GW. Perforation of the ileum as a complication of suprapubic catheterization. Obstet Gynecol 1983; 62(5): 662-4. DOI: https://doi.org/10.1097/00006250-198311000-00025
3. Peatfield R, Burt A, Smith P. Suprapubic catheterisation after spinal cord injury: A follow-up report. Paraplegia 1983; 21(4): 220-6. DOI: https://doi.org/10.1038/sc.1983.41
4. Goyal NK, Goel A, Sankhwar SN. Safe percutaneous suprapubic catheterisation. Ann R Coll Surg Engl 2012; 94(8): 597-600. DOI: https://doi.org/10.1308/003588412X13373405387060
5. Lawrentschuk N, Lee D, Marriott P, Russell JM. Suprapubic stab cystostomy: A safer technique. Urology 2003; 62(5): 932-4. DOI: https://doi.org/10.1016/j.urology.2003.06.005
6. Karsh L, Egerdie R, Albala D, Flynn B. The transurethral suprapubic endo-cystostomy (T-SPeC): A novel suprapubic catheter insertion device. J Endourol 2013; 27(7): 880-5. DOI: https://doi.org/10.1089/end.2012.0631
7. Johnson CD. Suprapubic catheterization at laparotomy. Dig Surg 2006; 23(6): 281-2. DOI: https://doi.org/10.1159/000096364
8. Mohammed A, Khan A, Shergill I, Gujral S. A new model for suprapubic catheterization: The MediPlus Seldinger suprapubic catheter. Expert Rev Med Devices 2008; 5(6): 705-7. DOI: https://doi.org/10.1586/17434440.5.6.705
9. Corder CJ, LaGrange CA. Suprapubic bladder catheterization. Treasure Island (FL): StatPearls Publishing 2020.
10. Lobel RW, Sand PK. Incisional hernia after suprapubic catheterization. Obstet Gynecol 1997; 89: 844-6. DOI: https://doi.org/10.1016/S0029-7844(97)00088-0
11. Robinson J. Suprapubic catheterization: Challenges in changing catheters. Br J Community Nurs 2005; 10(10): 461-4. DOI: https://doi.org/10.12968/bjcn.2005.10.10.19612
12. Yates A. The risks and benefits of suprapubic catheters. Nurs Times 2016; 112(6-7): 19-22. DOI: https://doi.org/10.7748/ns.2016.e10375
13. Branagan G, Moran B. Published evidence favors the use of suprapubic catheters in pelvic colorectal surgery. Dis Colon Rectum 2002; 45(8): 1104-8. DOI: https://doi.org/10.1007/s10350-004-6360-1
14. Healy EF, Walsh CA, Cotter AM, Walsh SR. Suprapubic compared with transurethral bladder catheterization for gynecologic surgery: A systematic review and meta-analysis. Obstet Gynecol 2012; 120(3): 678-87. DOI: https://doi.org/10.1097/AOG.0b013e3182657f0d
15. Sheriff MK, Foley S, McFarlane J, Nauth-Misir R, Craggs M, Shah PJ. Long-term suprapubic catheterisation: Clinical outcome and satisfaction survey. Spinal Cord 1998; 36(3): 171-6. DOI: https://doi.org/10.1038/sj.sc.3100560
16. Ghaffary C, Yohannes A, Villanueva C, Leslie SW. A practical approach to difficult urinary catheterizations. Curr Urol Rep 2013; 14(6): 565-79. DOI: https://doi.org/10.1007/s11934-013-0367-0
17. Mond DJ, Lee WJ. Fluoroscopically guided suprapubic cystostomy in complex urologic cases. J Vasc Interv Radiol 1994; 5(6): 911-4. DOI: https://doi.org/10.1016/S1051-0443(94)71420-0
18. Jane Hall S, Harrison S, Harding C, Reid S, Parkinson R. British Association of Urological Surgeons suprapubic catheter practice guidelines—revised. BJU Int 2020; 126(4): 416-22. DOI: https://doi.org/10.1111/bju.15123
19. Aguilera P, Choi T, Durham B. Ultrasound-guided suprapubic cystostomy catheter placement in the emergency department. J Emerg Med 2004; 26(3): 319-21. DOI: https://doi.org/10.1016/j.jemermed.2003.11.021
20. Lamont T, Harrison S, Panesar S, Surkitt-Parr M. Safer insertion of suprapubic catheters: Summary of a safety report from the National Patient Safety Agency. BMJ 2011; 342: d924. DOI: https://doi.org/10.1136/bmj.d924
21. Breul J, Block T, Breidenbach H, Hartung R. Implantation metastasis after a suprapubic catheter in a case of bladder

cancer. Eur Urol 1992; 22(1): 86-8.
DOI: https://doi.org/10.1159/000474729

22. Sethia K, Selkon J, Berry A, Turner C, Kettlewell M, Gough M. Prospective randomized controlled trial of urethral *versus* suprapubic catheterization. Br J Surg 1987; 74(7): 731-3.
DOI: https://doi.org/10.1002/bjs.1800740731

23. Harke N, Godes M, Habibzada J, Urbanova K, Wagner C, Zecha H, *et al.* Postoperative patient comfort in suprapubic drainage *versus* transurethral catheterization following robot-assisted radical prostatectomy: A prospective randomized clinical trial. World J Urol 2017; 35: 389-94.
DOI: https://doi.org/10.1007/s00345-016-1880-0

24. Randhawa H, Wang Y, Hoogenes J, Uy M, Shayegan B, Kapoor A, *et al.* Development and initial validation of a cost-effective, re-usable, ultrasound-compatible suprapubic catheter insertion training simulator. Can Urol Assoc J 2021; 16(2): 63.
DOI: https://doi.org/10.5489/cuaj.7230

25. Macdiarmid S, Arnold E, Palmer N, Anthony A. Management of spinal cord injured patients by indwelling suprapubic catheterization. J Urol 1995; 154(2 Pt 1): 492-4.
DOI: https://doi.org/10.1016/S0022-5347(01)67082-0

26. National Institute for Health and Care Excellence (NICE). S-Cath System for suprapubic catheterisation. Medtech innovation briefing [MIB68]. 2016; Available at: https://www.nice.org.uk/advice/mib68

27. NHS Scotland. Urinary catheterisation for adults: clinical guideline. 2022; Available at: https://rightdecisions.scot.nhs.uk/media/2210/urinary-catheterisation-adultsfinal.pdf

28. Cambridge University Hospitals NHS Foundation Trust. Suprapubic catheter insertion. Patient Information Leaflet. Available at: https://www.cuh.nhs.uk/patient-information/suprapubic-catheter-insertion/

29. British Society of Interventional Radiology (BSIR). Provision of interventional radiology services, 2nd Ed. 2019; Available at: https://www.bsir.org/media/resources/provision-interventional-radiology-services-second-ed2019_klzYwZt.pdf

30. National Health Service (NHS). Types of urinary catheters. 2023. Available at: https://www.nhs.uk/conditions/urinary-catheters/types/

31. O'Kelly T, Mathew A, Ross S, Munro A. Optimum method for urinary drainage in major abdominal surgery: A prospective randomized trial of suprapubic *versus* urethral catheterization. Br J Surg 1995; 82(10): 1367-8.
DOI: https://doi.org/10.1002/bjs.1800821023

32. Li MX, Cheng P, Yao L, Li HJ, Xun YQ, Yan PJ, Yang KH. Suprapubic tube compared with urethral catheter drainage after robot-assisted radical prostatectomy: A systematic review and meta-analysis. Asian J Surg 2019; 42(1): 71-80.
DOI: https://doi.org/10.1016/j.asjsur.2018.06.002

33. Robinson J. Clinical skills: How to remove and change a suprapubic catheter. Br J Nurs 2005; 14(1): 30-5.
DOI: https://doi.org/10.12968/bjon.2005.14.1.17345

34. Hunter K, Bharmal A, Moore K. Long-term bladder drainage: Suprapubic catheter *versus* other methods: A scoping review. Neurourol Urodyn 2013; 32.
DOI: https://doi.org/10.1002/nau.22356

35. Liang T, Lazare D, Schulz J, Flood C. A rare complication of suprapubic catheterisation following pelvic reconstructive surgery for urinary incontinence. Case Reports 2012; 2012: bcr0220125758.
DOI: https://doi.org/10.1136/bcr.02.2012.5758