



Urinary Retention Following Non-urologic Surgery

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Abstract

Purpose of Review To evaluate the literature assessing postoperative urinary retention (POUR) after non-urologic surgeries, including risk factors, as well as short- and long-term consequences.

Recent Findings POUR is multifactorial; however, several risk factors, such as male sex, advanced age, and preexisting lower urinary tract symptoms are well established. Procedures that do not involve damage to the urinary or nervous system are rarely associated with long-term consequences, as opposed to colorectal surgery in which long-term voiding dysfunction may be experienced. Improved surgical technique may improve results in these cases. Various preventive methods have been studied. While medical prevention has been efficacious in some cases, physical, noninvasive interventions failed to show a benefit.

Summary While general risk factors for POUR are known, the literature assessing these factors varies widely and, in many cases, with conflicting results. With the expansion of ambulatory surgery, it is expected that the POUR will become more frequent. Prospective, well-designed studies are needed to guide the management in these cases.

Keywords Urinary retention · Surgery · Postoperative

Introduction

With ambulatory and same day surgery gaining popularity, often urinary catheterization is no longer considered mandatory. This practice has potentially led to an increasing rate of post-operative urinary retention (POUR). The reported rate of POUR is highly variable, ranging from 5 to 70%. [1] Besides the obvious discomfort for the patient, POUR is associated with several adverse outcomes including increased risk for urinary tract infection (UTI), acute kidney injury, prolonged hospital stay, and increased healthcare costs. [2–7]

A large body of literature assessing the incidence and risk factors for POUR is available; however, the interpretation and application are limited by the wide variability in the type and techniques of surgery and definitions of urinary retention. Interestingly, despite many studies being methodologically solid, and including follow-up, information regarding the

long-term outcomes of POUR is sparse. In this manuscript, we aim to review the recent literature assessing POUR and the impact of various operative techniques.

Definition

Urinary retention is generally defined as an inability to void in the presence of a full bladder. There is a great variability in the definition of POUR in the literature. The terms “patient discomfort”, “sensation of a full bladder”, “palpable bladder”, “distended bladder”, “inability to void”, and “need for catheterization” have all been used in various combinations. [8–12] Clinical diagnosis of urinary retention in the post-operative setting is not straightforward. Patients with bladder distention are not always sensate or able to communicate their retention. Furthermore, the discomfort associated with bladder distention may be distracted by pain from recent trauma or surgery or masked by regional anesthesia or prior neurologic deficit. [13] Portable ultrasound devices have emerged as a cheap and reliable tool to estimate of bladder volume. They provide a reliable estimate for clinical decision making. Post void urine volumes between 400 and 600 mL have been generally employed to define urinary retention. The measuring error of these devices is relatively small and has been reported

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anywhere between 21 and 17.5 mL. However, it may cause confounding results that are present in obese patients. [14, 15] Bladder catheterization remains the gold standard for measuring residual volume and is also therapeutic; however, it is an invasive measure and hence associated with possible complications. Different criteria used to define POUR and the associated incidence of POUR is shown in Table 1.

Anatomy and Physiology

The detailed innervation of the lower urinary tract is beyond the scope of this work. Briefly, it includes a network of autonomic, somatic, and visceral nerves. The proper function of these components allows for coordination between the bladder, internal, and external sphincters, which is essential for execution of the storage and emptying phases. The detrusor and internal sphincter are innervated by the pelvic plexus,

which receives sympathetic and parasympathetic inputs. The parasympathetic input originates from the sacral spinal cord (S1–S3) via the pelvic nerve. The sympathetic (hypogastric) nerves arise from the superior hypogastric plexus, in the upper lumbar region. Afferent sensory nerves (A δ and C fibers) arise from stretch receptors in the bladder wall and travel mainly through the pelvic nerve. [16]

The voiding phase can be reflexive or voluntary. In the former case, a high-level afferent signal from the stretch receptors travels to the dorsal root ganglia of the sacral region of the spinal cord and propagates a parasympathetic output to the bladder, causing detrusor contraction and internal sphincter relaxation by inhibiting sympathetic activity. Voluntary micturition is further governed by higher centers in pontine micturition center and the frontal cortex and is affected by opioid analgesic and spinal anesthesia, as discussed in details later. [16] Insults to any portion of this complex signaling pathway may culminate in POUR.

Table 1 Definitions used for POUR

Definition of POUR	Type of procedure	Incidence of POUR
Clinical		
Failure to void more than 8 h after surgery ²	Cervical, thoracic, and lumbar surgeries via both anterior and posterior approaches	(35/397) 8.8%
Inability to void spontaneously when the bladder was distended ³³	Joint arthroplasty	(32/95) 33.7%
Inability to void requiring placement of either an indwelling catheter or straight catheter ²³	Total joint arthroplasty using opioid-free spinal anesthesia	(79/842) 9.3%
Inability to void postoperatively, with a lower suprapubic discomfort on palpation or inability to void with a palpable full bladder ³⁷	Elective posterior lumbar surgery	(61/370) 16.5%
Unable to void spontaneously and with a residual volume greater than 500 mL as measured by catheterization ⁸	Post-partum	(30/3364) 0.89%
Inability to pass urine ¹¹	Knee arthroscopy under unilateral/bilateral spinal anesthesia	(3/70) 4.3%
Patients' complaint in painful retention or observing fluid balance or palpation of suprapubic area in painless retention. ¹³	General surgical population	(18/280) 6%
Documented symptoms related to an inability to void after surgery or postoperative urinary retention identified by bladder ultrasonography. ¹⁹	Total hip or knee arthroplasty	(446/1031) 43.2%
Sonographic		
Postoperative urinary retention is diagnosed by a residual greater than 700 mL ²⁰	Hip arthroplasty	(29/80) 36%
Inability to void 4 h after the procedure and > 350 cc on bladder scan ²¹	Total joint arthroplasty	(145/378) 38.4%
Time to voiding or the need for catheterization, with a resulting volume of greater than 400 mL. ¹⁰	Inguinal hernia repair under spinal/epidural anesthesia	(8/150) 12%
Inability to empty the bladder voluntarily with a bladder volume of \geq 400 mL or with a bladder volume of \geq 600 mL in cases of symptomatic urinary retention ²⁵	Fast track total joint arthroplasty	(424/1054) 40.2%
Greater than 500 mL of residual urine in the bladder was detected ¹⁸	Total hip or knee arthroplasty under spinal anesthesia	(94/182) 51.6%
Patients who did not void within 4 h and had a urinary volume > 400 mL confirmed by ultrasound were managed with a one-time catheterization ¹⁷	Total knee replacement	(9/314) 2.8%
Failure of first voiding trial after surgery or post void residual volume of greater than 150 mL necessitating catheterization ⁵³	Laparoscopic and vaginal hysterectomy	(49/233) 21%
> 200 mL	Elective colorectal operations	(32/143) 22.4%
Post void residual, or the inability to urinate despite a bladder volume > 200 mL ⁷⁷		

Risk Factors for POUR

POUR is multifactorial. Risk factors can be stratified as patient related, procedure related, and anesthesia related. These risk factors are also summarized in Table 2.

Patient-Related Risk Factors for POUR

Several studies have shown that males are 2–3 times more likely to experience POUR [17–20] as well as older patients, probably as a result as pre-existing bladder outlet obstruction (BOO) or detrusor underactivity (DA) [17, 18, 21–24]. The impact of International prostate Symptoms Score (IPSS) on POUR after lower limb arthroplasty and hernia repair has been evaluated in several studies with conflicting results. Bjerregaard et al. performed a prospective observational study involving 1062 patients undergoing fast-track hip and knee arthroplasty. Preoperative IPSS was higher in the catheterized group, but the difference between groups was not clinically significant. [25] Two smaller studies which did show an association between IPSS and the risk of POUR did not include other variables into the analysis, while in two prospective studies, IPSS was not associated with POUR. [18, 22, 26,

Table 2 Summary of risk factors for POUR

<i>Patients characteristics</i>
Older age
Male sex
Higher IPSS
BPH
Preoperative PVR > 150 mL
<i>Procedure related risk factors</i>
Higher intraoperative volume infusion
Longer operating time
<i>Arthroplasty</i>
THA > TKA
<i>Spine surgery</i>
Fusion procedures
Previous spine surgery
L3–5 operating level
Fusion procedures
<i>Hernia repair</i>
Mesh fixation
<i>Colorectal cancer</i>
Non nerve sparing technique
<i>Gynecologic surgery</i>
Vaginal approach
Non nerve sparing, unilateral nerve sparing
<i>Anesthesia</i>
Spinal anesthesia > epidural > general
Opioids use (intravenous or intrathecal)

[27] The preoperative post-void residual volume (POPVR) has also been studied as a predictor of POUR. In a prospective study of 381 patients undergoing total joint arthroplasty, POPVR was associated POUR. However, one third of the patients with POUR spontaneously voided but had a PVR > 150 mL, which categorized them as POUR in this study. Once this group was removed from the analysis, POPVR was no longer associated with POUR. [28] These results support the notion that urinary function usually returns to its baseline shortly after minor surgery.

Procedure-Related Risk Factors for POUR

The risk of POUR has been associated with several intraoperative risk factors. Over hydration in the absence of a urinary catheter can lead to bladder over distention, which, in turn, can result in temporary detrusor dysfunction. [29] Several studies have found an association between the intraoperative intravenous fluid volume and the risk of POUR. However, results reported were inconsistent, and the mean differences in the infused volumes between the retention and non-retention groups ranged 150 to 200 mL, representing only 10–20% of the infused volume. Fluid administration is influenced by multiple factors, including patient's vital signs, intraoperative blood loss, and the length of surgery. Therefore, determining the appropriate intraoperative fluid volume is difficult with regards to POUR risk. [17, 21, 30] The effect of operating time has also been studied in this context. Tichler et al. found that the risk of POUR is 25% higher for every 15 min in the operating room in a group of patients undergoing total joint arthroplasty. Similarly, Hansen et al. found operating time > 2 h to be a significant predictor of POUR among 773 patients who had undergone orthopedic, abdominal, gynecological, or plastic surgery without a urinary catheter. This effect, however, could be a surrogate of the intraoperative infused volume, which has not been included in the analysis. [17, 23, 27, 30]

Surgery-Specific Risk Factors for POUR

Orthopedic Surgery

POUR has been the main outcome in multiple studies assessing complication after lower limb arthroplasty. Historically, the incidence of urinary retention after these procedures varied from 10 to 84%. [31] More recent literature reports a decreased incidence of 30% to 40%, [19–22, 24–26, 28, 30, 32] probably as a result of enhanced recovery after surgery (ERAS) protocols, which include optimal anesthetic and surgical technique, pain and stress management, and early ambulation. [33]

In a retrospective study of 1002 patients, Griesdale et al. found that POUR was 40% more common following total hip arthroplasty (THA) than total knee arthroplasty (TKA), after

controlling for multiple factors. [19] Later studies, however, did not demonstrate an association between the type of surgery and POUR. [3, 25, 28]

An important consideration in patient undergoing lower limb arthroplasty is the risk for developing bacteriuria, which can cause prosthetic infection. [34] Therefore, it is reasonable to monitor and drain the bladder for 24 h after the surgery. In a prospective study of 719 patients undergoing total hip arthroplasty, those with no need for catheterization were compared to those with an indwelling catheter, there was no difference in the incidence of UTI, and 22% of the patient in the first group did not need catheterization, making this approach more attractive. [35]

The literature regarding the occurrence of POUR after lumbar spine surgery is still evolving. Siddharth et al. prospectively evaluated risk factors for POUR after relatively minor posterior spinal procedures which do not typically require urethral catheterization. This analysis found fusion procedures more frequently associated with POUR in comparison to decompression or discectomy on univariate, but not on multivariate analysis (25.4% vs 11.4%). [36] In a retrospective study of 205 patient with POUR following spinal surgery, previous spinal surgery, L3-L5 operating level, and fusion procedures were associated with POUR-free status on multivariate analysis. While dura tearing and spinal stenosis were not associated with POUR, [37] these studies are limited by the absence of a preoperative urologic evaluation, as it is known from historic literature that a substantial proportion of these patients have pre-existing detrusor underactivity. [38]

Hernia Repair

Inguinal hernia repair is one of the most common surgical procedures performed by general surgeons throughout the world, and the reported incidence of POUR varies widely from less than 1% to greater than 20%. [39] It is advised to place a urethral catheter prior to surgery, in order to avoid an injury to the bladder.

Surgical techniques for hernia repair have been compared with respect to their main outcomes such as postoperative pain and recurrence, but only few of these studies included POUR rates as a secondary outcome. In a comparative review of 151 studies, 20 studies assessed the impact of open versus laparoscopic technique on the incidence of POUR. The authors found a substantial heterogeneity between studies, and no statistically significant differences. [40] In a meta-analysis of four randomized and five retrospective studies, no difference in POUR was found between fibrin glue and suture fixation in open hernia repair. [41] Conversely, in a randomized trial of 100 patients who underwent laparoscopic hernioplasty, mesh fixation was associated with higher rate of urinary retention in comparison to non-fixation, possibly as a result of pain scores and opioid usage. [42]

Literature supports that hernia repair can be safely performed without a postoperative urinary catheter. In a series of 8050 laparoscopic transperitoneal hernioplasties, only 0.5% of the patients experienced POUR, [43] and omitting the urinary catheter actually improved postoperative urinary symptoms. [44]

Colorectal Surgery

Treatment for colorectal cancer with abdominal perineal resection (APR) and low anterior resection (LAR) for low and high rectal lesions, respectively, can have significant impact on urinary function. Historically thought to be an inevitable consequence of the surgery, voiding dysfunction has become preventable with the introduction of new surgical techniques and multimodal treatment for rectal cancer. Total mesorectal excision (TME) of the rectum was introduced in 1979. The previous technique was now refined to include a direct vision dissection along anatomical planes, while preserving the pelvic autonomic nerves. [45] Hojo et al. presented five degrees of pelvic autonomic nerve preservation. Corresponding with the extent of nerve preservation, 10–78% of patient had an indwelling catheter 3 weeks after surgery. [46] In a prospective study of 150 patients undergoing surgery for rectal cancer, identification and preservation of the pelvic autonomic nerves decreased the rate of urinary dysfunction from 38.5 to 4.5%. Increased intraoperative blood loss was associated with difficulties in bladder emptying. [47]

Even with meticulous surgical technique, long-term urinary dysfunction may be experienced after radical pelvic surgery. The rate of urinary dysfunction after rectal surgery ranges from 33 to 70%. Injury to the parasympathetic autonomic nerves can result in detrusor hypoactivity, diminished bladder sensation, and overflow incontinence. Posterior tilting of the bladder, which may occur after APR as a result of weak posterior support, and inflammatory changes in the paravesical tissue can also result in emptying difficulties. [48–50] In the Dutch TME trial, 22.5% and 36% of patients reported difficulties in bladder emptying before and 3 months after surgery, respectively. The rate had subsequently stabilized at 18 months and remained at 30.6% after 5 years. Urinary function was unlikely to return after 18 months. [51] However, these numbers were not reproduced in other large-scale studies. The effect of neoadjuvant radiation therapy on urinary function has also been studied in the Dutch TME trial. The rate of voiding difficulties 5 years after surgery was 30.6% and was not different between the groups. [51]

Gynecologic Surgery

The incidence of urinary retention after hysterectomy ranges from 2 to 37%. In a prospective study evaluating the incidence of voiding dysfunction after vaginal or laparoscopic

hysterectomy for benign conditions, the overall rate of POUR was 13.7% and was 3 times higher in the vaginal approach, possibly due to preservation of uterosacral ligaments. [52] The results regarding POUR rates after laparoscopic versus open abdominal approach are mixed, and the studies assessing this question are limited by using different classifications for the extent of surgery. [53, 54]

Conventional radical hysterectomy for cervical cancer inevitably results in damage to the autonomic nerves in the hypogastric plexus and splanchnic nerves. [55] Given the excellent survival rates after radical hysterectomy for cervical cancer, nerve sparing approaches have gained popularity. Initially introduced in the 1960s, nerve sparing techniques have been revised several times, yielding at least five different classifications based on the extent of the dissection. [56–59] In a meta-analysis of 17 clinical trials, nerve sparing approach was associated with shorter time to bladder recovery, using different definitions based on bladder sensation, PVR, and patients' satisfaction. [60] In one study, 55% of the patients who underwent non-nerve sparing surgery were discharged with a urinary catheter, as opposed to 0–15% in nerve sparing techniques. [61] Patients who underwent bilateral nerve sparing surgery had a shorter time to catheter removal in comparison to patients who underwent a unilateral nerve sparing surgery (18 vs 9 days). [62]

Anesthesia and Analgesia

General and spinal/epidural anesthesia can cause urinary retention by suppressing the micturition at the level of the pons and by blocking the afferent and efferent neural transmission in the S2–S4 segments of the spinal cord, respectively. [63, 64] In minor, non-destructive surgeries, such as hernia repair and arthroplasty, the types of anesthesia and analgesia play a major role in the occurrence of POUR.

Short-term POUR seems to be more common in regional rather than general anesthesia; however, interpretation of the literature is limited by the variability in the types of surgeries. [1•] Spinal anesthesia is associated with higher rate of POUR in comparison to epidural anesthesia, especially with bilateral administration, higher infusion rates, long acting spinal anesthetics, and opioid use. [65–67] Similarly, higher infusion rates and concentrations were associated with higher risk of POUR in patients undergoing lower limb arthroplasty under epidural anesthesia. [68] The pharmacological properties of the anesthetic agents also affect the incidence of POUR. Lipophilic drugs such as fentanyl more easily distributed systemically, allowing a smaller local effect, while the effect hydrophilic drugs like morphine is mainly local. [69]

The risk for POUR can be decreased by employing a peripheral nerve block. Continuous femoral block has been shown to be equivalent to continuous epidural infusion and superior to patient controlled anesthesia in terms of pain

control, but was associated with significantly lower POUR after total knee arthroplasty and total hip arthroplasty. [70, 71] In patients undergoing herniorrhaphy or anorectal surgery, urinary retention is largely secondary to pain, leading to excessive sympathetic activity and pelvic floor spasm, respectively. In a retrospective study of 577 hernia repairs, the incidence of POUR was 0.5% and 2.4% with local and general anesthesia, respectively. [72] Perianal infiltration of local anesthetics is also recommended for benign anorectal conditions. [73]

Long-Term Squeal of POUR

Early POUR is multifactorial, resulting from anesthesia, analgesia, or post-operative pain. It usually resolves after removal of the inciting factor. Conversely, prolonged retention, beyond the immediate effect of surgery and anesthesia, can result from substantial and often irreversible damage to the urinary or nervous system. POUR can also develop in patient with severe pre-existing voiding problems that were not identified prior to the surgery.

While the incidence of urinary retention after low limb arthroplasty has been described in numerous studies, few studies reported on failure rate of initial catheterization requiring an indwelling catheter. Bjerregaard et al. reported that among patients who underwent TKA or THA, 0.5% needed an indwelling catheter after initial intermittent catheterization, but it is not specified for what duration. [25] Scholten et al. reported that 2.9% of patients who underwent lower limb arthroplasty were discharged home on intermittent catheterization or with an indwelling catheter. [28] In a small series by Elkhodair et al., two patients (2%) were discharged home with a suprapubic catheter. Both of these patients reported severe lower urinary tract symptoms before the surgery. [32] The literature regarding the natural history of urinary function after spine surgery is limited to spina bifida or spinal cord injury cases and does not include common fixation or decompression procedures. The short-term recovery of urinary function after lumbar spinal surgery was studied by Lee et al. and among 205 patients with POUR, 39% of the patients failed to void after 3 days and 8.8% after 7.5 days. [74•] No contemporary literature was identified with longer follow-up after spine surgery. In our experience, POUR may be a predictable outcome. We retrospectively reviewed all the data of male patient who underwent a TKA or THA in our institution between December 2008 and May 2014. We identified 1374 procedure in 1220 patient. This included 812 TKA and 562 THA. We reviewed their demographic, past medical, past urological, and perioperative variable and examined the risk of POUR after first voiding trial. Multivariable logistic regression model was used to identify independent predictors for POUR and a boot strapping and step wise elimination was

used to design a predictive nomogram. There incidence of POUR was 9.02% in 118 patients (90 knee, 34 hip, $p = 0.001$). On univariate analysis, patients who developed POUR were older ($p < 0.001$), had higher ASA score ($p = 0.007$), underwent knee replacement (0.001), less likely to be obese ($BMI > 35$) ($p = 0.04$), hypertensive ($p = 0.029$), with history of BPH ($p < 0.001$), or neurologic disorders ($p = 0.024$). On multivariable analysis age (60–69 years, $p = 0.023$, 70–79 years, $p = 0.008$, > 80 years, $p = 0.003$), knee replacement ($p = 0.014$), and history of BPH ($p = 0.013$) were independent predictors of POUR. A score was assigned to each predictor (total score = 31 point). The C-index of our nomogram was 0.65. There were three risk categories: 0–10, 11–17, and 19–24 points resulting in 2.8%, 8.0%, and 16.7% risk of retention, respectively. We have established a nomogram to predict risk of POUR in patient undergoing joint replacement surgery (Fig. 1).

The information regarding the long-term urinary outcome after rectal surgery is more robust than most other types of surgery, but the length of follow-up is variable. In a prospective study of 2355 patient undergoing colorectal surgery, POUR occurred in 1.7% and 9.1% of patients with colon and rectal cancer, respectively. Urinary catheter was required in 1.8% of the patients 1 month postoperatively and was associated with gender, American Society of Anesthesiologists’ score, tumor location, presence of drainage, and pelvic infection. [75•] Similarly, Kin et al. reported POUR in 21.9% of patient undergoing LAR and APR. Only 1.5% of the patients were discharged with a urinary catheter. [76] Studies that focused on postoperative urinary function in females showed higher incidence of chronic emptying problems: Tekkis et al. studied the urinary outcomes in women following rectal cancer surgery. After 5 years, 7% of the patients who underwent APR had chronic urinary retention requiring a urinary catheter or intermittent catheterization. [77] Similarly, Giacomo et al. reported on 436 patients who underwent bowel resection for

deep infiltrating endometriosis. Recto sigmoid and rectal resection were performed in 80.9% and 6.6%, respectively, in a nerve-sparing fashion. Early and late (30 days) POUR occurred in 19.9% and 9.5% of the patient, respectively. [78] The urodynamic changes after TME surgery were prospectively studied by Nesbakken et al. who reported that detrusor pressure, peak flow rate, and residual volumes were not different pre and postoperatively. In 4% of patients, diminished detrusor pressure was found after 3 months. [79]

These studies suggest that even with nerve sparing approach, a small but not insignificant proportion of patients will develop chronic urinary retention.

Prevention

There are several non-pharmacological and pharmacological measures that can be taken to reduce the risk of POUR. These are summarized in Table 3.

Non-pharmacological

Patients should void prior to the procedure to prevent bladder distention. Preoperative catheterization should be considered in long procedures or high-risk patients. Catheterization was shown to reduce POUR in older studies prior to the “fast track” era under general anesthesia. [17, 80] As mentioned earlier, the impact of intravenous fluids is controversial, but it is reasonable to limit the infused volume so that patients are adequately volume replete, and not beyond this. [81] There is also suggestion that limiting overzealous postoperative fluid intake (<250 mL) may reduce the need for catheterization from 14.5% to 3.5% however this was only demonstrated in a single cohort study. [82]

Early ambulation was shown to reduce the incidence of POUR from 41 to 18% after anal surgery under spinal

Fig. 1 A nomogram to predict risk of POUR in patient undergoing joint replacement surgery

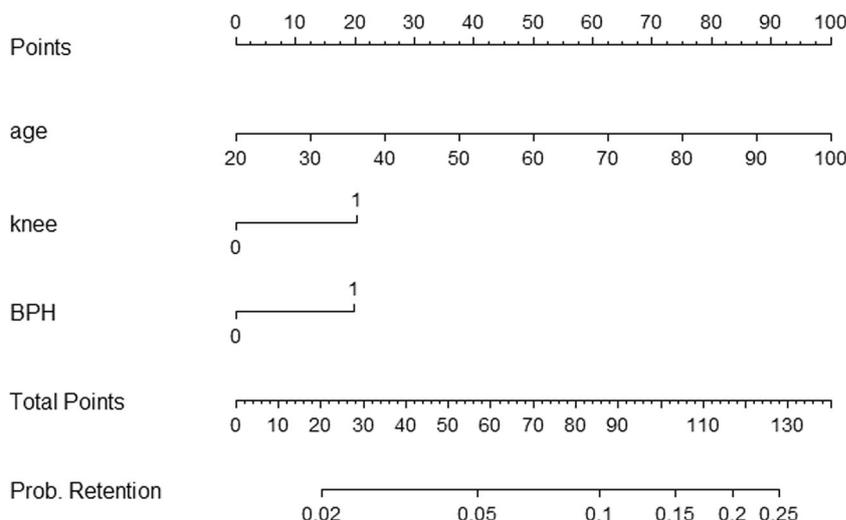


Table 3 Measures for prevention of urinary retention

Positive results	Negative results
<i>Non-pharmacological</i>	
Voiding prior to surgery	Electro acupuncture
Limit fluid intake preoperatively	Suprapubic vibratory stimulation
Early ambulation	Infrared radiation
Suprapubic hot packs	Postoperative anal packing
<i>Pharmacological</i>	
Phenoxybenzamine	Prazosin
Tamsulosin	Lorazepam
Alfuzosin	
Dexamethasone	
Drotarevine	

anesthesia. [81] A more specific question was answered by Hansen et al. who prospectively studied the role of early mobilization to the toilet to pass urine on the incidence of POUR. Among 152 patients, 52% and 19% in the control and intervention groups, respectively, developed POUR. [83•]

A handful of studies evaluated non-pharmacological interventions for the prevention of POUR. Electro acupuncture was studied in a group of 61 patients following spinal anesthesia. Patients in the control group have less bladder over distention and shorter time to voiding, but the incidence of POUR was not different from the control group. [84] The queen's square device is a hand held device that elicits suprapubic vibratory stimulus, resulting in improved bladder emptying in patients with neurogenic bladder. [85] It was prospectively evaluated among 41 patients who underwent major knee surgery. No statistically significant differences in rates of urinary retention could be demonstrated between the groups. [86] Placing either a hot pack or lukewarm-water-soaked gauze on the suprapubic region was shown to provide relief from urinary retention and to allow bladder emptying in comparison to no treatment. [87]

Pharmacological

The role of α -blockers in preventing urinary retention has been studied in various settings. This stems from studies from the 1980 that demonstrated that intraoperative phenoxybenzamine administration decreased the incidence of POUR after hernioplasty and colorectal surgery. [88, 89] The role of tamsulosin for prevention of POUR was studied in contemporary randomized controlled trial enrolling 95 patients undergoing spine surgery. In the treatment and control groups, respectively, 36% and 28% developed POUR ($p = 0.45$). [90] A Cochrane review from 2010 concluded that prazosin is not effective in preventing POUR, while tamsulosin decreased POUR rate after rectal cancer surgery by 12.5%. [91, 92] In a

prospective study comparing the prophylactic effect of tamsulosin, alfuzosin, and placebo, the rate of POUR was 5%, 6.7%, and 25%, respectively ($p < 0.05$). There was no statistically significant difference between the treatment groups. [93•]

Intraoperative dexamethasone has also been studied in this context. In a retrospective study of 979 patients who underwent laparoscopic inguinal hernioplasty, dexamethasone administration was associated with lower incidence of POUR in males (9.8% vs 3.7%). The effect was not dose dependent, and there was substantial heterogeneity between the intervention and control groups. [94]

Various cholinergic medications as well as benzodiazepines were used in clinical trials and did not reveal any significant impact on the rate of POUR, while drotaverine 40 mg, an antispasmodic drug structurally related to papaverin, showed clinical benefit in males. In a prospective study of 230 orthopedic patients, men in the treatment group had shorter time to micturition (441 vs 563 min) and less POUR events (6 vs 19%) in comparison to the control group. The mechanism of this effect was not discussed. [95–97]

Each of these measures has had variable reported benefits for POUR. They may be used safely as an adjunct to mitigate the risk of POUR given their non-invasive nature. Table 3 summarizes these interventions.

Conclusion

Urinary retention is common after non-urological surgeries. The literature assessing this condition is characterized by wide variations in the definitions of urinary retention. Male gender, old age, long operative time, and intraoperative fluid volume infusion are all well-established risk factors for POUR. In patients undergoing hernia repair or an orthopedic surgery, POUR is usually secondary to anesthesia, particularly when regional and is short lasting. Gynecological or colorectal surgeries are associated with prolonged or even permanent voiding dysfunction. In these cases, nerve sparing approach has proven to be superior in terms of urinary function. The literature regarding the natural history of POUR is sparse, but it seems that a very small fraction of the patients after orthopedic surgery or hernioplasty will need an indwelling catheter, as opposed to a more substantial portion after rectal surgery. Several strategies can reduce the risk for POUR, including early ambulation, regional anesthesia, and the use of alpha blockers perioperatively.

Compliance with Ethical Standards

Conflict of Interest Amihay Nevo, Abdul-Muhsin Haidar, Anojan Navaratnam, and Mitchell Humphreys declare that they have no conflict of interest.

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