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Original article

Suprapubic Catheterization in Neurogenic Bladder by Distending Bladder with Air-A Novel Technique

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Abstract

Suprapubic catheterization (SPC) in patients with neurogenic bladder (NGB) is difficult and high risk. Our aim is to provide a novel SPC method in patients with NGB by distending the bladder with air. A total of 26 patients with NGB underwent SPC using this new method. The bladder was first filled with air based on its volume of urine or liquids. Then, a reusable trocar was advanced into the bladder as per the general method. Preoperative demographics of patients and operative details were recorded. SPC was performed under local anaesthesia in 26 patients with NGB, including 18 men and 8 women. The mean age of the patients was 36 years (range, 28-77). An 18F Foley catheter was used for all patients. Blood loss was minimal, and the procedure was performed successfully in all patients without any complication. By distending the bladder with air, the SPC method is presented as an effective and safe method suited for patients with NGB. To our knowledge, this is the first report of this novel procedure.

***Keywords*:** suprapubic catheter insertion; neurogenic bladder; OAB; complications; lower urinary tract symptoms

Introduction

Many patients with spinal trauma or neurogenic bladder (NGB) require suprapubic catheterization (SPC) for long-term urinary drainage. SPC is typically regarded as a safe and common procedure that can be performed without any complications. However, it is difficult to perform in patients with NGB. NGB has a small-capacity or poor filling-compliant bladder, and the inability to distend the bladder is the main obstacle to performing SPC [1]. Several methods have been reported for SPC in patients with NGB [2]. In the Lowsley retractor method, SPC in patients with NGB is performed by advancing a curved Lowsley retractor through the urethral meatus into the bladder and pointing toward the anterior abdominal wall [3,4]. Transurethral suprapubic endo-cystostomy provides an "inside out" approach to SPC [5,6]. Both methods are undertaken through the urethral meatus. Difficulties arise, however, when patients with NGB have urethral stricture, in which case the existing SPC methods are impracticable. Another question that needs to be asked, however, is how to fill the NGB and keep the filling shape before SPC. In these situations, an open approach must be considered. Here, we describe a new method of SPC in patients with NGB by distending the bladder with air.

Materials and Methods

Patients

Informed consent was obtained for all patients before the procedure. A total of 26 primary catheter placements were performed in patients, including 18 men and 8 women. The mean age of the patients was 36 years (range, 28-77). Of the male patients, 83% (15/18) had urethral stricture. All procedures were performed under local anaesthesia in the outpatient department at our hospital between December 2018 and April 2020. No prophylactic antibiotics were needed after the procedure. The demographics of the patients and aetiology of NGB are listed in Table 1.

Table 1 Patient demographics

Mean age	**36 years (range 28-77)**
Sex	
Male	18
Female	8
Cause of NGB	
Spinal trauma	12
Diabetes	4
Complication due to urethral stricture	15

NGB, neurogenic bladder
Some patients (5) have both spinal trauma and urethral stricture

Surgical Technique

Patients were placed in a dorsal position. A reusable stainless-steel trocar was used for the procedure. First, a 16F catheter was inserted into the bladder through the urethra and pulled against the bladder neck after inflating the balloon. For male patients with urethral stricture, the catheter was inserted into the anterior urethra and fixed. Then, 300 to 400 mL of air was injected into the bladder through the catheter based on the existing volume of liquid or urine. The filled bladder was then palpated, and the 16F catheter was pulled out. After local anaesthesia, a suprapubic incision (about 1 cm) was made 2 to 4 cm cephalad to the pubic symphysis in the midline through the subcutaneous tissues and fascia. The trocar was advanced into the bladder through the incision, and the obturator was removed, keeping the sheath inside the bladder after confirmation of liquid spill, and the assistant inserted an 18F Foley catheter quickly through the sheath. The Foley balloon was then inflated with 10 mL of saline, pulled up against the anterior abdominal wall, and fixed suprapubically.

Results

SPC was performed under local anaesthesia in 26(100%) patients with NGB. All patients were inserted with the 18F Foley catheter. The operation time documented in 26 cases was 15. 2±4. 8 minutes (range 4-25). Blood loss was minimal, and the procedure was performed successfully in all patients without any complication.

Discussion

Any disease or lesion of the central nerves, peripheral nerves, or spinal cord may result in NGB, which influences the storage and voiding of the bladder. Data from medical and pharmacy claims have identified more than 40, 000 patients with NGB and 4, 000 patients with spinal cord injuries, respectively, from 2002 to 2007 in the United States [7]. When untreated, NGB may lead to several complications, such as urinary calculi, vesicoureteral reflux, hydronephrosis, urinary tract infection, and progressive renal damage. Long-term indwelling catheter drainage or intermittent catheterization can prevent or delay many of these complications [8]. SPC has been proven to be an effective and well-tolerated method of urinary incontinence management in patients with NGB [9,10]. Techniques for SPC include direct puncture using an SPC trocar [11,12], radiologic imaging or ultrasonography-guided SPC [13,14], and SPC using a transurethral suprapubic endocystostomy device [6].

However, SPC is associated with more complications in patients with NGB compared with those who have other lower urinary tract dysfunction. Sheriff [9] reported a 10%complication rate with SPC, with a 2. 7% incidence of bowel injury in 157 patients with NGB. Ahluwalia [2] reported a 6%malposition/expulsion rate with SPC, a 5%bowel injury/perforation rate, and a 4%mortality rate in a retrospective series of 219 cases. The overall SPC complication rate was higher in patients with NGB than in those with other forms of bladder oracle obstruction (34%vs 21%). In particular, the intraoperative complications were higher in the NGB group (11%) compared with the bladder oracle obstruction group (7%).

Several factors play a role in the complications of SPC in patients with NGB. First, the inability to distend the bladder is the main obstacle when performing SPC in small-capacity or poor filling-compliant NGB. In the case of NGB patients with urethral stricture, the catheter cannot be inserted into the bladder; consequently, the bladder cannot be filled as soon as possible. Second, although high-compliance NGB could be filled with bulk liquid or urine, the bladder is un-palpable for over distention, and the trocar could damage the intestine through the entire bladder. Third, NGB is an unstable bladder and is unable to hold back urine due to detrusor over activity, which makes bladder filling difficult [15,16]. Finally, it is also difficult to perform SPC in patients with previous lower abdominal surgery because of the surgical scarring of the lower abdominal wall. Distending the bladder is the first and main step of SPC. Injury of adjacent organs is more frequent when the bladder is not distended [1]. For risk assessment, the open approach must be considered.

Here we provide a new method to perform SPC in patients with NGB. Filling the bladder with air has the following advantages. First, the injected air will float on the surface of the urine in the bladder, which is sealed by urine and cannot flow, keeping the bladder-filled shape without compression or deformation and maintaining the safety of the puncturing process (Fig 1). Second, injected air does not stimulate detrusor over activity, which allows for the complete filling of the bladder without urine leak. Third, in the case of urethral stricture, air can be injected into the bladder through the urethra or a catheter inserted into the urethra to fill the bladder quickly without any obstacle.

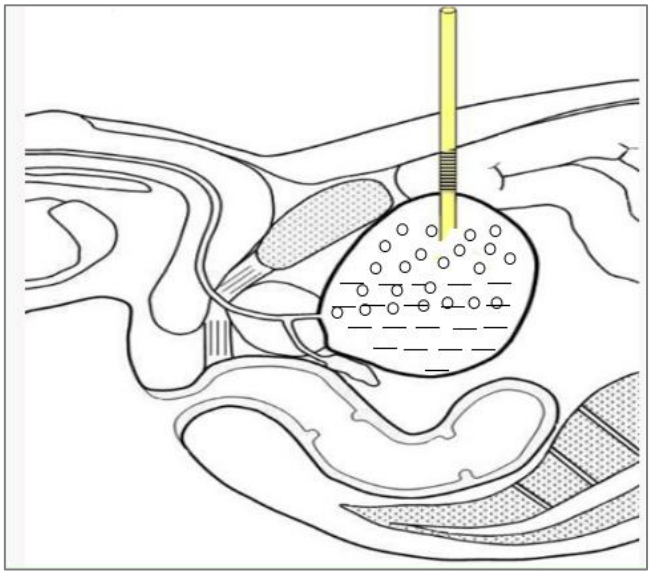

Figure 1: The schematic illustration of SPC with air. The injected air float on the surface of the urine in the bladder, and is sealed by urine, keeping bladder-filled shape without compression or deformation.

In this procedure, the bladder filled by air is based on having some urine in it, not only the air. When the trocar enters the bladder and the obturator is removed, air leaks out rapidly from the sheath followed by urine, which leads to sudden bladder decompression and possible sheath displacement. Accordingly, it is indispensable to advance the sheath a little further inside the bladder while withdrawing the obturator and insert the Foley catheter quickly.

SPC in patients with NGB is arduous and at high risk of complication. The first and main step of SPC is to distend the bladder and make it palpable. The new SPC procedure described herein, distending the bladder with air and maintaining its filled shape, keeps the puncturing process safe and is proven to be effective and safe and better than current SPC methods. To our knowledge, no other institutional experience with this technique has been reported.

Conclusion

SPC in patients with NGB is formidable and high risk. By distending the bladder with air, SPC is presented as an effective and safe procedure suited for patients with NGB. To our knowledge, this is the first report of this novel procedure.

Declarations

Ethics approval and consent to participate: The study was approved by the ethic committee of the affiliated 900th hospital of Fujian medical university. All methods were performed in accordance with the clinical practice guideline for bladder management for adults with spinal cord injury.

List of Abbreviations

SPC: suprapubic catheterization
NGB: neurogenic bladder
Consent for publication: Not applicable

Data Availability

Xinghui Sun should be contacted if someone wants to request the data.

Competing of interests

The authors declare that they have no competing interests

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None

Authors' contributions

Study concept and design: Xinghui Sun,
Drafting of manuscript: Xinghui Sun
Date analysis: Xinghui Sun

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