

Update on voiding dysfunction managed with suprapubic catheterization

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Abstract: As the population ages the prevalence of long-term urinary catheters, especially in the elderly, is going to increase. Urinary catheters are usually placed to manage urinary retention or incontinence that cannot be managed any other way. There is significant morbidity associated with an indwelling catheter. The commonest problems are catheter blockages, infection and bladder stones. These will occur with a similar incidence with either a suprapubic or a urethral catheter. Urethral complications such as strictures, scrotal infection and erosion are less common with suprapubic catheterization (SPC). However the benefit of having a SPC needs to be balanced against the risks involved in inserting the catheter suprapubically. Patient reported symptoms show that a SPC is more comfortable and better tolerated than a urethral catheter. However there needs to be more research into developing better catheters that reduce the frequency of urinary infections and blockages and hence catheter morbidity.

Keywords: Long-term catheterization; bladder stones; voiding dysfunction; suprapubic catheter

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Introduction

Voiding dysfunction is a descriptive term that refers to both the storage and emptying phases of the lower urinary tract (1). This can result in a wide variety of lower urinary tract symptoms including frequency, urgency, urge incontinence, poor stream and difficulty emptying the bladder. Difficulty emptying the bladder causing a large residual volume may necessitate insertion of a urinary catheter. In some cases this may need to be a permanent option if there is detrusor failure or if the patient is not fit for surgical management. Intermittent catheterization should also be considered.

Voiding dysfunction resulting in the need for a permanent urinary catheter is a decision that should be made once all treatment options have been considered. In the frail elderly, the need for a catheter may also be considered for incontinence and pressure sore management.

Prevalence of long-term catheterization

The prevalence of long-term catheterization has increased

with time. A similar area in England was surveyed in 1989 and again in 2008. During that time the prevalence increased from 0.07% of the population to 0.14% of the population (2,3). The increase in the elderly population is likely to be the cause of this increasing prevalence as the incidence increases with age (0.732% in over 70 years, 1.224% over 80) especially amongst men (2). Women were more likely to have a suprapubic catheter and have a neurological cause for their need to be catheterized (2).

Suprapubic versus Urethral catheter

Usually a urethral catheter is the first choice when external bladder drainage is decided to be necessary. Once it has been decided that the catheter will be in place long-term, a decision should be made as to whether the patient's urinary tract would be better managed with a suprapubic catheter (SPC) than a urethral catheter. This decision should take into account patient factors such as frailty, fitness for a surgical procedure and likely length of catheterization. The patient should be involved in the decision if they are able.

All catheters, be they placed urethrally or suprapubically are associated with a significant incidence of urinary tract infections and bladder stones. A number of studies have compared the incidence of urinary tract infections between the two catheter types and there appears to be no difference in both long term and short term use of catheters (4). Amongst spinal injured patients, 93–98% had a symptomatic urinary tract infection during more than 11 years of follow-up (5).

Bladder calculi rates have only been compared in neuropathic patients showing the incidence is the same in both methods of bladder drainage (6,7). In an elderly population presenting with catheter blockages, 45% had bladder stones (8). This suggests that it is the presence of the catheter and the resultant bacteria and high urinary pH that occur, which are the causes of the bladder calculi (3,4).

Suprapubic catheterization does confer an advantage with regards to less urethral complications. The incidence of urethral strictures and epididymitis in males is lower with suprapubic catheterization (5,7). In men with a urethral catheter, penile urethral erosion in poorly mobile elderly men has been reported. Direct pressure of the catheter due to improper securement of the catheter was the proposed cause (9). These complications are avoided by suprapubic catheter placement.

In females a patulous urethra may occur if a urethral catheter is left in long term. This can occur in both neurogenic and non-neurogenic females. The urethra loses tone over a number of years allowing the urethral catheter to fall out with the balloon intact. This may also be a result of trauma from the catheter balloon on the bladder neck resulting in a urethral erosion. This is more typically seen in neuropathic patients. Unfortunately the urethra does not recover with removal of the catheter. Incontinence will occur when a suprapubic catheter is inserted and this requires some form of repair of the bladder neck, either complete closure if there is a severe erosion or a pubovaginal sling which will still allow urethral access (10,11).

Patients prefer a suprapubic catheter to urethral catheter. In two quantitative studies patients discussed their wish to have more information before making the decision to have a suprapubic catheter inserted (12,13). When patients were followed up by a telephone call and outpatient review, 89% that had a previous urethral catheter preferred the SPC. Patients found that it was more comfortable and the catheter was easier to manage. Changes were not as painful (14). Having the catheter

coming through the abdomen rather than the urethra does allow the resumption of sexual activity in some patients.

The option of replacing a urethral catheter with a suprapubic catheter should be considered when the decision is made that the patient will have long term drainage of their bladder by catheterization. Long-term complications of a urethral catheter will be avoided if the catheterization method is changed earlier.

However there are some patients that are not suitable for a SPC. If a patient has had a history of bladder cancer, especially transitional cell carcinoma of the bladder, there may be seeding along the SPC tract so suprapubic catheterization should be avoided. In obese patients, there may be difficulty at the initial insertion of the suprapubic catheter. Due to the depth of the bladder from the skin there may need to be an incision made down to rectus fascia to allow easier placement. Thought needs to be given as to the ideal placement of the catheter so it is not kinked if the catheter is caught in the folds of the abdominal skin.

Complications of suprapubic catheters

However suprapubic catheters are not without their own problems. Insertion of a suprapubic catheter is usually done using a trocar system. This may be done using cystoscopic or ultrasound guidance. Intraoperative complications of suprapubic catheter insertion is higher in patients with a neuropathic bladder than those with insertion for bladder outlet obstruction (BOO) (14). This may be because the bladder is harder to fill in the neuropathic group. There is a small risk of small bowel injury due to adhesions or failure of the filled bladder to adequately push away small bowel loops. Bowel injuries occurred in 2.4% of patients (14). Mortality rate has been reported in a study of 232 patients at 1.8% (14). These are often frail elderly patients that are having the catheter inserted usually under general anaesthetic or local anaesthetic and sedation, so the risks need to be considered compared with continuing with urethral drainage.

A greenish discharge commonly occurs around the site of the SPC. Swabs of this region may grow *Staph aureus*. These do not specifically need treating unless there is evidence of cellulitis. Wiping daily with Betadine will reduce the incidence of *Staph aureus* infection.

Overgranulation may occur around the SPC tract. This may cause bleeding and discomfort at the time of SPC changes. Granulation tissue can be removed by applying silver nitrate sticks to the area. Generally patients do not find

this painful if care is taken to avoid contact with the skin. Treatment with a low dose hydrocortisone cream may also reduce redness and granulation tissue around the SPC tract.

There can also be problems with changes of suprapubic catheters. Generally changing a SPC is easier and less uncomfortable for the patient. However if the catheter inadvertently falls out, it may not be possible to reinsert the catheter down the same tract especially if some time has elapsed before this is performed. The patient may then have to undergo a further suprapubic catheter insertion under anaesthetic.

There is a report of a balloon being inflated in the urethra causing trauma and haematuria with resultant hospitalization (15). Though this case occurred in a spinal cord injury patient without sensation, it would be possible in demented elderly patients as well. Care needs to be taken that the catheter is not inserted in too far and filling the bladder with a small amount of fluid prior to catheter removal, may help to check if the catheter is in the correct position. Some patients may develop hypersensitivity around the SPC insertion site especially in neuropathic patients. Resiting the catheter may relieve this in some patients.

Management of long term catheters

Type of catheter

The ideal material for catheter composition has been debated. Catheters commonly in use are silicone coated latex catheter with or without a lubricated coating and a pure silicone catheter. The latter tend to have a more rigid balloon material than the silicone coated catheter, making them more painful to change. Antimicrobial catheters have been developed to prevent the formation of biofilm and bacteriuria. A Cochrane review from 2012 did not show any evidence for one type of catheter over another. In the same year, a large randomised controlled study of antimicrobial catheters including silver alloy and nitrofurazone releasing catheter showed no decrease in symptomatic catheter associated urinary tract infections (16). Studies looking at use and complications of different catheter materials have shown that patient discomfort is greater with nitrofurazone coated catheters (17).

Change of catheter

A Cochrane review has been undertaken to look at options

for the ideal management of long term catheters. Cooper *et al.* in 2016 reported on research to assess if the timing and method of changing the catheter affected the incidence of complications from the catheter. They could not find any difference between changing the catheter regularly or waiting until it is clinically indicated. Cleaning the insertion site with chlorhexidine or saline solution did not alter the incidence of catheter associated urinary tract infections (CAUTI). The use of antibiotics at the time of catheter change did not change the incidence of infection associated with the change (18). The use of antibiotics at the time of catheter change is therefore not recommended even in patients with artificial implants.

Catheter drainage method

CAUTI prevention includes maintenance of a sterile closed uninterrupted drainage system (16). This is usually done by connecting a catheter to a leg bag and at night attaching a larger night bag to the bottom of the leg bag. The timing of catheter bag changes has been poorly researched. One study looking at daily versus every 3 day changes, shows no difference between groups in CAUTI rates (19). Instillation of antiseptic solutions into the drainage bag does not affect infection rates (20).

Some patients prefer the use of a valve on the catheter allowing the leg bag to be removed and the bladder to fill then be emptied via the catheter at timed intervals or when the bladder feels full. This technique is used in patients with a reasonable bladder capacity suggested to be over 300mls. There is no published research on the effect of CAUTI in these patients. However, in patients with short term catheters with good capacity there was an improvement in social activity and acceptance of the catheter (21). These results were confirmed in a larger longer term study (22), which also showed no significant difference in infection rates. This technique of drainage may be used for the selected non neuropathic patient with a long term SPC. In the neuropathic patient, urodynamics would need to be undertaken to ensure there is adequate low pressure bladder volume without overactivity or dysreflexia.

Complications of long term catheterization

CAUTI

Bacterial colonization of the bladder resulting in bacteriuria will occur with long term catheterization. This may result

in a catheter associated urinary tract infection (CAUTI). The incidence of CAUTI does not differ between urethral or suprapubic catheters. Bacteriuria risk increases with days of catheterization and over time, all people with a catheter will develop bacteriuria. Bacteriuria should not be treated however if a symptomatic infection occurs, this should be treated with appropriate antibiotics. Guidelines have been developed to help reduce the incidence of CAUTI (16). Common to all guidelines, appropriate use of catheters and short-term use of catheters is the key factor in preventing CAUTI. However, in the group of patients requiring long-term catheterization, emphasis should be placed on the aseptic insertion of the catheter and maintaining a sterile closed draining system that allows unobstructed flow.

Catheter blockages

Bacteriuria causes formation of a biofilm on the catheter and encrustation which may result in catheter blockages. Different solutions have been used for bladder washout to try and prevent catheter blockage. Shepherd *et al.* undertook a Cochrane review of studies that assessed different bladder washout solutions to prevent catheter blockages (23). Seven studies were included however there was not enough evidence to conclude if washouts were beneficial or harmful. The studies compared washout to no washout and different types of washout solutions including citric acid (Suby G, Solution R), sterile water, acetic acid and antibiotic solution of neomycin/polymixin. Symptomatic infections and catheter removal rates due to blockage were not shown to be significantly different between the washout groups. Overall there is not enough evidence to recommend undertaking regular bladder washouts.

Increasing oral fluid intake and monitoring urine output through the day may decrease catheter blockages but not CAUTI (24). However, during the study, the incidence of CAUTI was low in both groups so may not have been sufficiently powered to show difference in symptomatic infections.

Bladder spasms

CAUTI have also been associated with bladder spasms (25). Treating the CAUTI with antibiotics may reduce the spasms, however in some patients the spasms will persist. In this group, spasms may be treated with anticholinergic medications such as oxybutynin or solifenacin. Despite use of adequate doses of anticholinergic medications,

spasms may persist causing bladder pain or urinary leakage. Mirabegron, a beta3 adrenoreceptor agonist may be trialed. It is effective in reducing overactivity though has not been studied in patients with a catheter in place.

Though there is no published data on the use of botulinum toxin to prevent bladder spasm and pain in patients with a long term SPC, it is used both in neuropathic and non-neuropathic patients to relieve symptoms. Other methods of preventing detrusor overactivity such as sacral nerve stimulation or tibial nerve stimulation may also be considered.

Use of Suprapubic Catheter in Neuropathic Bladder

Clean intermittent catheterization (CIC), is the management of choice in spinal cord injury. However, many patients do not have adequate upper limb function to perform CIC or the bladder is not able to adequately fill, to make this a safe option. In these patients, SPC is preferable to urethral catheterization for long-term management. Early reports had suggested that there was a higher incidence of upper renal tract damage in patients with an SPC compared to CIC (26). However, more recent studies have shown when there is careful management of these patients, injury to the upper tract is similar to those performing CIC.

Management does include medication to reduce overactivity of the bladder. This may be regular anticholinergic medications or Botulinum toxin injections. The catheter requires regular changes and there needs to be screening for urinary tract calculi (27).

There is an increased risk of malignancy in the neuropathic bladder regardless of bladder drainage method. However regular screening with cystoscopy has not shown to be of benefit with the majority of tumours being detected due to haematuria rather than at the time of cystoscopy (28).

Current research on catheter design

Despite Foley balloon catheters having been used since the 1930s, the complications of urinary tract infections and bladder stones have not changed.

The ideal catheter would have some method of preventing a biofilm developing, with resultant encrustation and catheter blockage. Previously silver impregnated catheters have been trialed with no decrease in infection and encrustation rates (29). This may involve the constant

release of an antimicrobial to prevent bacteria adhering to the catheter (30).

With a SPC there is the problem of the small residual pool of urine in the base of the bladder that is not drained by the catheter which is placed through the anterior aspect of the bladder wall. A similar effect happens with a *urethral* placed catheter, due to the catheter balloon sitting at the bladder neck with the catheter opening near the tip sitting higher, allowing 10–100 mL to sit in the bladder base (31). The ideal catheter would allow complete emptying of the bladder through a flexible catheter that is not an irritant to the bladder but still remaining in place without the need of an external device.

The ideal suprapubic catheter should be easy to insert and change. More permanent channels such as a Mitrofanoff channel and a *gastrostomy* button have been trialed (32). The catheterizable channel does require intra-abdominal surgery but may be an option for younger patients needing long-term catheters.

Conclusions

In some patients with voiding dysfunction, catheter drainage of the bladder is necessary to provide the best form of bladder emptying and urinary containment. If the patient is to have a catheter long term, then the evidence suggests that a SPC may be a better option. However, infection rates and the resulting complications are the same regardless of catheter method. There remains a need to develop a better catheter material to prevent these complications.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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