The utility of abdominal ultrasound during percutaneous suprapubic catheter placement

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Introduction: *To evaluate the use of ultrasound (US) at the time of percutaneous suprapubic catheter (SPC) placement. US has been recommended as a way to minimize complications, such as bowel injury, during percutaneous SPC placement, yet there is limited data supporting this recommendation.*

Materials and methods: *A retrospective chart review was performed on patients undergoing percutaneous SPC placement from 2002 to 2011. The method of percutaneous SPC placement (cystoscopic and/or ultrasound guidance, blind) was recorded and patients were subdivided into groups based on the use of US. The need to modify the approach based on US findings and complications such as bleeding or bowel injury were noted and compared between groups.*

Results: *A total of 307 percutaneous SPCs were placed: cystoscopy alone was used in 190 (62%) patients, cystoscopy + US in 86 (28%) patients, US alone in 6 (2%) patients, and 25 (8%) patients had the SPC placed blindly. Previous lower abdominal surgery was noted in 41/92 (45%) of patients with and 32/215 (15%) of patients without US usage. US identified intervening loops of bowel in 5/92 cases (5%), all of whom had a history of lower abdominal surgery. The approach was modified in 2/5 and abandoned in 3/5 based on US findings. Postoperative bleeding occurred in 1/215 (0.5%) of patients with and 1/92 (1%) of patients without US usage. No bowel injuries occurred.*

Conclusions: *While US may not be needed in most patients, particularly when cystoscopy is used, it may help to avoid bowel injury in patients with a history of lower abdominal surgery.*

Key Words: suprapubic, catheter, percutaneous, ultrasound

Introduction

Open or percutaneous suprapubic catheter (SPC) placement is a common urologic procedure used in the management of neurogenic bladder, bladder outlet obstruction, urethral injuries and incontinence. Percutaneous SPC placement is considered a routine and safe procedure although complications such as infection, bleeding, and adjacent organ injury (particularly bowel) can occur. The reported incidence of bowel injury ranges from 0.15%-2.7%[1-3] and is usually associated with previous abdominal surgery, obesity or inadequate bladder distention. Percutaneous SPCs can be placed using a variety of techniques including the use of a blind trocar, cystoscopic visualization, urethral sound, needle placement with ultrasound guidance, or a combination of these techniques. Preprocedural ultrasound has been proposed as an acceptable method for identifying bowel, blood vessels or other structures located between the bladder and the anterior abdominal wall.[4,5] Recent guidelines from the British Association of Urological Surgeons (BAUS) promote the use of ultrasound (US) guidance during percutaneous SPC placement in patients with prior abdominal surgeries or small bladder capacity/incomplete bladder distention.[6] They noted, however, a current lack of evidence regarding the safety of SPC placement, especially regarding the role of US guidance. Jacob et al, recently published on the technique of US guided percutaneous SPC placement and mentioned their experience with 25 cases but do not provide details on the patients or the outcomes.[4] Similarly, Lawrentschuk et al, described a technique of combined cystoscopic and US guided SPC placement but did not present their results.[7] The purpose herein is

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to report our results with percutaneous SPC placement with special attention to the utility of ultrasound guidance.

Materials and methods

After obtaining institutional review board approval, the records of patients undergoing percutaneous SPC placement (either alone or as part of another concomitant procedure) during the years 2002-2011 were retrospectively reviewed. Patient characteristics including age, gender, body mass index (BMI) and history of lower abdominal surgery were noted. Operative reports were reviewed to determine the use of lower abdominal US guidance, introducer needle guidance and concomitant cystoscopy. Simultaneous US findings, if any, were recorded.

The decision to use US guidance and/or cystoscopy was based on surgeon discretion. In general, the procedures were performed in a cystoscopy suite with general anesthesia or monitored anesthesia care depending on the patient's degree of sensation. Cystoscopy, when used, was performed using either a flexible or rigid cystoscope to maximally distend the bladder and allow for direct visualization of the SPC placement in the bladder. If a urethral stricture was present and there was no intention of performing a dilation at the time of SPC placement, a flexible ureteroscope was used to allow scope passage beyond the stricture. The determination to use lower abdominal/pelvic US was based on surgeon discretion, and was performed by an experienced sonologist during SPC insertion. A 3.5 Mhz probe covered with a sterile non latex sheath was used for all US procedures. US was used to assess bladder distension and the presence of intervening bowel or vascular structures between the anterior abdominal wall and the wall of the bladder, Figure 1. At surgeon discretion, an introducer needle (20 or 22 gauge) was percutaneously inserted into the bladder. Insertion was typically in the midline of the lower abdomen, 1-2 fingerbreadths above the pubic symphysis. Once the needle was confirmed by cystoscopy and/or US to be through the bladder wall and in the bladder lumen, aspiration was performed to confirm the presence of urine. When intervening bowel was noted during US the patient was placed in Trendelenburg position and US was repeated. If intervening bowel or other structures were still present the procedure was aborted, Figure 2.

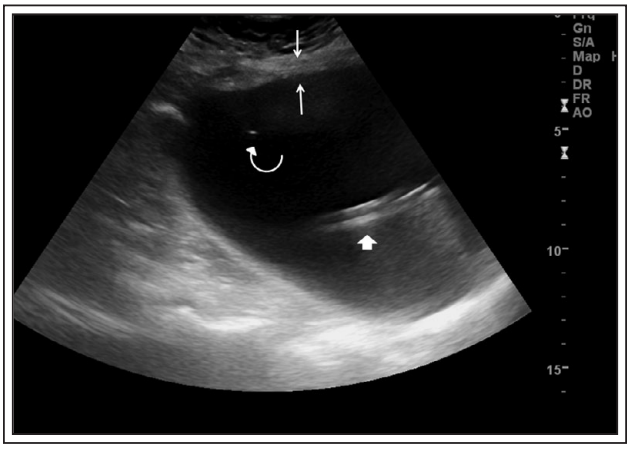

Figure 1. Ultrasound image (sagittal) of distended bladder (anterior bladder wall identified between straight arrows) without intervening bowel. A cystoscope (wide arrow) is identified within the bladder lumen. An introducer needle tip (curved arrow) is identified within the lumen of the bladder.

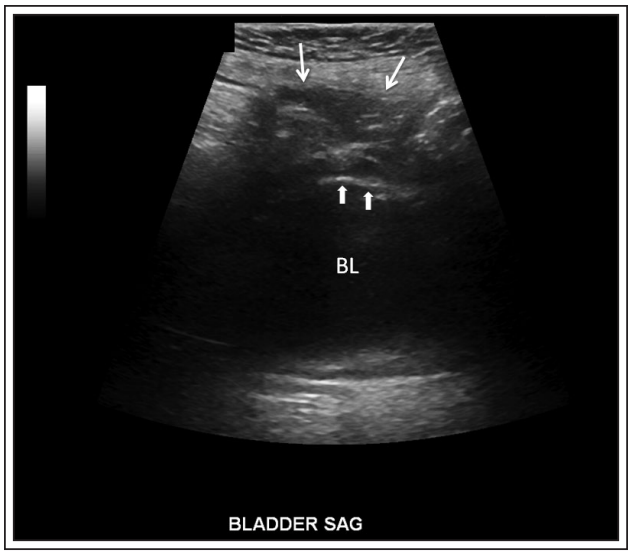

Figure 2. Ultrasound image (sagittal) showing intervening echogenic omental fat and bowel (thin arrows) between bladder wall (wide short arrows) and abdominal wall.
BL = bladder lumen

SPC was placed using a trocar and peel away plastic sheath that allows for placement of a 16 Fr Foley catheter. The trocar was inserted at a site in the lower abdominal midline approximately two fingerbreadths above the pubic symphysis (or wherever US demonstrated a pathway for needle placement without intervening bowel or other structures) after making a 1 cm skin incision. Once entry into the bladder was confirmed, the trocar was removed, leaving the plastic sheath traversing the skin,

anterior abdominal wall and anterior bladder wall. A 16 Fr Foley catheter was passed through the sheath and advanced into the bladder lumen. The catheter balloon was filled with sterile water and the peel away sheath was removed over the Foley catheter.

Follow up from the time of SPC insertion to catheter exchange or removal was reviewed particularly for any adverse events. Our primary complication of interest was bleeding and/or bowel injury.

Patients were divided into groups based on the use of ultrasound, cystoscopy and introducer needle. Demographic data and outcomes were compared. Where appropriate, chi-squared test was used to compare categorical data and student's t-test was used to compare numerical data between groups.

Results

During the period studied, 309 percutaneous SPCs were placed in 293 patients. Two cases without complete documentation were identified and omitted from analysis. The indications for SPC placement are in Figure 3. The majority of SPCs were placed as a component of an additional surgical procedure or for the management of urinary retention. Lower abdominal/pelvic US was performed in 92/307 (30%) of cases. Of the 92 cases in which US was used, cystoscopy was also performed in 86/92 (90%). Twenty-five of 307 (8%) cases were performed blindly (without US or cystoscopy).

Patient characteristics and results, stratified by the use of US, are outlined in Table 1. The patients with US guidance tended to be older ($p < 0.01$), more likely to have a history of lower abdominal surgery ($p < 0.01$) and more often male ($p < 0.01$). There was no significant difference between groups in regard to BMI.

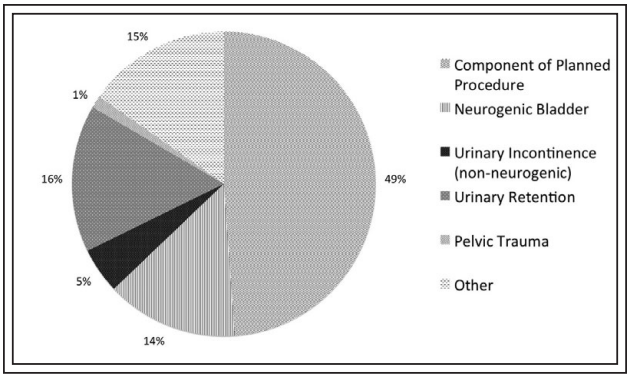

Figure 3. Indications for suprapubic catheter placement.

Major complications occurred in 2 of 307 (1%) cases. Both complications involved bleeding (one perivesically in the space of Retzius, the other intravesically) that required an additional procedure and/or readmission to the hospital (Clavien grade IIIb, grade IIIa, respectively). US and cystoscopy was used during SPC placement in one of these cases, whereas neither was used in the other. No bowel injuries were reported.

Intervening bowel was noted in 5 of 92 (5%) cases in the US group. Three of these procedures were abandoned while two were able to be safely completed percutaneously utilizing an approach modified based on US imaging. All five cases had a prior history of lower abdominal surgery.

TABLE 1. **Patient characteristics and results stratified by the use of ultrasound**

	Ultrasound used (n = 92)	**No ultrasound used (n = 215)**
Age (average ± SD)	61.7 ± 16.2	53.7 ± 17.5
Male	68 (73.9%)	187 (87.0%)
Body mass index (average ± SD)	29.0 ± 7.3	29.2 ± (8.37)
Prior lower abdominal surgery*	41 (44.6%)	32 (14.9%)
Use of cystoscopy	86 (93%)	190 (88%)
No use of cystoscopy	6 (7%)	25 (12%)
Bowel injury	0	0
Bleeding	1 (1%)	1 (0.5%)
Follow up (average days ± SD)	32 ± 21.6	27.1 ± 15.2

*Lower abdominal surgeries included: hysterectomy (19 patients), colectomy/colostomy (17 patients), appendectomy (11 patients), radical prostatectomy (9 patients), pelvic lymphadenectomy (8 patients), Caesarian section (6 patients), renal transplant (5 patients), enterocystoplasty (5 patients), and exploratory laparotomy (3 patients) with some patients having more than one.

Discussion

SPC placement is a common urologic procedure with a variety of indications. The procedure can often be performed on an outpatient basis with minimal recovery time. Despite the widespread use and relative safety, complications such as bowel injury or bleeding can be disastrous.

Percutaneous SPC placement may be performed without the use of adjunctive imaging, and indeed can be done safely in select patients. Our data show a low complication rate (1/215, 0.5%) and no incidence of bowel injury in those patients undergoing percutaneous SPC placement without the use of ultrasound. The vast majority of these patients, 85.1%, had no prior history of lower abdominal surgery. Of utmost importance is ensuring that the bladder is adequately distended at the time of placement. We used cystoscopy in 88% of these cases to help maximally distend the bladder. It also allows for direct visualization of trocar and catheter placement in the bladder. Injuries to prostate, rectum, vagina and uterus have been reported with SPC placement,[8,9] and the use of cystoscopy may help avoid these injuries.

Percutaneous SPC placement with the use of ultrasound guidance has been proposed to reduce the risk of complications, specifically bowel injury or vascular injury to overlying vessels. This approach has been suggested especially for patients at higher risk of complication, notably those with a history of lower abdominal surgery or small bladder capacity. Our patients who underwent SPC placement with the use of ultrasound had a higher likelihood of previous lower abdominal surgery compared to those in which ultrasound was not used (44.6% versus 14.9%). However, the majority of patients in whom ultrasound was used, 55.4%, actually did not have a prior history of lower abdominal surgery. The decision to use US was based on surgeon discretion, generally to provide an added confirmation of safety. The fact that no modification of approach was required in these patients and that no instance of bowel injury was encountered could argue for the safety of placing a percutaneous SPC in patients without the addition of US if there is no history of lower abdominal surgery.

The main advantage of US during SPC placement in our experience was noted in the five patients in whom we either modified the approach of the SPC catheter (two cases) or abandoned SPC placement (three cases) due to the presence of intervening bowel. All of these patients underwent simultaneous cystoscopy and had a history of lower abdominal surgery. If US had not been used, there could have been a higher risk of bowel injury. The two major complications we encountered were related to bleeding. US had been used in one of these two cases. One patient was managed conservatively with continuous bladder irrigation but required overnight hospitalization. The other patient underwent exploration for major vessel injury, which was negative. It was presumed that the bleeding came from injury to small perivesical blood vessels.

Our study is limited by its retrospective design as well as the lack of standardization for the decision as to which technique to use to place the SPC. The method of SPC placement was based on surgeon discretion. Cystoscopy was utilized in the majority of patients and is generally our preferred method to ensure adequate bladder distension. Ultrasound was used in most, but not all patients with a history of lower abdominal surgery. This was based on surgeon discretion which adds some degree of selection bias. While our study does not suggest that US is needed for all patients undergoing percutaneous SPC placement, particularly if cystoscopy is used, it does confirm the added advantage of using US to help identify the presence/absence of bowel that could be at risk for inadvertent injury. This is particularly true in patients with a history of lower abdominal surgery. □

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