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# *Management of Bladder Function after Outpatient Surgery*

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***Background:*** **This study was designed to test a treatment algorithm for management of bladder function after outpatient general or local anesthesia.**

***Methods:*** **Three hundred twenty-four outpatients, stratified into risk categories for urinary retention, were studied. Patients in category 1 were low-risk patients (n = 227) having non-pelvic surgery and randomly assigned to receive 10 ml/kg or 2 ml/kg of intravenous fluid intraoperatively. They were discharged when otherwise ready, without being required to void. Patients in category 2 (n = 40), also presumed to be low risk, had gynecologic surgery. High-risk patients included 31 patients having hernia or anal surgery (category 3), and 31 patients with a history of retention (category 4). Bladder volumes were monitored by ultrasound in those in categories 2–4, and patients were required to void (or be catheterized) before discharge. The incidence of retention and urinary tract symptoms after surgery were determined for all categories.**

***Results:*** **Urinary retention affected 0.5% of category 1 patients and none of category 2 patients. Median time to void after discharge was 75 min (interquartile range 120) in category 1 patients (n = 27) discharged without voiding. Fluids administered did not alter incidence of retention or time to void. Retention occurred in 5% of high-risk patients before discharge and recurred in 25% after discharge.**

***Conclusion:*** **In reliable patients at low risk for retention, voiding before discharge appears unnecessary. In high-risk patients, continued observation until the bladder is emptied is indicated to avoid prolonged overdistention of the bladder. (Key words: Anal surgery; hernia; residual volume; ultrasound; urinary retention.)**

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BLADDER function is a concern in the treatment of patients after outpatient surgery. It is known that certain types of anesthesia, surgery, analgesics, anticholinergics, and underlying medical conditions may predispose patients to development of urinary retention after surgery.[1,2] Voiding has traditionally been considered a prerequisite to discharge after outpatient surgery. However, the value of requiring patients to void has been questioned.[3] At issue is a concern that patients may develop urinary retention and an overdistended bladder after discharge. Overdistention can cause bladder atony that is temporary or may become permanent.[4-6] Conversely, it is also possible that requiring patients to void before discharge may simply prolong the recovery process unnecessarily.

In a previous study of factors that affected discharge time, requiring patients to void before discharge resulted in a delay of discharge in 5-6% of patients after general, local, or peripheral nerve block.[7] In another study, urinary retention was reported in 0% of outpatients having non-pelvic surgery under general or local anesthesia, 4% having gynecologic surgery, 18% after hernia surgery, and in 25% after anal surgery.[8] Based on the results of these previous studies, we hypothesized that voiding before discharge is unnecessary in patients who are at low risk for retention. A second hypothesis was that liberal intravenous fluids do not cause urinary retention in patients without underlying risk factors for retention. A third postulate was that patients at increased risk for retention should be required to void or be catheterized before discharge to avoid prolonged overdistention of the bladder after discharge.

This study was designed to test the previously described hypotheses. A treatment algorithm for management of bladder function was designed that permitted low-risk patients to leave without voiding if otherwise fit for discharge. In high-risk patients (patients having hernia or anal surgery or with a history of retention), bladder volume was monitored by ultrasound, and patients were required to void before discharge or were catheterized if unable to void at a bladder volume more than

600 ml. Gynecologic patients were also monitored and required to void before discharge.

The outcomes assessed were the incidence of urinary retention (unable to void at a bladder volume > 600 ml), the incidence of discharge without voiding, the time required to void (either before or after discharge), the incidence of repeat retention (re-retention) after discharge, and the incidence of new onset urinary tract symptoms after surgery. Within the low-risk group, outcomes were compared in patients randomly assigned to receive high or low fluids during surgery. The effects of anticholinergic use and opioid dose were also assessed retrospectively in the low-risk group.

## Methods and Materials

Approval to perform this study was obtained from the Institutional Review Board at the University of Washington School of Medicine.

*Subjects*

All patients signed a written consent to participate. The subjects studied were patients undergoing elective outpatient surgery at the University of Washington Medical Center or at Harborview Medical Center from September 1996 to January 1998. Patients solicited for study were aged more than 18 yr, of either sex, American Society of Anesthesiologists physical status I-III, who met the criteria for the categories defined here.

Category 1: Low-risk patients (n = 222): patients having non-pelvic surgery under general, local, or peripheral nerve block anesthesia.

Category 2: Possible low-risk patients (n = 40): patients having vaginal or pelvic gynecologic surgery under general anesthesia.

Category 3: Patients high risk by surgery (n =31): patients having hernia (n = 21) or anal surgery (n = 10) under general or local anesthesia.

Category 4: Patients high risk by history (n = 31): patients having general, local, or peripheral nerve block anesthesia, with a history of urinary retention on one or more occasions in the past.

*Methods*

The experimental protocol was as follows. Patients who met the previously listed criteria completed a questionnaire before surgery regarding any previous history of urinary retention and the presence or absence of urinary tract symptoms in the 5 days preceding surgery. Symptoms elicited included frequency, nocturia, hesitancy, urgency, weak stream, dysuria, incontinence, enuresis, and inability to empty the bladder fully. Patients were encouraged to void before surgery, and preoperative urine volumes were measured by ultrasound using the Bladder Scan BVI 2500 (Diagnostic Ultrasound, Redmond, WA).

Patients in the low-risk category were assigned to a high or low fluid group using randomized permuted blocks of six. Depending on group assignment, the primary anesthesia caregiver was requested to administer fluids during surgery in an amount equal to (± 25%) 250 ml plus 10 ml/kg of Ringer's lactate solution (high fluids group) or 250 ml plus 2 ml/kg (low fluids group) during surgery. In the remaining categories (2-4), rates of fluid administration were left to the discretion of the anesthesiologist providing care.

After surgery, bladder volume was measured by ultrasound on entry to a recovery unit, at time of transfer to phase 2 care, and at hourly intervals thereafter until voiding occurred or until patients were catheterized for inability to void at full bladder capacity (bladder volume > 600 ml). Ultrasound measurements of bladder volume were made by a trained research technologist. At the same times, patients were requested to estimate their bladder volume using the following criteria: 1 = bladder feels empty, no urge to void; 2 = bladder feels moderately full, could probably void; 3 = bladder feels stretched, somewhat uncomfortable, possibly painful, strong urge to void. After the first spontaneous void, post-void residual volume was measured by ultrasound. Fluids were administered postoperatively by nurses at their discretion. Nurses were aware of the results of ultrasound measurements of bladder volume. The volume of fluid administered was recorded as well as the type and duration of anesthesia and surgery, the type and dose of anesthetics, opioids, and anticholinergics received during surgery.

Category 1 patients were allowed to be discharged without voiding if otherwise fit for discharge. Patients in categories 2-4 were required to void before discharge. If retention developed (unable to void at a bladder volume > 600ml), the bladder was either partially drained by in-out catheterization and patients were requested to stay until spontaneous voiding occurred, or alternatively, at the discretion of the patient's physician, the bladder was completely emptied and patients were allowed to go home. All patients were instructed to return to a hospital if unable to void within 8-12 h of discharge. Subsequently, patients were questioned by phone at

**Table 1. Patient Demographics**

| Category | Randomized Low Risk | | Nonrandomized Low Risk | | | High Risk | | |
|---|---|---|---|---|---|---|---|---|
| | High Fluids | Low Fluids | Fluids >900 ml | Fluids <900 ml | Gynecology | Hernia Surgery | Anal Surgery | History |
| n | 79 | 44 | 89 | 133 | 40 | 21 | 10 | 31 |
| Age (yr) | 40 ± 13 | 39 ± 14 | 42 ± 13 | 40 ± 13 | 35 ± 10 | 45 ± 15 | 34 ± 8 | 44 ± 15 |
| Height (cm) | 173 ± 10 | 175 ± 12 | 173 ± 10 | 173 ± 10 | 165 ± 8 | 178 ± 10 | 175 ± 10 | 173 ± 10 |
| Weight (kg) | 79 ± 17 | 81 ± 16 | 82 ± 18 | 77 ± 17 | 70 ± 15 | 81 ± 14 | 82 ± 13 | 91 ± 24 |
| Surgery duration (min)* | 99 ± 42 | 81 ± 27 | 113 ± 48 | 85 ± 31 | 104 ± 43 | 132 ± 30 | 87 ± 14 | 103 ± 49 |
| % female | 42 | 30 | 37 | 45 | 100 | 10 | 10 | 42 |
| % MAC | 8 | 14 | 4 | 15 | 0 | 10 | 10 | 13 |
| % PNB | 14 | 20 | 8 | 14 | 0 | 0 | 0 | 10 |
| % GA | 78 | 66 | 88 | 71 | 100 | 90 | 90 | 77 |

MAC = local anesthesia with monitored anesthesia care and sedation; PNB = peripheral nerve block; GA = general anesthesia.

Values are mean ± SD or %.

* Duration of surgery was from the time into the operating room to the time out of the operating room.

24 h and 5 days, regarding whether they had experienced urinary tract symptoms after discharge or had required a return visit to hospital for management of retention.

The pre- and postoperative questionnaires relating to bladder symptoms were used to determine the presence of preexisting bladder dysfunction and the incidence of new onset symptoms. (Symptoms were considered new when the number of days a symptom was present postoperatively exceeded the number of days the same symptom was present preoperatively).

*Statistical Analysis*

Means for categorical data were compared by analysis of variance, with *post hoc* Bonferroni-Dunn test. Medians were compared by Kruskall-Wallis with Mann-Whitney U test for individual pairwise comparisons. Proportions were compared by chi-square or Fisher exact test when appropriate. An overall $P$ value of 0.05 was considered significant.

## Results

The demographic characteristics of the patients studied are shown in table 1. In table 2, results are summarized by risk category for time to void, bladder volumes at time of voiding, and incidence of retention. In the low-risk category, only one patient was classified as having urinary retention. This patient was catheterized for 600 ml by her request immediately on emerging from general anesthesia. Of 109 patients randomized to the low fluids group, 57 (53%) received fluids that exceeded 125% of protocol requirements. In 113 patients randomized to the high fluids group, 20 patients (18%) received less than 75%, and 14 patients (12%) received more than 125% of desired fluids. Because of frequent protocol violations, we analyzed the data relating to the effects of fluid in two different ways. The first analysis compared only patients randomized to high or low fluid groups who actually received 75–125% of fluids required by protocol. In a second analysis, comparisons were made between patients who received greater or less than 900 ml of fluid during surgery regardless of randomization status. The value selected (900 ml) for dividing patients into groups was the average fluid allotment required by protocol for patients randomized to the high fluids group.

Using either method of analysis, there was no difference in the time required to void between high and low fluid groups (table 2). The median bladder volume at the time of voiding was greater in patients who received more than 900 ml of fluid as compared with those who received less.

Overall, there was a significant positive correlation between the volume of fluid infused intraoperatively and bladder volume attained at the end of surgery ($R^2$ = 0.082, $P < 0.0001$), and between total fluids received and bladder volume measured just before voiding ($R^2$ = 0.064, $P = 0.0005$; fig. 1).

Twelve percent of low-risk patients, otherwise fit for discharge, were permitted to leave without voiding (table 2). Their median time to void after discharge was 75

**Table 2. Time and Volume Required to Void and % Incidence of Urinary Retention**

| | Randomized Low Risk | | Nonrandomized Low Risk | | | High Risk | | |
|---|---|---|---|---|---|---|---|---|
| Category | High Fluids | Low Fluids | Fluids >900 ml | Fluids <900 ml | Gynecology | Hernia Surgery | Anal Surgery | History |
| n | 79 | 44 | 89 | 133 | 40 | 21 | 10 | 31 |
| Time to first void/cath (min) | | | | | | | | |
| Mean ± SD | 109 ± 72 | 92 ± 58 | 111 ± 69 | 95 ± 61 | 108 ± 66 | 129 ± 85 | 178 ± 99 | 123 ± 66 |
| Median ± IQ | 100 ± 83 | 88 ± 53 | 100 ± 80 | 90 ± 61 | 95 ± 84 | 140 ± 135 | 170 ± 90 | 125 ± 84 |
| Bladder volume at 1st void/cath (ml) | | | | | | | | |
| Mean ± SD | 350 ± 175 | 306 ± 189 | 429 ± 210 | 305 ± 174* | 131 ± 129 | 355 ± 160 | 295 ± 226 | 351 ± 228 |
| Median ± IQ | 331 ± 229 | 270 ± 195 | 400 ± 296 | 280 ± 200* | 97 ± 209 | 341 ± 175 | 200 ± 382 | 311 ± 200 |
| % Urinary retention and catheterization | | | | | | | | |
| Before discharge | 0 | 0 | 0 | 0.8 | 0 | 5‡ | 10‡ | 3‡ |
| After discharge | 0 | 0 | 0 | 0 | 0 | 0§ | 20§ | 0§ |
| Intraoperative fluids (ml) | 978 ± 185 | 428 ± 70† | 1,173 ± 294 | 577 ± 180* | 1,146 ± 422 | 1,129 ± 319 | 920 ± 374 | 924 ± 437 |
| Total fluids at 1st void (ml) | 1,387 ± 399 | 750 ± 263† | 1,612 ± 438 | 908 ± 303* | 1,610 ± 621 | 1,662 ± 659 | 2,128 ± 884 | 1,412 ± 671 |

Values are mean ± SD or %.

* $P$ = <0.0001 *versus* nonrandomized low-risk category, who received fluids >900 ml.

† $P$ = <0.0001 *versus* high fluid group in randomized low-risk category.

‡ $P$ = 0.034 for all high-risk categories combined *versus* all low-risk patients.

§ $P$ = 0.047 for all high-risk categories combined *versus* all low-risk patients.

min (interquartile range 120). The distribution of patients discharged without voiding was 9% for those receiving general anesthesia, 23% for those receiving peripheral blocks, and 21% for those receiving local with monitored anesthesia care.

In the gynecology category, none of the patients developed retention before or after discharge; 90% were catheterized intraoperatively. As a result, bladders were nearly empty, and bladder volumes at the time of voiding were lower than in all other categories.

In the combined high-risk categories (hernia or anal surgery and history of retention groups), the incidence of retention before discharge was greater than in the low-risk category (5% *vs.* 0.5% respectively, $P = 0.034$; table 2). In hernia patients, with a 5% incidence of retention before discharge, none developed retention after discharge. After anal surgery, one patient catheterized for retention before discharge developed a second episode of retention after discharge that was treated by continuous catheter drainage for 3 days. This patient had been discharged after a first catheterization without subsequently being required to void spontaneously. A second patient voided 10 ml before discharge and went home with a residual volume of 418 ml. This patient returned the same evening with painful retention that was treated by 3 days of continuous catheter drainage. Overall, the initial incidence of retention was 20%, and the rate of re-retention was 50% after anal surgery. In patients presumed at high risk because of a history of retention, only one developed retention (3%), with no episodes after discharge.

In table 3, patient's estimates of bladder fullness are presented in relation to ultrasound measurements of bladder volume. Overall, 61% of patients with a volume exceeding full bladder capacity (600 ml) failed to experience discomfort or an urgent desire to void. In figure 2, post-void residual volumes are shown in relation to the maximum bladder volume attained before voiding. This figure demonstrates that in some patients, post-void residual volume was still near normal bladder capacity after a single spontaneous void.

In table 4, the incidence of high post-void residual volumes (> 300 ml) and new onset symptoms are presented for low- risk patients in relation to maximum bladder distention, intraoperative fluids, use of anticholinergics, and dose of opioids (fentanyl). In low-risk patients, increased fluid administration and anticholinergic use were associated with increased symptomatology and higher residual volumes; fentanyl, > 150 μg, was associated with a slight delay in voiding.

In high-risk patients, new symptoms were more common, and residual volumes were greater than in low-risk patients (table 5). There was also an association between achieving a maximum bladder volume of more than 600 ml (= retention) and having a high post-void residual urine volume. This relationship was not observed in

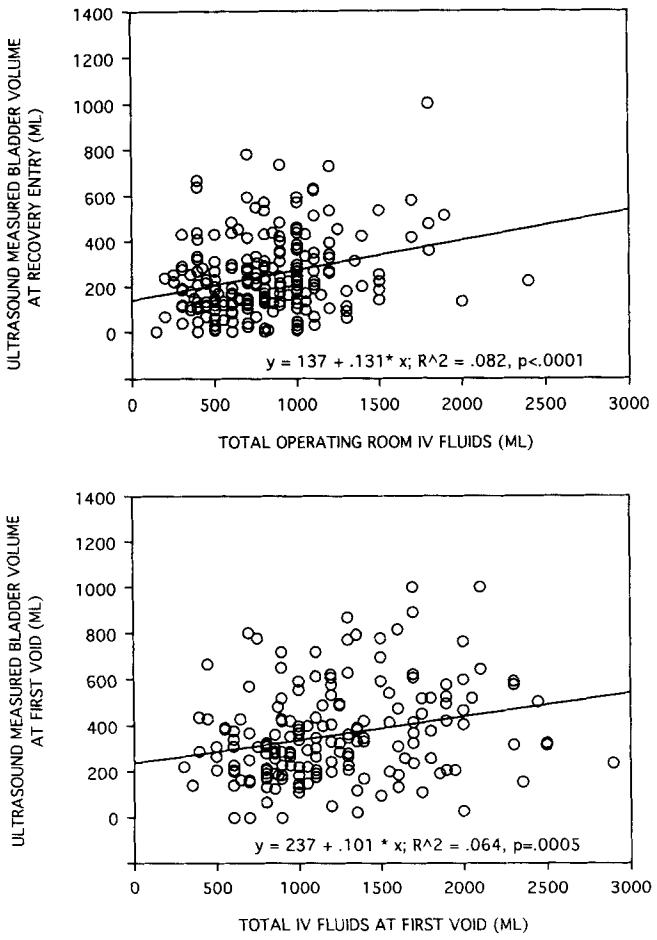


**Fig. 1. The relationship of fluids administered to measured bladder volume. (*Upper*) Total intraoperative fluids *versus* bladder volume at recovery room entry. (*Lower*) Total intravenous fluids received until first voiding *versus* bladder volume at the time of first voiding. Values of $R^2$ are shown in each panel.**

low-risk patients and suggests that overdistention in high-risk patients is more likely to be associated with high post-void residual volumes. The effects of fentanyl dose and anticholinergics (not shown in the table) were qualitatively similar to those observed in low-risk patients but, because of fewer patients, were not statistically significant.

## Discussion

The results of this study support the hypothesis that patients at low risk for urinary retention do not benefit from being required to void before discharge. All patients, with one exception, voided spontaneously either before or after discharge with no evidence of urinary retention. Patients who were discharged without voiding on average voided approximately 75 min after discharge without problem. This is consistent with the results of a previous study in which 229 low-risk patients had a similarly low rate of retention (0%).[8] Increasing the amount of fluid administered to low-risk patients did not increase the incidence of retention or hasten the time to voiding, but it did increase the amount of urine in the bladder when they were first able to void. It also increased the incidence of urinary tract symptomatology after discharge and the likelihood of having a high post-void residual volume. Thus, it would appear that voiding before discharge is unnecessary and that attempts to hasten the onset of voiding by fluid administration simply increase the likelihood of developing minor urinary tract symptoms after surgery. The savings realized in terms of recovery time by allowing patients to be discharged without voiding approximated 75 min per patient in 12% of patients who were otherwise ready for discharge.

In patients having gynecologic surgery and intraoperative catheterization, our results indicate there is no significant increased risk of urinary retention compared with low-risk patients. Therefore, these patients may be treated as low-risk patients—assuming they have no other risk factors for retention. This finding is consistent with the results of a previous study.[8]

In high-risk patients having hernia or anal surgery or with a history of retention, our study indicates there is a significant risk of urinary retention immediately after surgery (5%) compared with low-risk patients. However, when patients who did develop retention were treated by bladder drainage within 1–2 h, only one of four subsequently developed a second episode of retention (re-retention) after discharge. Of interest, 61% of patients with a bladder volume exceeding 600 ml were unaware of having a very distended bladder (*i.e.*, did not

**Table 3. Patient Estimates of Bladder Volume**

| Patient Evaluation | Ultrasound Measured Bladder Volume | |
|---|---|---|
| | ≥600 ml | <600 ml |
| Grade 1 | 0 (0) | 28 (12) |
| Grade 2 | 19 (61) | 189 (81) |
| Grade 3 | 12 (39) | 17 (7) |
| Total | 31 (100) | 234 (100) |

Grade 1 = bladder feels empty, no urge to void; Grade 2 = bladder feels moderately full, could probably void; Grade 3 = bladder feels stretched, somewhat uncomfortable, possibly painful, strong urge to void.

Values are n (%).

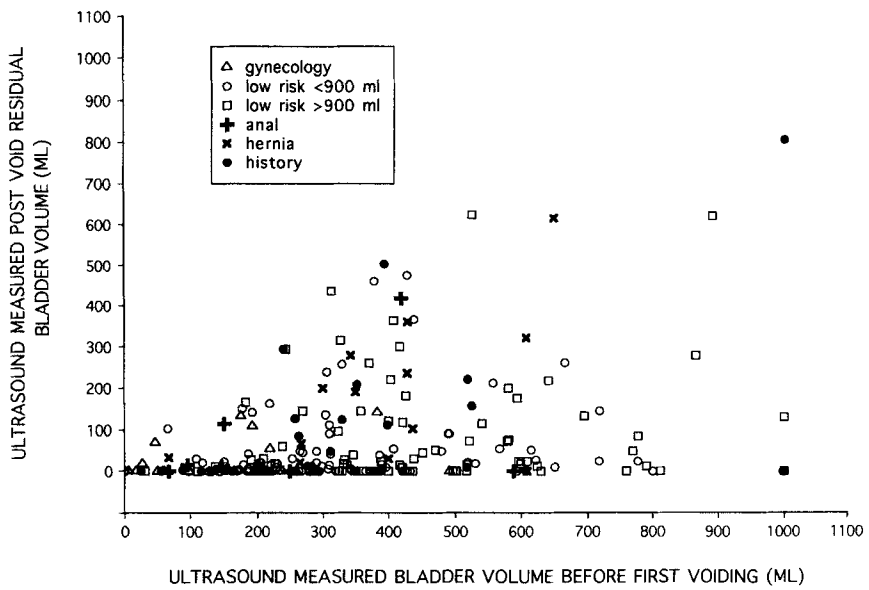


**Fig. 2. Postvoid residual volumes in relation to prevoid measured bladder volume. Risk categories of individual patients are indicated in the legend on the figure.**

have discomfort or a strong urge to void). This is consistent with a report by Stallard and Prescott of painless retention in 61% of patients with retention after general surgery operations.[9] Overall, the results of our study suggest that monitoring of bladder volume is useful in the detection and management of urinary retention in high-risk patients. Once catheterized for retention, the incidence of re-retention was still significant (25%). It may be justifiable to allow reliable patients who have been treated for retention to go home without requiring them to refill their bladder and void spontaneously. However, they should be made aware that there is a significant risk of re-retention, and they should seek medical assistance if unable to void within a further 8 h.

**Table 4. Incidence of High Residual Volume and New Symptoms in Low-risk Patients as a Function of Bladder Distention, Fluids Administered, Use of Anticholinergics, and Fentanyl**

| | n | Time to Void/Cath (min) | Residual Volume (ml) | % Incidence Residual Volume ≥300 ml | % Incidence of New Onset Symptoms | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Frequency | Nocturia | Weak Stream | Hesitancy | Urgency |
| All low risk | 221 | 102 ± 65 | 61 ± 110 | 5 | 20 | 17 | 8 | 10 | 8 |
| Maximum bladder distention | | | | | | | | | |
| <600 ml | 159 | 104 ± 65 | 57 ± 107 | 5 | 22 | 19 | 9 | 9 | 9 |
| ≥600 ml | 24 | 100 ± 55 | 88 ± 141 | 4 | 25 | 13 | 4 | 21 | 13 |
| Intraoperative fluids | | | | | | | | | |
| Randomized | | | | | | | | | |
| Low fluids | 44 | 92 ± 58 | 40 ± 85 | 2 | 11 | 16 | 5 | 5 | 5 |
| High fluids | 79 | 109 ± 72 | 51 ± 107 | 4 | 22 | 15 | 10 | 13 | 10 |
| Nonrandomized | | | | | | | | | |
| <900 ml | 109 | 95 ± 61 | 44 ± 89 | 3 | 14 | 14 | 7 | 6 | 5 |
| ≥900 ml | 86 | 111 ± 69 | 81 ± 129† | 7 | 28‡ | 21 | 10 | 14† | 13† |
| Anticholinergics* | | | | | | | | | |
| No | 123 | 114 ± 56 | 49 ± 88 | 3 | 23 | 20 | 7 | 11 | 5 |
| Yes | 33 | 133 ± 82 | 106 ± 167‡ | 13† | 19 | 22 | 22‡ | 24‡ | 9 |
| Fentanyl* | | | | | | | | | |
| ≤150 μg | 65 | 103 ± 54 | 48 ± 86 | 3 | 12 | 10 | 7 | 7 | 5 |
| >150 μg | 91 | 128 ± 66‡ | 70 ± 126 | 6 | 30‡ | 28‡ | 12 | 15 | 10 |

Values are mean ± SD or %.

* For comparison of anticholinergics and fentanyl dose, only general anesthesia patients were considered.

† $P$ = ≤0.05–>0.01 *versus* the mean values of the same parameter in the comparator group located on the line directly above.

‡ $P$ = ≤0.01–0.001 *versus* the mean values of the same parameter in the comparator group located on the line directly above.

**Table 5. Incidence of High Residual Volumes and New Symptoms in High-risk Patients as a Function of Bladder Distention, Intraoperative Fluids, and Risk Category for Retention**

| | n | Time to Void/Cath (min) | Residual Volume (ml) | % Incidence Residual volume ≥300 ml | % Incidence of New Onset Symptoms | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Frequency | Nocturia | Weak Stream | Hesitancy | Urgency |
| All low risk | 221 | 102 ± 65 | 61 ± 110 | 5 | 20 | 17 | 8 | 10 | 8 |
| All high risk* | 61 | 133 ± 79‡ | 110 ± 171† | 11 | 30 | 18 | 20‡ | 21‡ | 11 |
| Maximum bladder distention | | | | | | | | | |
| <600 ml | 46 | 139 ± 62 | 89 ± 126 | 7 | 35 | 24 | 20 | 20 | 13 |
| ≥600 ml | 7 | 129 ± 159 | 290 ± 353‡ | 50‡ | 14 | 0 | 0 | 0 | 0 |
| Intraoperative fluids | | | | | | | | | |
| <900 ml | 21 | 122 ± 93 | 111 ± 175 | 12 | 14 | 5 | 14 | 5 | 0 |
| ≥900 ml | 40 | 139 ± 73 | 110 ± 172 | 11 | 38 | 25† | 23 | 30† | 18 |
| High-risk category | | | | | | | | | |
| Hernia | 21 | 129 ± 85 | 146 ± 167 | 16 | 48 | 19 | 29 | 38 | 24 |
| Perianal | 9 | 178 ± 99 | 70 ± 146 | 13 | 22 | 11 | 22 | 11 | 11 |
| History | 31 | 123 ± 66 | 98 ± 182 | 7 | 19 | 19 | 13 | 13 | 3 |
| Gynecology | 40 | 108 ± 66 | 24 ± 57 | 0 | 18 | 18 | 10 | 10 | 5 |

Values are mean ± SD or %.

* High risk includes hernia and anal surgery, and high risk by history.

† $P$ = ≤0.05–>0.01 *versus* the mean values of the same parameter in the comparator group located on the line directly above.

‡ $P$ = ≤0.01–0.001 *versus* the mean values for the same parameter in the comparator group located on the line directly above.

Our study also demonstrates that some patients who are able to void spontaneously still have a large post-void residual volume (> 600 ml). Patients at risk for retention who are discharged with a residual volume already approaching full bladder capacity would be predicted to be at considerable risk of overdistention after discharge. Ultrasound measurement of post-void residual volume facilitates identifying such patients, who could then be monitored for an extended time or catheterized if ultimately unable to empty their bladder more fully. Animal studies suggest that overdistention persisting for as few as 4–24 h can be associated with a reduction in the number of cholinergic receptors in the bladder wall and alteration of contractile function.[10]

The incidence of retention after hernia repair in this study (5%) is somewhat lower than reported by Kozol *et al.* (9–15%), or by Petros (19%) but is similar to the results quoted by other studies (3% by Stallard and Prescott).[9,11–13] This variability may reflect differences in anesthetic or surgical techniques or methods of diagnosis and treatment. It may also be related to monitoring of bladder volume in our patients because nurses were aware of bladder volume and may have limited fluids in patients with bladders that were already near capacity.

The incidence of urinary retention after perianal surgery observed in our study (10–20%) is consistent with other reports in the literature of 0–19%.[14–16] Barone suggested that retention under these circumstances was related to functional outlet obstruction based on urodynamic studies of patients with retention after anorectal surgery.[17] It was hypothesized that obstruction was a result of increased sympathetic outflow to the bladder in response to pain or distention. Normally, relaxation of the internal sphincter of the bladder requires reflex inhibition of sympathetically mediated contraction. The role of fluid administration as a factor contributing to retention has been emphasized by Campbell and by Bailey.[15,18] Both advocated extreme fluid restriction in the perioperative period to avoid development of urinary retention. As an example, Campbell proposed limiting total fluids (oral and intravenous) to 75 ml in the first 24 h after surgery, following an overnight fast for liquids.[18] Whether this degree of dehydration is beneficial or desirable in all patients is not totally clear. Campbell and Bailey both reported no adverse consequences in 100 patients in one study and 228 patients in another. However, there was no evaluation of renal function in either study. Nor is it known how renal function would be affected by the combined use of dehydration and nonsteroidal antiinflammatory drugs, which are commonly used to manage pain. The latter were not commonly used when the studies by Campbell and Bailey were conducted. However, it would seem desirable to avoid administering excessive quantities of intravenous fluid intraoperatively because of the observed effects on bladder volume after surgery.

Based on the results of this study, we draw the following conclusions.

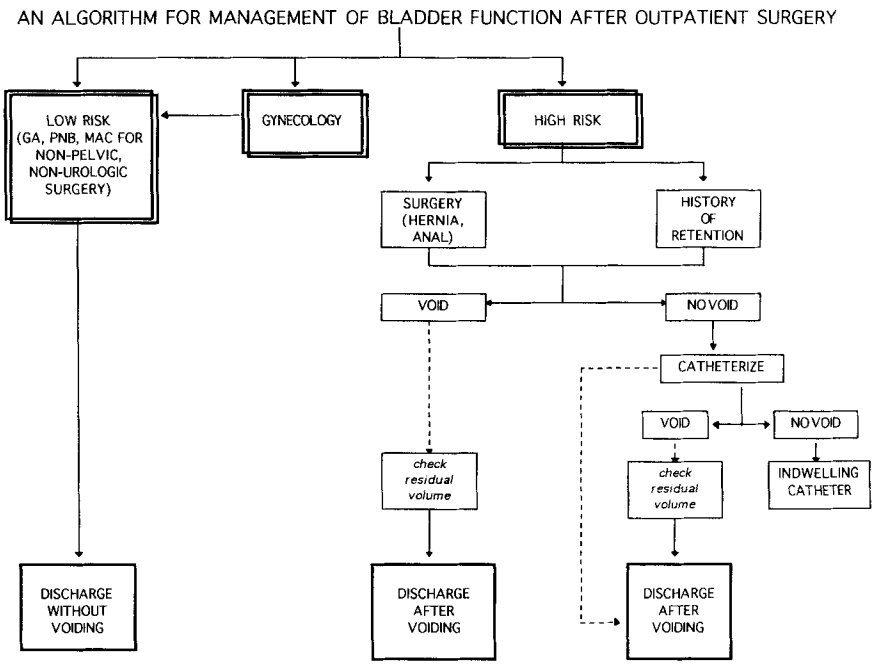


**Fig. 3. Suggested algorithm for managing bladder function after outpatient surgery. GA = general anesthesia, PNB = peripheral nerve blocks not involving lumbo sacral nerves, MAC = local anesthesia with monitored anesthesia care. A dashed line indicates that high-risk patients who are catheterized for retention have a high risk of re-retention. If they are permitted to leave without voiding, they should be instructed that they have a 25% chance of re-retention and should seek medical aid if unable to void in a further 8 h. High postvoid residuals may be identified by ultrasound measurements of bladder volume after voiding.**

1. Patients in low-risk categories should not be required to void before discharge. Approximately 12% of patients may be affected by modification of policy, and recovery time saved may approximate 75 min in affected patients.
2. Patients undergoing routine outpatient gynecologic surgery should be considered and treated as low risk for retention.
3. Patients at high risk should be observed, bladder volume monitored by ultrasound, and the bladder drained if unable to void with a bladder volume $\geq$ 600 ml. Alternatively, if ultrasound is not available, they should have their bladder evacuated if unable to void when otherwise ready for discharge. Subsequently, if they will have ready access to a medical facility and are reliable, they could be discharged but cautioned to return if unable to void within a further 8 h.
4. Patients in all risk categories should receive fluid in judicious amounts to avoid overdistending the bladder before patients are ready to void, particularly in patients at high risk for retention. The time patients are able to void appears to be related to a variety of factors, including the type of anesthesia and surgery as well as individual responses to drugs and painful stimuli. Excessive fluid administration does not appear to hasten the onset of voiding, but rather increases bladder volume so that retention may be more likely.
5. All patients should be cautioned to return to a medical facility if unable to void within 8–12 h of discharge.

These suggestions are presented in the form of an algorithm for management of bladder function after outpatient surgery in figure 3. Further testing of the algorithm in a large number of patients would be desirable to validate the safety of permitting low-risk patients to leave without voiding.

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