POST-OPE RATIVE URINARY CATHETERIZATION IN GYNAECOLOGY

Melanie Chanda, BSc, MD,1
Shawna Johnston, MD, FRCSC,2

1Resident,
2Assistant Professor,
Department of Obstetrics and Gynaecology,
Queen's University

ABSTRACT
Urinary catheterization is frequently required during the postoperative course of patients who have had gynaecological surgery. A variety of drainage options is available, including indwelling urethral or suprapubic catheterization, and clean intermittent catheterization. The choice of drainage method for the individual patient depends on age, the pre-operative voiding mechanism and operative procedure. Selective urodynamic evaluation may be warranted. The goal of postoperative catheterization should be removal of the indwelling catheter as soon as possible, while adequate bladder emptying is ensured. Adherence to this principle will limit the rate of catheter-associated urinary tract infection and its consequences.

RESUME
Un sondage vesical est fréquemment requis durant la période postopératoire chez les patientes qui ont subi une intervention chirurgicale gynécologique. Parmi les diverses techniques de vidange possibles, on compte la sonde à demeure urérale ou sus-pubienne et la sonde inter­mittente sans contamination. Le choix de la méthode de drainage pour chaque patiente dépend de l’âge, du mécanisme de vidange préopéra­toire et du procédé opératoire. Une évaluation urodynamique sélective peut être indiquée. Le but de la sonde postopératoire devrait être de pouvoir enlever la sonde à demeure aussi tôt que possible tout en assurant une vidange adéquate de la vessie. L’observance de ce principe réduira le taux d’infections des voies urinaires associées à la présence d’un cathéter et leurs conséquences.

KEY WORDS
Urinary catheterization, postoperative care, urethral catheter, suprapubic catheter, clean intermittent catheterization, urinary tract infection.

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INTRODUCTION

An estimated 80 percent of gynaecology patients require urinary catheterization during the postoperative period. Gynaecological training imparts a healthy respect for the ureters and bladder. However, everyday urologic considerations—including postoperative bladder drainage options, urinary tract infection and postoperative voiding difficulty—receive little more than cursory attention. As stated by Hilton in his review of the catheterization practices of gynaecologists in the British Isles, "...It is perhaps the very familiarity which both medical and nursing staff feel they have with catheterization which leads them all too often to neglect the basic principles of bladder drainage". This article is designed to prompt clinicians to review these basic principles, evaluate their current practices and perhaps consider alternative strategies for the management of the patient requiring postoperative bladder drainage.

THE POSTOPERATIVE STATE

In order to determine how the bladder should be drained, it is first necessary to understand why urinary catheterization is performed. Peri-operatively, reasons for catheter placement include: a) avoidance of urinary retention, b) surgical exposure and delineation of anatomy and c) monitoring of urinary output and volume status.

FACTORs CONTRIBUTING TO POSTOPERATIVE URINARY RETENTION

Recuperation from pelvic procedures is often characterized by a period of inability to resume spontaneous voiding. This is a frequent postoperative complication, seen in 20 to 50 percent of patients undergoing gynaecological surgery. Spontaneous voiding requires the coordination of voluntary muscular activity of the abdominal wall and pelvic floor with autonomic function of the musculature of the bladder wall and urinary sphincter (Figure 1). Incomplete emptying and urinary retention contribute to overdistension of the bladder, with the possible adverse sequelae of urinary tract infection or detrusor hypotonia.

The nerves of the pelvic plexus which supply the bladder pass around the vagina, with the bulk of the plexus lying below the cardinal ligament (Figure 2). Dissection of paracervical and paravaginal tissues can cause neuropraxic injury and partial denervation of the bladder. With time and healing of damaged nerves, normal bladder function usually resumes. Rarely after pelvic surgery is there total and permanent bladder paralysis, although in procedures where the rectum is removed (for example, posterior exenteration) the nerves may be completely interrupted. Tissue ischaemia, haematoma formation and oedema may also contribute to voiding dysfunction.

From a functional standpoint, detrusor activity is effectively paralysed by regional or general anaesthetic techniques adequate for abdominal and pelvic surgery. Atropine, neuroleptics and various muscle relaxants block parasympathetic activity of the bladder. Length of operative time may be important because of the higher total doses of the anaesthetic agents required. Incisional pain and tenderness of

FIGURE 1A
THE NEURAL CONTROL OF VOIDING

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FIGURE 1B
FILLING/STORAGE
Inhibition of parasympathetics
Stimulation of sympathetic alpha-conduction beta-relaxation
Stimulation of somatic nerves to striated urogenital sphincter

VOIDING
Stimulation of parasympathetics
Inhibition of sympathetic
Inhibition of somatic nerves to striated urogenital sphincter

the pelvic floor muscles stimulate pelvic floor muscle spasm and, thus, interfere with urethral relaxation for voiding. Postoperative narcotic analgesics potentiate voiding difficulty through their direct anticholinergic action on detrusor activity, reducing the perception of the urge to void and limiting mobility through sedation. Patient-controlled analgesia and continuous epidural infusions are noteworthy culprits. In a retrospective study of 366 patients undergoing uncomplicated abdominal or vaginal hysterectomy for benign disease, those using patient-controlled analgesia were 5.7 times more likely (95% confidence interval 2.6 to 12.4) to have urinary retention than those given an intramuscular narcotic agent.10 Similar findings have been reported in patients undergoing a variety of general surgical procedures.11-14

PRE-OPERATIVE ASSESSMENT

Identification of women at risk for prolonged postoperative voiding dysfunction allows the surgeon to choose the best catheterization option. Physician experience will contribute to both the duration of drainage and the choice of drainage method.1

Whatever the choice, the patient can be advised about the options and anticipate better the events of her postoperative recuperation. For some women, this information may influence their decision to proceed with surgery; the possibility of requiring self-catheterization, however remote, may be far less acceptable to them than their original presenting symptom. If prolonged recovery with the need for self-catheterization seems likely, the technique can be taught prior to surgery.

How then are we to identify the patient at risk for prolonged catheterization? The route of surgery is a major factor. Laparoscopic techniques may allow for early ambulation and shorten the requirements for an indwelling catheter, although studies to verify this are lacking. In a large cohort study, patients undergoing vaginal hysterectomy were 5.5 times more likely to have urinary retention than the patients who underwent abdominal hysterectomy (95% confidence interval 2.5 to 12.4).10 Peri-urethral swelling from surgical dissection, trauma from vaginal retractors and pelvic floor spasm may play a role.

Surgical procedures for genuine stress incontinence, severe pelvic prolapse and gynaecological malignancy are known to contribute to urinary retention. Voiding difficulties and urinary retention occur in 20 percent of patients following colposuspension, but are usually transient.15 Anterior colporrhaphy has been associated with a lesser degree of voiding dysfunction. In general, the more successful the incontinence procedure, the higher the incidence of voiding difficulty postoperatively.9 Radical oncology procedures requiring extensive dissection will result in more voiding difficulty because of bladder denervation.16-18 The greater the dissection, the longer the period of recovery of normal voiding.9

Individual patient characteristics will predict the ability to resume spontaneous voiding. In a retrospective review of 100 patients undergoing colposuspension, 12 percent of women under 50 years of age, 25 percent aged 50 to 64, and 50 percent over age 65 experienced moderate or severe disturbances in voiding postoperatively.5 Whether this effect is due to an age-related decline in detrusor function or is due to the extent of estrogen deficiency is unknown. The beneficial effects of estrogen on urinary symptoms...
have been well described. A small, retrospective review of post-menopausal women undergoing prolapse surgery demonstrated that the use of estrogen replacement therapy for at least three months preoperatively was associated with a marked reduction in the duration of postoperative catheterization. Controlled trials of estrogen administration prior to surgical correction of incontinence and prolapse are required.

Urodynamic parameters may also be predictive. Stanton et al. found that reduced pre-operative peak urinary flow rate, defined as less than 20mL/second, correlated well with postoperative voiding difficulty after Burch colposuspension. Detrusor pressure on voiding may be more predictive. While the normal voiding mechanism requires urethral relaxation in coordination with contraction of the detrusor muscle, incontinent women may exhibit variations, including voiding by urethral relaxation alone or voiding by Valsalva, without detrusor contraction. The risk of prolonged postoperative bladder drainage has been found to be 12 times greater in patients who did not mount an adequate detrusor contraction during voiding.

Bhatia and Bergman suggested that the combination of peak flow rate and detrusor pressure enhances the ability to predict the need for prolonged drainage. In their study, none of the women with bladder contraction greater than 15 cm H$_2$O required urinary drainage for longer than seven days, while one in three women with inadequate contraction required prolonged catheterization. All women with no detrusor contraction and decreased urinary flow rate needed drainage for more than seven days. A more recent retrospective review of 154 patients undergoing colposuspension demonstrated that women who voided pre-operatively without detrusor contraction took almost twice as long to resume normal micturition than those who had normal pre-operative detrusor function (mean 9.0 versus 4.7 days, p<0.001).

While the majority of patients undergoing surgery for urinary incontinence have pre-operative urodynamic studies performed, few general gynaecology patients do. A simple enquiry about the patient's voiding habits may elicit symptoms of voiding dysfunction including incomplete emptying, poor or intermittent stream, or straining to void. For any procedure, then, where postoperative voiding dysfunction is anticipated, or for any patient with pre-operative symptoms, full objective urodynamic evaluation is suggested.

CATHETER-ASSOCIATED URINARY TRACT INFECTION

The urinary tract is the major source of postoperative infection following gynaecological surgery. In those patients with catheter-associated urinary tract infections (UTI), one to four percent will develop bacteraemia. Platt et al. demonstrated a nearly three-fold increase in mortality among hospitalized patients with UTI and an indwelling urethral catheter (odds ratio 2.8, 95% confidence interval 1.5–5.1, adjusted for age, severity of illness and duration of catheterization).

The uroepithelium of the normal, healthy bladder inhibits bacterial adherence and proliferation. If it is disrupted by the presence of a urinary catheter, bacterial colonization of the lower urinary tract by endogenous gastro-intestinal flora is facilitated. Three mechanisms have been proposed for the pathogenesis of bacteriuria in the catheterized patient. Micro-organisms from the perineum and peri-urethral area may be directly transported into the bladder at the time of catheter insertion. Insertion alone has been associated with rates of bacteriuria of less than one percent in healthy patients and 15 percent in elderly hospitalized patients. Bacteria may subsequently ascend into the bladder through the lumen of the catheter or around its outer surface. The use of closed drainage systems has dramatically decreased the introduction of infection by the intraluminal mechanism. Extraluminal migration of bacteria remains the major pathway for bacterial entry into the lower urinary tract, particularly in women. Meatal colonization with the infecting strain precedes the development of bacteriuria in the majority of patients.

The newest concept in the pathogenesis of catheter-associated UTI is that a bacterial biofilm, composed of a sheet of micro-organisms embedded in an extracellular matrix of host proteins and bacterial products, coats the catheter surfaces. Biofilm
production is associated with particular bacterial types, including *proteus* and *pseudomonas*. The organisms within the biofilm are relatively protected from antimicrobial agents and are, therefore, resistant to eradication.

Numerous strategies for the prevention of catheter-associated UTI have been proposed. Use of a closed drainage system for indwelling catheters has been advocated for decades, and has greatly reduced infection rates. Limiting the duration of indwelling catheterization is also protective. Bacteriuria develops at a rate of three to ten percent per day in the patient undergoing continuous urethral bladder drainage. Long term catheterization (arbitrarily defined as greater than 30 days) is associated with bacteriuria rates approaching 100 percent. Early removal, or even avoidance of indwelling urethral catheterization altogether, decreases the risk of developing a clinical infection. The prophylactic use of systemic antibiotics for the duration of catheterization has been shown to delay the onset of bacteriuria. Widespread acceptance has been limited by arguments about the emergence of resistant strains, cost and adverse drug reactions. Other strategies which have not consistently been shown to be effective are the use of antiseptic gels at the time of catheter insertion, peri-urethral care regimens, antibiotic irrigations of the bladder or the urine collection bag or the use of antibacterial catheter materials.

Most cases of bacteriuria developing during short-term urethral catheterization will be asymptomatic. Irritative symptoms may be due to either infection or the mere presence of the catheter. Fever is uncommon but may be present. The definitive diagnostic test is urine culture. The traditional threshold of 10^5 cfu/mL was established using clean-voided specimens in uncatheterized patients. Lower values, for example 10^2 cfu/mL, may be significant in the catheterized patient. This level has been associated with rapid progression to the higher level in more than 90 percent of patients.

Treatment of infection in the symptomatic patient should be based on microbial sensitivities. Replacing or removing the catheter is a logical, but unproven, adjunct to antibiotic therapy. In general, asymptomatic bacteriuria is not treated as long as the catheter is in place. Bacteriuria clears quickly following catheter removal provided the patient is able to void without high residuals.

**OPTIONS FOR POSTOPERATIVE BLADDER DRAINAGE**

**Indwelling Urethral Catheter**

The traditional approach to postoperative bladder drainage has been the use of the indwelling urethral catheter. The advantages of urethral catheterization are widespread familiarity with the technique and ease of insertion. This method is entirely adequate for most gynaecological procedures, particularly when there is minimal surgical manipulation of the bladder neck and urethra, and the anticipated period of drainage is less than five days. Repeated insertions of urethral catheters are required when the patient fails to void spontaneously after removal of the catheter, making this method less desirable if a real risk of prolonged voiding dysfunction exists.

**Suprapubic Catheter**

The introduction of the suprapubic catheter to gynaecological practice has been attributed to Hodgkinson and Hodari in 1966. The primary advantages of this method are increased patient comfort, decreased rates of bacteriuria and the ability to conduct voiding trials without repetitive urethral catheterization. The lower infection rate has been attributed to the decrease in bacterial colonization around the insertion site—the anterior abdominal wall rather than the perineum. Nine prospective, randomized, controlled trials have evaluated the rates of infection with suprapubic versus urethral catheterization (Table 1). While the standards and methodologies differ between studies, in general the findings indicate bacteriuria rates are decreased by 50 percent or more with the suprapubic route.

Currently, the accepted indications for suprapubic catheterization in gynaecology are the anticipation of prolonged bladder drainage and the facilitation of voiding trials. The closed and open methods of insertion, and subsequent management of the suprapubic catheter are described in Appendix A and
B. The presence of bladder cancer or gross haematuria are contra-indications to the use of the suprapubic catheter. Because of the risk of bowel perforation, closed insertion is contra-indicated if the patient has undergone previous abdominal or pelvic surgery, radiation therapy, or if the bladder cannot be distended with 500 mL of fluid.

Non-infectious complications include obstruction and inadvertent removal. Haematuria is common following insertion, but usually resolves spontaneously within 12 hours. 48

CLEAN INTERMITTENT CATHETERIZATION

Clean intermittent catheterization (CIC) is the procedure of choice for urinary drainage in patients with chronic voiding dysfunction. When this method was first introduced, emphasis was placed on the need for aseptic technique to minimize the risk of infection. Lapides et al. 58 revolutionized the technique with their assertion that the procedure need not be sterile. Rather, the emphasis was shifted to the frequency of catheterization and avoidance of overdistension. Overdistension may decrease blood flow within the bladder wall, increasing the susceptibility to infection.

Patients can learn the technique of CIC preoperatively if prolonged voiding dysfunction is anticipated (Appendix C). The patient catheterizes herself every three to four hours during the day, and once or twice at night. The volume drained each time should be less than 400 mL, or the frequency of catheterization should be increased. 59,60 The patient may attempt to void spontaneously before catheterizing herself, and then measure the residual urine volume in order to determine when the procedure can be discontinued.

The main complication of CIC is bacteriuria and UTI. Each episode of catheterization is associated with a one to three percent risk of bacterial contamination, 40 but in the patient who empties adequately these bacteria are readily cleared and do not result in infection. Clinical UTI is more common in patients with the highest mean volumes of urine at catheterization. 59,60

### LONG-TERM INDWELLING CATHETERS

Use of the indwelling catheter for longer than 30 days is universally associated with bacteriuria. Febrile episodes occur at a rate of one per 100 days of catheterization. 61 Other sequelae include detrusor instability, renal and bladder stones, urethral strictures, fistulae, acute or chronic pyelonephritis, vesico-ureteral reflux, hydronephrosis, bladder carcinoma, patulous urethra and incontinence. Suprapubic catheterization is not protective for many of these complications which develop as a result of the presence of a foreign body in the bladder.

When long-term use is required, urethral

### TABLE 1

<table>
<thead>
<tr>
<th>Author</th>
<th>Surgery</th>
<th>Number of Patients</th>
<th>Level of Bacteriuria</th>
<th>Suprapubic Infection Rate</th>
<th>Urethral Infection Rate</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perrin 59</td>
<td>Rectal</td>
<td>108 females</td>
<td>&gt;10⁵</td>
<td>24% 20% females</td>
<td>49% 55% females</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Vandoni 50</td>
<td>General</td>
<td>50 females</td>
<td>&gt;10³</td>
<td>0% 0% females</td>
<td>41% 75% females</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>O'Kelly 51*</td>
<td>Aortic or rectal</td>
<td>57</td>
<td>&gt;10⁵</td>
<td>7%</td>
<td>7%</td>
<td>NS</td>
</tr>
<tr>
<td>Sethia 52</td>
<td>General</td>
<td>66 females</td>
<td>&gt;10⁴</td>
<td>6% 0% females</td>
<td>47% 61% females</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Rasmussen 53*</td>
<td>Rectal</td>
<td>56</td>
<td>&gt;10³</td>
<td>0%</td>
<td>18%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Schiotz 54</td>
<td>Vaginal repair</td>
<td>78</td>
<td>&gt;10⁵</td>
<td>44.7%</td>
<td>40.0%</td>
<td>NS</td>
</tr>
<tr>
<td>Bergman 55</td>
<td>Vaginal incontinence</td>
<td>51</td>
<td>&gt;10³</td>
<td>17%</td>
<td>63%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Wiser 56</td>
<td>Vaginal repair</td>
<td>150</td>
<td>&gt;10⁵</td>
<td>12%</td>
<td>38%</td>
<td>Not stated</td>
</tr>
<tr>
<td>Andersen 57</td>
<td>Colposuspension or vaginal repair</td>
<td>92</td>
<td>&gt;10⁵</td>
<td>20.8%</td>
<td>45.5%</td>
<td>&lt;0.25</td>
</tr>
</tbody>
</table>

* Trials did not differentiate between infection rates in males and females.
catheters are changed every eight to twelve weeks. Suprapubic catheters should be changed slightly more frequently, or every six to eight weeks. Those patients with recurrent infection or stone formation require more frequent changes.

CONCLUSION

Urinary catheterization is frequently required following gynaecological surgery. Peri-operative indications for catheter placement include: a) avoidance of urinary retention, b) surgical exposure and delineation of anatomy and c) monitoring of urinary output and volume status.

The aetiology of voiding dysfunction after pelvic surgery is complex; partial bladder denervation, pelvic floor muscle spasm and the effects of anaesthetic and analgesic medications have been implicated. The patient's age and the surgical procedure performed will, in part, determine postoperative catheterization requirements, with older patients and those undergoing surgery with extensive dissection being at increased risk. Urodynamic parameters (including a peak urine flow rate of less than 20 mL/second, or a maximum detrusor pressure on voiding of less than 15 cm H2O) can predict the ability to resume spontaneous voiding.

Bacteriuria develops at a rate of three to ten percent per day in the patient undergoing continuous urethral bladder drainage. Maintenance of the closed drainage system and limiting the duration of indwelling catheterization decrease markedly the rates of catheter-associated UTI. Only those infections which are symptomatic need be treated. The role of prophylactic antibiotics during catheterization is controversial.

Urethral catheterization is adequate for most gynaecological procedures in patients with normal voiding function, particularly when there is minimal surgical manipulation of the bladder neck and urethra, and the anticipated period of drainage is less than five days. The advantages of suprapubic catheterization are increased patient comfort, decreased rates of bacteriuria and infection, and the ability to conduct voiding trials without repetitive urethral catheterization. When voiding difficulty is expected after surgery, the suprapubic catheter is preferred. Clean intermittent catheterization is the procedure of choice for urinary drainage in patients with chronic voiding dysfunction and can be taught pre-operatively.

APPENDIX A - INSERTION OF THE SUPRAPUBIC CATHETER

The suprapubic catheter can be placed before or after the operative procedure, under local, regional or general anaesthesia. The three possible insertion techniques are open, closed or with the assistance of a transurethral sound. The open technique is convenient at the time of laparotomy and, because it permits direct visualization, is preferred in patients who have had previous abdominal or pelvic procedures. It is also used when distension of the bladder is difficult or a recent cystotomy has been performed.

OPEN INSERTION AT THE TIME OF LAPAROTOMY

1. A separate, small incision site above or beside the laparotomy incision is preferred, and extends through the fascia.
2. The anterior bladder wall is grasped using two Allis clamps.
3. A cystotomy incision is made between the clamps. Electrocautery may be used, and has the benefit of producing haemostasis.
4. The catheter (12F-14F) is placed through the skin incision and cystotomy, the balloon inflated and the drainage bag connected.
5. An absorbable, purse-string suture is used to close the cystotomy and secure the catheter.
6. The catheter is secured to the abdominal wall and a sterile dressing applied. If a transurethral catheter was used intra-operatively, it is removed.

CLOSED INSERTION TECHNIQUE (FIGURES 3 AND 4)

Alternative catheter sets are available without peel-away sheaths, but the basic principles of insertion are the same.
1. The bladder is distended with 500 mL of sterile saline injected through a transurethral catheter.
2. The patient is placed in the Trendelburg position to displace the abdominal contents.
3. A small, midline skin incision is made within three cm of the pubic symphysis. This incision does not extend through the fascia.
4. The trocar is held at a 30 degree angle from the vertical, and inserted firmly but carefully through the fascia until the bladder is entered.
5. Urine flow is confirmed by removing the trocar from its sheath.
6. The catheter is fed through the sheath, the balloon inflated and the catheter pulled back gently to remove any excess length in the bladder.
7. The catheter is connected to the drainage bag.
8. The peel-away sheath is removed.
9. The catheter is secured to the abdominal wall and a sterile dressing applied. If a transurethral catheter was used intra-operatively, it is removed.

APPENDIX B - SUGGESTED SUPRAPUBIC CATHETER CLAMPING PROTOCOL

One of the main advantages of using a suprapubic catheter is that it allows for a trial voiding and determination of postvoid residual volumes (PVR) without repeated urethral catheterizations. Most protocols call for continuous drainage for the first 48 to 72 hours. The drainage connection, and not the catheter itself, is then clamped and the patient allowed to void urethrally. Unclamping the catheter allows the residual urine volume to drain and be measured. Once two consecutive postvoid residuals measuring less than 100 mL are achieved, the catheter is removed. An alternative approach is to continue the clamping protocol until the postvoid residual volume is less than 20 percent of the voided volume. The accepted values for the postvoid residual are based on population data. Higher residuals may be accepted in patients with pre-operative voiding dysfunction.

At our institution, the following protocol is used. For those patients who are discharged with the suprapubic catheter in place, the regimen is easily followed by the visiting nurse or the patient herself.

On the third postoperative day (for Burch colposuspension):
0800h: Clamp suprapubic catheter.
        Allow patient to void per urethra.
        Measure and record volume of void.
1500h: Ask the patient to void on own, measuring volume.
Unclamp suprapubic catheter. Measure postvoid residual volume (PVR): 
a) If PVR>100mL, unclamp catheter to straight drainage until next morning when protocol can be tried again.
b) If PVR<100mL, reclamp suprapubic catheter and allow patient to void.
2000h: Ask the patient to void, measuring volume. Unclamp suprapubic catheter. Measure PVR.
 a) If PVR>100mL, unclamp suprapubic catheter to straight drainage until next morning.
b) If PVR<100mL, reclamp suprapubic catheter and allow patient to void on own.
Encourage the patient to void at least once through the night (approximately 0300h). In the morning, ask the patient to void per urethra, and measure the PVR. If this volume is less than 100 mL, remove the suprapubic catheter.

If at any time the patient becomes uncomfortable, unclamp and measure the volume drained. Do not unclamp the catheter and connect it to a spigot. Use a rubber-shod Kelly clamp and clamp the catheter along the clear tubing of the catheter bag (clamping the catheter itself may cause it to fracture).

APPENDIX C - METHOD OF CLEAN INTERMITTENT CATHETERIZATION

Patients and their caregivers can be taught this simple technique before or after surgery. Initial attempts by the patient will require a mirror to identify the urethra, but eventually this can be done by palpation alone. Elaborate aseptic technique is unnecessary. The emphasis is on frequent and complete emptying of the bladder. Voided volumes should be less than 400 mL.
1. The patient’s hands and the catheter are washed with soap and water.
2. The non-dominant hand is used to separate the labia.
3. The dominant hand holds the catheter two to three cm from the tip. The second and fourth fingers are used, so that the third is available to palpate the urethral meatus.
4. The catheter is inserted and the bladder emptied.
5. The catheter is gently advanced and withdrawn to ensure complete evacuation.

REFERENCES


