Ambulatory Surgery Patients May Be Discharged before Voiding after Short-acting Spinal and Epidural Anesthesia

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Background: Voiding before discharge is usually required after outpatient epidural or spinal anesthesia because of concern about bladder overdistention and dysfunction. Shorter duration spinal and epidural anesthesia may allow return of bladder function before overdistention occurs in low-risk patients (those younger than age 70, not having hernia, rectal, or urologic surgery, and without a history of voiding difficulty), and predischARGE voiding may not be necessary.

Methods: After institutional review board approval and informed consent, 201 low-risk ambulatory patients were prospectively studied in either a standard or accelerated pathway after undergoing spinal or epidural anesthesia with procaine, lidocaine, 2-chloroprocaine, or less than 7 mg bupivacaine; epinephrine was not used in any anesthetic. Standard pathway patients (n = 70) were required to void before discharge. Accelerated pathway (n = 131) patients were not required to void. (After randomization of an initial 163 patients to one of the two tracks, 32 additional patients were assigned to the accelerated pathway.) If accelerated pathway patients voided, they were discharged when all other discharge criteria were met. If they did not spontaneoualy void after block resolution, a bladder ultrasound (BUS) was performed. If the BUS indicated a urine volume of less than 400 ml, the patients were discharged and instructed to return to the emergency department if they were unable to void within 8 h of discharge. If the BUS indicated a urine volume of greater than 400 ml, the patients were reassessed in 1 h and were discharged if they could void spontaneously. If they could not void spontaneously, they were catheterized to facilitate discharge. All patients were contacted the next day to assess the return of normal bladder function.

Results: All standard pathway patients voided without difficulty, and were discharged in 153 ± 49 (SD) min. 62 patients in the accelerated pathway voided spontaneously after resolution of their block and were discharged in 127 ± 41 min. 46 patients were discharged with a BUS less than 400 ml in 120 ± 42 min. 23 patients had a BUS greater than 400 ml; of these, 20 patients voided within an hour and were discharged in 162 ± 45 min. Three were catheterized after 1 h, and were discharged in 186 ± 61 min. Mean discharge time for all patients in the accelerated pathway was 22 min shorter than the standard pathway (P = 0.002). No patients had difficulty voiding or returned to the hospital for urinary problems. None reported new urologic symptoms.

Conclusions: Delay of discharge after outpatient spinal or epidural anesthesia with short-duration drugs for low-risk procedures is not necessary, and may result in prolonged discharge times.

LONG-ACTING spinal anesthetics with bupivacaine and tetracaine delay the return of bladder function beyond the resolution of sensory anesthesia, and may lead to distention of the bladder beyond its normal functioning capacity.¹ This may cause urinary retention, or possibly even bladder damage.² Because of this potential, it is customary to insert bladder catheters in the presence of prolonged spinal or epidural anesthesia. This concern has been extended to outpatient surgery,³ where the traditional requirement for patients to void after spinal and epidural anesthesia often delays discharge.⁴ In contrast, voiding is not considered a requirement after outpatient general anesthesia, especially if bladder volume monitoring with ultrasound is available.⁵ With shorter duration spinal or epidural anesthetics, bladder function returns to normal before overdistention.⁶ Clinical comparative reports show that the use of shorter acting local anesthetics for spinal or epidural anesthesia is associated with a lower frequency of bladder catheterization⁷ and has not been associated with urinary retention in outpatient surgery.⁸⁻¹² We hypothesized that for patients undergoing procedures at low risk for urinary retention using short-acting spinal or epidural anesthesia, discharge from the hospital before voiding would accelerate discharge and not be associated with a significant risk of postdischarge retention requiring return to the hospital.

Methods

After institutional review board approval (Virginia Mason Research Center, Seattle, WA) and informed consent, ambulatory surgical patients between June 3, 1999 and March 14, 2000, were prospectively evaluated in either a “standard” pathway or “accelerated” pathway in the postanesthesia care unit (PACU) after a short-acting spinal or epidural anesthetic. Anesthetic techniques were limited to spinal anesthesia with procaine, lidocaine, or 6 mg or less of bupivacaine; or epidural anesthesia with 2-chloroprocaine or lidocaine. The specific techniques were at the discretion of the anesthesia care team, who were not aware of the evaluation group, and there was no attempt (except with bupivacaine) to control the dose or frequency of reinjection of epidural catheters. The only restriction was that epinephrine was not used in any anesthetic mixture,¹³,¹⁴ and patients taking anticholinergic medications were excluded. Patients were evaluated by one of the investigators before surgery, and those undergoing procedures associated with a high risk of urinary retention (hernia repair,
rectal, or urologic surgery), older than 70 years of age, or with previous voiding difficulty were excluded from participation.

Standard pathway patients, in addition to the standard discharge criteria (progressive attainment of an Aldrete score greater than 10 [including alertness and stable vital signs], pain control, absence of nausea, ability to stand), were required to void before discharge after resolution of their central neuraxial blockade. The block was considered resolved when patients had full return of sensation in the perianal area and normal proprioception in the feet and were able to ambulate. Accelerated pathway patients were asked if they felt an urge to void after block resolution. If so, and they voided, they were discharged after return of normal bladder function. If not, a bladder ultrasound (BUS) was performed using a Bladder Manager PCI 5000 (Diagnostic Ultrasound, Redmond, WA). If the BUS indicated a urine volume of less than 400 ml, the patients were reassessed in 1 h and were discharged if they met all other discharge criteria. Patients discharged without voiding were instructed to return to the emergency department if they were unable to void within 8 h after discharge. If the BUS indicated a urine volume of greater than 400 ml, the patients were reassessed in 1 h and were discharged if they could void spontaneously. If they could not void spontaneously, they were catheterized to facilitate discharge. All patients were contacted the next day to assess for return of normal bladder function. They were specifically asked when they had first voided, if there was any difficulty in voiding, or if they experienced any new voiding symptoms such as frequency or hesitancy.

Patients were initially randomized by use of sealed envelopes before their procedures in equal proportions to the accelerated and standard pathways. After 5 months of randomization, and enrollment of 163 patients, there was a disproportionate number of patients following the standard pathway, including all standard pathway patients and 45% of accelerated pathway patients who voided on resolution of their anesthetic, and were thus discharged in a manner indistinguishable from the standard pathway protocol. This created a lower percentage of patients in a critical component of the design of the accelerated pathway: “discharged without voiding.” This relatively low percentage was not anticipated. Before any outcome data had been analyzed, with IRB approval, all subsequent eligible patients were assigned to the accelerated pathway to fill out essential cells of the study design. (We believe that this change did not introduce bias in estimating the impact of the treatment arm on PACU time, because there appears to be no effect of date of treatment on PACU time. Both in the accelerated and standard pathways, the Pearson correlation coefficient between treatment date and PACU time is between 0.0 and 0.1 [negligible] and not statistically significant, indicating no learning or experience curve in each pathway.) All data were analyzed initially on the basis of intent to treat. A secondary analysis was performed on actual subgroups obtained during the study period.

The type of anesthetic and drug and dosage were recorded for each patient, as well as the duration of surgery and time to resolution of block, total intravenous fluid administered, time to void after admission to PACU, bladder volume (in the accelerated pathway patients who did not void spontaneously), and time to discharge (measured from arrival in PACU to actual discharge). Need for return to the hospital, time of first voiding, and any voiding difficulties were recorded by the observer during a follow-up telephone interview.

**Statistical Analysis**

A power analysis based on discharge times from Pavlin et al. identified a need for 72 patients in each of the original two groups to substantiate a 30 min difference in discharge times at the 0.05 level with a power of 80%. A secondary power analysis of the actual subgroups identified in the study suggests that 30 patients would be required in each subgroup to confirm the same difference. Demographic characteristics were compared between pathways using Student t test and chi-square. Time to discharge was compared between the pathways by the t test, and subgroups of the accelerated pathway were compared by analysis of variance (ANOVA) with post hoc adjustment of P values. Association of clinical factors with recovery time was assessed with the t test, linear regression, and Pearson correlation. Differences were considered statistically significant if P < 0.05.

**Results**

Two hundred-thirteen patients were evaluated, originally 77 in the standard pathway and 136 in the accelerated pathway. Analysis of the original data revealed 12 patients with unrecognized risk factors, leaving 70 standard pathway and 131 accelerated pathway patients. There was no significant difference between the pathways in gender composition, anesthetic type (spinal or epidural), or choice of drugs (table 1). 174 patients underwent lower extremity orthopedic procedures, and the others included miscellaneous procedures of skin and soft tissue in the lower abdomen or leg. The average age of patients in the standard pathway was greater than the accelerated pathway by 4 yr. Durations of procedures were similar between the groups.

Mean discharge time (time from arrival in PACU until discharge) for all accelerated pathway patients was 22 min shorter (P = 0.002) than standard pathway patients (table 1). Accelerated pathway patients who were not held for reassessment (n = 108) were discharged an average of 29 min earlier (P < 0.001). Regression analysis of dis-
charge time controlling for age showed that the treatment group was significant at the 0.005 level, with accelerated pathway patients discharged earlier than standard pathway patients. All patients in the standard pathway voided without difficulty. In the accelerated pathway, 62 patients voided spontaneously upon resolution of their block and were discharged. Of the remaining 69 patients, 46 had a BUS less than 400 ml and were discharged. These two subgroups were both discharged earlier than the standard pathway group (table 2). 23 had BUS greater than 400 ml and were held until they voided spontaneously (n = 20) or were catheterized (n = 3). The discharge times for these subgroups were not different from the standard pathway group (table 2). There was no predictive relationship between either fluid administration or bladder volume and lack of ability to void. None of the patients who were catheterized reported subjective discomfort before catheterization. All discharged patients voided by 8:00 am. None had difficulty voiding, required treatment for urinary retention, or reported any symptoms of hesitancy or frequency.

The choice of spinal anesthesia was associated with a longer discharge time, compared with epidural anesthesia. The choice of drug significantly affected discharge time for epidural anesthesia (P < 0.001) and was marginally significant for spinal anesthesia (P = 0.055) (table 3). The dose administered correlated with prolonged duration only in the case of procaine spinal anesthesia. Fentanyl added to spinal anesthesia significantly prolonged duration in the standard pathway.

**Discussion**

Normal bladder function requires active contraction of the detrusor muscle of the bladder wall combined with relaxation of the internal and external urinary sphincters. Both general anesthesia and neuraxial blockade interfere with detrusor contraction. If during detrusor paralysis the bladder is distended beyond the volume associated with voluntary emptying, voiding is impaired after return of function, and retention of urine is common.1,5,16

**Table 2. Discharge Times by Subgroups Resulting from Protocol Compliance**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Discharge time (min) ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>70</td>
<td>153 ± 49</td>
</tr>
<tr>
<td>Accelerated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharged without voiding</td>
<td>46</td>
<td>120 ± 42*</td>
</tr>
<tr>
<td>Voided spontaneously</td>
<td>62</td>
<td>127 ± 41*</td>
</tr>
<tr>
<td>Held for BUS &gt; 400, voided spontaneously</td>
<td>20</td>
<td>162 ± 45</td>
</tr>
<tr>
<td>Held for BUS &gt; 400, catheterized</td>
<td>3</td>
<td>186 ± 61</td>
</tr>
</tbody>
</table>

*Correlation between PACU recovery time and dose of each spinal or epidural anesthetic.

<table>
<thead>
<tr>
<th>Mean PACU Time (min)</th>
<th>SD</th>
<th>Correlation</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anesthesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal</td>
<td>110</td>
<td>151</td>
<td>46</td>
</tr>
<tr>
<td>Epidural</td>
<td>91</td>
<td>125</td>
<td>46</td>
</tr>
<tr>
<td>Spinal*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>15</td>
<td>173</td>
<td>50</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>28</td>
<td>155.3</td>
<td>37</td>
</tr>
<tr>
<td>Procaine</td>
<td>67</td>
<td>143</td>
<td>47</td>
</tr>
<tr>
<td>Chloroprocaine</td>
<td>43</td>
<td>102</td>
<td>34</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>48</td>
<td>146.0</td>
<td>46</td>
</tr>
</tbody>
</table>

* Correlation between PACU recovery time and dose of each spinal or epidural anesthetic.

N = number; SD = standard deviation.

Anesthesiology, V 97, No 2, Aug 2002
Detrusor dysfunction with prolonged neuraxial anesthesia is well documented. Spinal anesthesia with bupivacaine 20 mg produces detrusor dysfunction persisting significantly longer than the blockade of sensory and peripheral motor function, allowing bladder overdistention and urinary retention. Kamphuis et al. measured cystometric volumes in healthy male patients undergoing nonurologic surgery after 10 mg bupivacaine spinal anesthesia. The average delay to return of detrusor function was 462 ± 61 min. During that time, patients generated an average of 875 ml of urine, 1.6 times the average “cystometric capacity” (the volume at which these patients felt an urge to void in the preanesthetic state, 505 ± 119 ml). In contrast, short-acting spinal anesthesia with 100 mg lidocaine was not associated with bladder overdistention. His study suggests that bladder function is likely to return to normal after short duration blockade, in contrast to data after prolonged spinal anesthesia.

Clinically, urinary retention with longer acting spinal drugs has been substantiated by several reports. Comparisons of short and long acting local anesthetics, however, have supported Kamphuis’ observation that the risk of retention appears less with shorter acting drugs. Bridenbaugh et al. showed a direct correlation between the frequency of catheterization and the duration of action of the epidural local anesthetics used for cesarean childbirth, comparing chlorprocaine, lidocaine, mepivacaine, and bupivacaine. Ryan et al., showed in a high-risk group undergoing hernia repair a lower incidence of catheterization (6%) after lidocaine anesthesia compared with bupivacaine or tetracaine spinal anesthesia (30% catheterization). Reports of ambulatory surgery with short-duration neuraxial blockade also reflect an absence of urinary retention.

Our data confirm that retention is a low risk after short-acting spinal or epidural anesthesia. We saw the rapid return of bladder function in 199 of 201 patients. For three patients, bladder catheterization was performed to facilitate discharge according to protocol. None of these patients described a sense of distention or symptoms of retention. We do not know if these patients could have voided spontaneously if a longer time was allowed.

In similar investigations of voiding function after general anesthesia, Pavlin found retention requiring catheterization in 1 of 222 and 1 of 229 patients. She assessed bladder volume with the BUS, and considered 600 ml as the limit of tolerance, and allowed a longer time for voiding. If we had used her criteria, we would have retained only 8 of our patients who had volumes greater than 600 ml. All of these with volumes greater than 600 ml voided spontaneously within an hour. These observations suggest that retention is no more frequent after short-acting spinal or epidural anesthesia than after general anesthesia for low-risk procedures.

We also showed that accelerated discharge reduces PACU time and is associated with a low risk of postdischarge retention in selected patients. Even with the addition of the patients required to stay until voiding or catheterization, our average discharge time for our accelerated pathway program was significantly shorter than the standard pathway protocol. More importantly, we were able to discharge 23% of our patients after low-risk procedures without voiding. We saw no difficulty in voiding or new voiding symptoms in this group of 46 selected patients. Pavlin discharged 15 patients in her general anesthesia group before voiding without significant problems. Despite the absence of complications in either group, we agree with her that a large series of patients is needed to confirm the safety of this practice.

Our data confirm previously reported patterns of duration of spinal and epidural anesthesia, and confirm that voiding times are related to total durations of anesthesia. Chloroprocaine epidural anesthesia provided the most rapid resolution with no difficulty in urination. The effect of duration of anesthesia on distention may be related to the volume of intravenous fluids administered during the anesthetic. Larger volumes may increase the potential for over-distention, though Ryan et al. could find no correlation between the volume administered and the frequency of catheterization. We could not predict the bladder volume in our patients based on the volume of intravenous fluid administered or clinical symptoms. While there is a recommendation for rectal surgery that restriction or elimination of fluid administration may reduce the incidence of retention, generous fluid administration (20 ml/kg) has been shown to reduce the frequency of postoperative symptoms after outpatient surgery. The appropriate volume of fluid administration with outpatient neuraxial anesthesia requires further study.

A potential criticism of our protocol is that we required catheterization after 1 h for patients with volumes greater than 400 ml. We chose that volume after consultation with our urologists, recognizing that it represents a conservative value at the lower end of the range of normal cystometric capacity. This confuses our results because it is not clear if these patients would have voided spontaneously. It also raises the question of the risks of elective catheterization, which include possible infection, bleeding, urethral damage, and patient discomfort. We chose, with IRB guidance, to include catheterization as an option in the protocol because we were studying a situation that was characterized as “high-risk” for retention, with the associated risks of bladder damage, which appeared more significant than the risks of a single catheterization. While we attempted to avoid these complications, it could be argued that our protocol actually delayed discharge for a subset of patients, and caused unnecessary catheterizations.

Anesthesiology, V 97, No 2, Aug 2002
on our data, we now feel that the risk of retention in this group is small, and does not merit a delay in discharge or the risks of catheterization before discharge.

We agree with Pavlin that hernia repair and rectal procedures are “high risk,” and require voiding before discharge. During the study period, 105 patients underwent these surgeries in our hospital, four of whom required catheterization for retention. The high frequency of retention associated with these operations may be caused by inhibitory pain reflexes associated with the increased perineal pressure associated with the attempt to void. Pavlin found that patients undergoing hernia repair or rectal surgery remained in a high-risk category with a 5% frequency of retention before discharge and an even higher percentage of recurrent retention after discharge. It appears currently that patients undergoing these procedures who received neuraxial block, regardless of the duration of the block, should be required to demonstrate ability to void before discharge.

In summary, our data support a relaxation of the requirements for voiding after outpatient neuraxial blockade with short-acting drugs for low-risk surgical procedures. Patients receiving short-duration spinal or epidural anesthetics (without epinephrine) appear to be at low risk of over-distention of the bladder, and thus of urinary retention. Further study is needed to confirm the safety of this practice in a large population.

References


Anesthesiology, V 97, No 2, Aug 2002