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Suprapubic Catheter Change Methods

A Crossover Comparison Cohort Trial

Alyson Sweeney

ABSTRACT

PURPOSE: The purpose of this study was to compare 2 methods of suprapubic catheter (SPC) change, instillation and observation. The instillation method requires instillation of saline to the bladder prior to SPC removal; the observation method is completed taking note of the angle and length at which the indwelling SPC is withdrawn and observation of urine from the newer catheter when inserted.

DESIGN: Nonrandomized crossover trial.

SUBJECTS AND SETTING: Fifty-nine community-dwelling adults who were long-term SPC users participated in the study. There were 38 males and 21 females, with a mean age of 68.5 years. Most had chronic, progressive, or complex comorbidity. The mean duration of SPC use was 3.5 years.

METHODS: Participants underwent 4 SPC changes using the instillation method, followed by 4 changes using the observation method. Data were collected using a 3-part survey document; it queried demographic and catheter-related clinical information, the number of symptomatic catheter-associated urinary tract infections (CAUTIs) requiring antibiotic treatment, the number of catheter blockages that occurred during data collection, and nurses' experiences during catheter changes (including narrative feedback-related problems, concerns, or comments in relation to each catheter change). The comparative CAUTI and blockage outcomes were analyzed using McNemar's test for 2 paired samples. Narrative data were analyzed using thematic analysis.

RESULTS: There were 231 SPC changes using the observation method. No episodes of catheter displacement occurred. Analysis of nurses' narrative revealed concerns regarding "slowness" of urine drainage from the newly inserted catheter. This concern was addressed by promotion of adequate hydration prior to catheter change. There were 120 paired useable surveys included in the CAUTI and blockage incidence comparison; no statistically significant differences in CAUTI occurrences were found based on catheter change method (11 vs 11, $P = .7728$). No differences in the catheter blockage episodes were found based on catheter change method (8 vs 6, $P = .7237$).

CONCLUSION: The observation method of SPC change was as effective as the instillation method.

KEY WORDS: Community, Long-term suprapubic catheter, Suprapubic catheter, Suprapubic catheter change.

INTRODUCTION

Suprapubic catheter (SPC) insertion is an alternative to indwelling urethral catheterization for long-term bladder drainage. Locating the catheter above the pubic symphysis away from the genital region reduces the risk for urethral erosion, and several studies have demonstrated improved patient comfort and satisfaction.[1,2] Nevertheless, the presence of a long-term indwelling catheter is not without problems. The presence of any foreign body in the lower urinary tract, including a catheter, alters the defenses of the bladder and provides a surface for bacterial colonization and biofilm formation.[3] Regular catheter replacement aims to decrease the likelihood of developing symptomatic catheter-associated urinary tract infections (CAUTIs) and catheter blockage.[4]

Alyson Sweeney, MNg (Continence), RN, *Community Continence Service, Clarence Integrated Care Centre, Tasmania, Australia.*

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Correspondence: *Alyson Sweeney, MNg (Continence), RN, Community Continence Service, Clarence Integrated Care Centre, 16-22 Bayfield St, Rosny Park, Tasmania, Australia (alyson.sweeney@ths.tas.gov.au).*

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A number of clinical practices for SPC care have been adapted from our knowledge of the indwelling catheters placed in the urethra. Although there are similarities between the 2 the SPC relies on a surgically created tract from the abdomin to the bladder vesicle that remains patent only in the presence of an indwelling catheter. Suprapubic catheters are typically changed by skilled professional nurses practicing in a variety of practice settings. Most uncomplicated changes occur either in the community clinic setting or the person's home. Potential risks during SPC change include loss of the suprapubic tract; therefore, a new catheter should be inserted without delay and while the track is still easy to identify since closure of the track may occur over a brief period of time.[5]

Tissue trauma of the suprapubic tract also may occur if the catheter is not adequately advanced into the bladder and the retaining balloon is inflated in the tract. Insertion of the catheter too far also must be avoided because it may result in advancement of the catheter into the urethra, resulting in trauma when the clinician attempts to inflate the balloon.[5,6] Urine drainage from the newly inserted catheter indicates its correct location in the bladder. When this sign is observed, the nurse should advance the catheter few centimeters and inflate the retention balloon.

We searched the literature and found clinical practice guidelines for SPC change from the Australian and New Zealand Urological Nurses Society[7] and the European Association of Urology Nurses.[8] We reviewed these guidelines and observed that they reported only weak evidence guiding practice for multiple components of SPC care. We also found variability in practices based on geographic location and tradition.[9] For example, we identified variability in recommended procedures for SPC changes. Three techniques were recommended; clamping, instillation, and observation methods. The first 2 methods, clamping and instillation, are designed to ensure adequate urine or fluid in the bladder, enabling confirmation that the catheter is in the vesicle and the retention balloon is not inadvertently inflated in the suprapubic tract or urethra.[7] The clamping method requires securing the drainage tubing for 30 to 60 minutes prior to SPC change in order to ensure accumulation of a moderate volume of urine in the bladder during catheter change. The instillation method requires instillation of 50 to 100 mL of 0.9% sodium chloride into the bladder using a catheter-tipped syringe. The observation method requires the nurse to carefully observe the angle and length at which the older catheter is withdrawn and use this as a guide for insertion of the new catheter; placement of the catheter into the bladder vesicle is confirmed by observation of urine draining from the newly inserted catheter.[8]

The first 2 methods for SPC change are based on the premise that a catheterized bladder on continuous drainage contains only a small volume of urine at any given moment. While this volume is typically small, catheter drainage does not ensure complete evacuation of urine from the bladder vesical. For example, the drainage eyes of the indwelling catheter are located above the retention balloon, for the indwelling catheter this does not allow for complete bladder evacuation.[3,10,11] These methods supplement intravesical volume via instillation or by clamping the catheter until more urine is present in the bladder.

Our literature review identified only sparse evidence to inform best practices for SPC changes in persons with a long-term SPC. We found that the observation method for SPC change best aligns with the Healthcare Infection Control Practices Advisory Committee (HICPAC) recommendations for the prevention of CAUTI.[12] The HICPAC guideline was revised in 2009 to be inclusive of long-term catheterization in non–acute care settings. The HICPAC guideline recommends use of a closed drainage system in all health care settings. The instillation method of SPC change requires detachment of the collection tube from the catheter, causing interruption of the closed system and potential entry of pathogens into the lower urinary tract. In addition, instillation has been shown to increase shedding of the urothelial cells, predisposing to infection.[13,14] The HICPAC guideline also recommends maintaining unobstructed urinary flow. The instillation procedure causes retrograde flow via the heavily colonized catheter. The volume instilled disrupts flow that may contribute to bladder overdistension and resultant compromised tissue perfusion, increasing the opportunity for bacterial invasion.[15,16] Based on these reasons, we decided that the instillation method does not constitute best practice for our patient population.

Our revised guidelines for SPC change led to a switch for SPC change using the instillation method to change via the observation method. This study evaluates that practice change. The primary aim of the study was to evaluate the effectiveness of the observation method of SPC change versus the instillation method based on 2 main outcome measures, occurrence rates of CAUTI and catheter blockage, and to identify problems or concerns with either method reported by nurses completing SPC changes.

METHODS

We completed a nonrandomized crossover comparison cohort trial. Data were collected using a 3-part document, specifically designed for this study. Nurses delivering direct patient care collected demographic and catheter-related clinical data at baseline. Demographic and pertinent clinical data included age, gender, reason for SPC, primary medical condition, duration of catheterization, and catheter type. Nurses also recorded observations of the participants' past 4 catheter changes with each method; the instillation method was used in each subject initially, followed by the observation method. Data collection included concerns, problems associated with the instillation method, the volume of saline instilled at the last catheter change, the number of symptomatic CAUTIs requiring antibiotic treatment, and the number of catheter blockages during that period. Nurses then recorded narrative data related to the first 4 SPC changes where the observation method was used, along with the number of symptomatic CAUTIs requiring antibiotic treatment and episodes of catheter blockage. The number of weeks between each catheter change was also recorded. Following each catheter change, nurses were asked, "Did you experience any problems or concerns with the SPC change today," with a request for free text entry if they answered "yes." Open comments from nurses were also invited. Study procedures were reviewed and approved by the Human Research Ethics Committee of Tasmania (reference no. H0014436).

Study Procedures

In conjunction with clinical in-service to introduce the observation method of SPC change, an explanation of this study and its aims was provided to the each of the community nurse groups by the primary investigator (A.S.). The recruitment process, data collection form, and related study documents were explained and given to the nurses at that time. Ninety nurses from 6 urban- and rural-based nursing services collected data. Adults living in the community with a long-term SPC were eligible to participate in the study. The nurses introduced the study to potential participants verbally, along with a letter of introduction, information sheet, and primary investigator contact details. All volunteers who agreed to have their data collected from their health care record and in relation to their SPC changes comprised the study sample. All subjects provided informed consent. Completed surveys were returned to the primary investigator via mail for data collation and analysis.

Data Analysis

Quantitative data were recorded and analyzed using GraphPad software (LaJolla, California). McNemar's test was used to compare occurrences of CAUTI or catheter blockage episodes. Narrative data (written comments provided by nurses regarding "problems or concerns" with each SPC change and "other comments") were analyzed using thematic analysis.[17]

RESULTS

The target population comprised 97 adults with a long-term indwelling SPC; 60 agreed to participate in the study. One participant withdrew from the study prior to beginning data

collection, so our final sample that underwent baseline assessment comprised 59 subjects. There were 38 male and 21 female adults. Their ages ranged from 23 to 93 years, with a mean age 68.5 years. Sixty-one percent of participants were older than 65 years, and half of these were (32%) 80 years or older. The primary conditions leading to SPC were broadly categorized as urological (47%; 28) (eg, related to outlet obstruction), neurological conditions (27%; 16) (eg, Parkinson disease or multiple sclerosis), spinal cord injury (12%; 7), and other (14%; 8) (eg, severe musculoskeletal disorder). The length of time since participants required SPC insertion varied from less than 12 months (11) to 20 years (1), with a mean duration 3.5 years.

Forty-eight participants used a hydrogel-coated catheter, 10 used a catheter with a silicone substrate, and 1 used an antibacterial catheter. Three had valves attached to their catheters, enabling bladder filling and intermittent drainage via the closure and opening of the device. The remainder wore leg bags on continuous drainage. Data were recorded for 212 SPC changes using the instillation method and 231 changes using the observation method. The SPC changes were performed by 31 nurses. There were no episodes of catheter displacement. Following each of the 231 observation method catheter changes, nurses reported 14 incidences of "problems or concerns". The majority of SPC changes (n = 143; 61%) occurred every 4 weeks. The volume of normal saline instilled into the bladder during the instillation period varied between 10 and 60 mL (mean volume = 39 mL).

Analysis of narrative data revealed that some nurses identified delay in flow of urine from the newly placed catheter using the observation method as a problem. Time to flow ranged from 3 to 5 minutes, with 1 incidence of 20 minutes. Half of these comments about flow concerns related to 2 individual SPC users. Five other comments were related to participants' first change, and the first and second changes for one other participant. The hydration status of these participants was noted with comments: "concentrated urine" and "dehydrated." Subsequent comments reflected strategies implemented by the nurses to address this deficit, "encouragement to keep up fluids" and "had plenty to drink—no problem at all," indicating adequate hydration promoting flow.

One nurse reported a problem with balloon inflation "….due to the catheter position, this resolved through by moving the catheter [further] into the bladder slightly." Two male participants communicated their preference for the noninstillation of saline. Nurses' comments were "not instilling saline prior to SPC change is more comfortable for him. The instillation of saline used to cause discomfort at around [the] 30-mL stage," and the other "…client states [that the] irrigation method was uncomfortable for him." Two nurses also made comment of their own preference for the observation method: "no concerns, SPC change went well without incident, much faster process" and "no problems, much quicker."

Only 30 of 59 participants had useable data, allowing evaluation of CAUTI occurrences and catheter blockage episodes. As a result, this analysis was based on 120 catheter changes occurring in both the instillation and observation phases. Eleven episodes of symptomatic CAUTIs occurred during changes using the instillation method and 11 occurred using the observation method (P = .7728; odds ratio [OR] = 1.000; 95% confidence interval [CI], 0.267-3.741). Eight episodes of catheter blockage were recorded in the instillation period, and 6 during the observation period (P = .7237; OR = 0.600; 95% CI, 0.093-3.084; Table).

TABLE.
Incidence of Symptomatic CAUTI and Blockage (N = 30)

	Instillation Method	Observation Method
Symptomatic CAUTI	11	11
Catheter blockage	8	6
Total	19	17

Abbreviation: CAUTI, catheter-associated urinary tract infection.

DISCUSSION

We found that the observation method of SPC change was as effective as the practice of instilling saline for this group of people living in the community with a long-term SPC. Nurses indicated support of the revised practice in terms of efficiency and the comfort of their clients. We found no prior studies comparing these outcomes using different methods of SPC change.

Study findings also revealed that participants with long-term SPC tended to be older and vulnerable. Along with the cumulative risk to health often brought about by aging, the health conditions of participants in our study included multiple chronic, progressive, and/or complex comorbid conditions. Their vulnerability was also influenced by the presence of a long-term indwelling catheter that carries a risk for adverse side effect such as CAUTI, bacteremia, and urosepsis.[18-20] These complications associated with catheter use underpin grade A recommendation of the International Continence Society that states indwelling catheter use should only occur when all other strategies have been considered and rejected as unsatisfactory.[21] The mean duration of catheterization in our sample was 3.5 years, and 19% had lived with a catheter for longer than 5 years. While some individuals may live with an indwelling catheter for much longer periods, the mean duration of indwelling catheterization in our study was comparable to that reported by others.[1,22-24]

Most catheter changes (61%) occurred at 4-week intervals; this schedule for routine catheter changes is similar to that reported by others.[24,25] The frequency of routine catheter change takes into consideration the patient's typical pattern of catheter blockage (when present) and the risk of CAUTI in patients with a long-term indwelling catheter.[12,26] Catheter-associated bacteriuria risk increases by 3% to 10% per day of catheterization, and all persons with indwelling catheters are likely to have bacteriuria within a 30-day period.[27,28] We hypothesize that this observation also impacts the usual practice of planned catheter changes every 4 weeks.

Symptomatic CAUTI and blockage occurrence rates did not differ significantly with the instillation or observation method. We acknowledge that multiple risk factors other than frequency of catheter changes or methods of SPC change contribute to the likelihood of developing a CAUTI. For example, inoculation can also occur from the flora of the SPC tract when the catheter is inserted, or via the intraluminal route at any time when the closed system is breached, or via bacterial migration along the outside of the catheter or by way of the urethra.[12,29] The presence of calculi within the urinary tract may also be the source for reinfection and blockage symptoms.[30,31] Some people are more prone to catheter blockage than are others.[28]

It was not possible for us to isolate the route of bacterial entry leading to CAUTI in our patients or the precise point in time of bacterial entry.

However, we also believe that avoiding instillation of saline benefited our patients because it avoided interruption of the closed urinary drainage system, retrograde flow of fluid from the catheter to the bladder vesicle, and the potential for bladder overdistension. These 3 phenomena have been associated with catheter blockage and/or symptomatic CAUTI.[32] These complications can have significant effects on health-related quality of life of long-term catheter users and adversely impact available health care resources.[10,23,24,33-35] Continued recording over a more extensive period may have helped identify any impact on the incidence of symptomatic CAUTI or blockage brought about by the noninstillation of saline at SPC change.

The volume of saline recorded by nurses during the retrospective instillation phase was low. A volume of 10 mL was documented for 9 participants, and the mean instilled volume was 39 mL. This finding is considerably lower than the volumes advocated by the Australian and New Zealand Urological Nurses Society of 50 to 100 mL.[7] Other sources do not specify volumes with recommendations of "some" fluid[36] or "partially filling the bladder"[5] or "only performing SPC change when the bladder is full,"[37] indicating ambiguity and inconsistency in relation to recommended instillation volumes. Two patients told their nurses that they experienced discomfort associated with the instillation of saline at catheter change despite low infused volumes (<30 mL). Urinary catheter–related pain has been reported elsewhere; however, this pain is in relation to insertion or removal procedures, bladder spasm, or pain related to blockage.[23,25,34,38,39] We did not find other studies that reported discomfort during SPC change associated with bladder instillation, and this observation deserves further investigation.

Delayed flow from the catheter emerged as a potential limitation of the observation method for SPC change; narrative data related to 2 participants indicated that this was resolved by promoting hydration just before catheter changes. Nevertheless, in some individuals for whom adequate hydration is not attainable at the time of catheter change, instillation of saline may overcome this limitation.

A further notation from one nurse indicated uncertainty regarding correct catheter placement, with resistance felt on attempt to inflate the catheter balloon. This problem was addressed by slight advancement of the catheter into the bladder. Follow-up narrative data indicated that uncertainty with SPC placement persisted. After we concluded data collection, we modified our protocol to provide additional guidance to ensure the retention balloon has not been inflated in the SPC tract or urethra (see the Appendix). Following the signal of flow and nonresistant balloon inflation, a gentle, full 360° proximal catheter rotation is performed. The catheter that freely rotates signals nonconfinement, thus corroborating evidence of a correctly placed catheter.

LIMITATIONS

This study used a crossover design that compared outcomes of 2 SPC change methods; random allocation using a parallel group design may have increased our ability to detect differences between the SPC change methods. Symptomatic CAUTI and catheter blockage occurrences during the instillation method of SPC change were not accurately transcribed by some nurses; this also reduced the number of observations of CAUTI and blockage using the 2 methods and the potential power of our study to detect differences between the SPC change methods.

CONCLUSION

This study explored 2 methods for SPC change, instillation versus observation. The observation was found to be no different than the instillation method in terms of CAUTI or catheter blockage occurrences. Many aspects of long-term SPC-related care in the community setting remain to be clarified by further studies, and additional research is needed to assist nurses in selecting an optimal method for SPC change in a given individual.

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APPENDIX

Procedure for Suprapubic Catheter Change

Nursing Action	Rationale
Ensure the individual has a drink 30 min prior to changing SPC	Promotes urine production that signals placement of SPC in the bladder
Position supine	
Perform hand hygiene, clean the work surface, and gather equipment	Promotes asepsis to minimize the risk of infection
Don PPE, perform hand hygiene, and place the trolley on your dominant side	Ease of access to equipment
	Allows use of the dominant hand to change the catheter
Prepare the aseptic field	All equipment prepared prior to gloving
Open all required equipment using nontouch technique, separate trays, pour cleansing solution onto gauze balls	
Perform hand hygiene and don sterile gloves	Asepsis is maintained to reduce the risk of infection
Lubricate the catheter tip	
Draw up 10-mL sterile water in the syringe	
Drape with the fenestrated aseptic field; the drape folded in half	To provide an aseptic field
Cleanse the SPC site	To decrease the number of pathogenic microorganisms
Remove water from the catheter balloon using the empty 10-ml syringe, hold catheter with gauze square, attach the syringe, and allow the balloon to passively deflate	Deflating the balloon under suction leads to ridging/cuffing of the catheter
Place the tray with the new catheter onto the sterile field and place a sterile towel around the SPC site	Ensures a new catheter is inserted under aseptic conditions
With dominant hand, hold the catheter with gauze square and remove with a gentle twisting motion	
Take note of the length at which the catheter is withdrawn as a guide for the insertion of the catheter	
Discard the gauze and catheter	
Pick up a new catheter, gently insert until urine drains	Urine drainage signals the catheter is in the bladder
Advance the catheter a further 2-3 cm into the bladder	Ensures the catheter balloon is inflated within the bladder
Inflate the balloon with the appropriate volume of sterile water	
Gently rotate the catheter 360°	Facilitates further evidence that the balloon has not been inflated in the cystostomy tract or urethra
Gently withdraw the catheter until resistance is felt	Places the catheter balloon snugly against the bladder wall
Connect sterile drainage device using the nontouch technique	To contain urine and maintain a closed system
Remove gloves and perform hand hygiene	Prevents cross contamination
Secure the catheter with a catheter strap	To prevent traction on the catheter or accidental removal
Assist individuals to replace their clothes and ensure they are comfortable and the catheter is draining	To promote comfort
Dispose of used equipment	
Perform hand hygiene	Prevent cross contamination
Clean the work surface	
Perform hand hygiene	
Attend documentation	Date and time of catheter insertion
	Size and type of the catheter inserted
	Batch number
	Volume of sterile water in the balloon

Abbreviation: PPE, personal protective equipment.