Incidence of Urinary Retention in Patients with Thoracic Patient-Controlled Epidural Analgesia (TPCEA) Undergoing Thoracotomy

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ABSTRACT:
Up to 100% of patients treated with epidural analgesia can experience urinary retention, which may be related to dermatomal level of the epidural block, epidural medication, and surgical procedure. This study was designed to identify the incidence of urinary retention in patients who receive thoracic patient-controlled epidural analgesia (TPCEA) after thoracotomy. Forty-nine patients were enrolled and received epidural infusion of ropivacaine 0.2% or mixture of bupivacaine 0.1% with hydromorphone 0.015 mg/mL. Epidural catheter placement level was verified by chest X-rays. Indwelling urinary catheters were removed between 12 and 48 h after surgery when no longer required for fluid monitoring. Four hours later, patients were assessed for urinary retention using bladder ultrasound. Residual bladder volume was recorded, and urinary retention was defined as an inability to void or a bladder volume of greater than 600 mL at 4 h. Twenty-four hours after the catheter removal, patients completed a questionnaire to assess their perception of the indwelling catheter before and after its removal. Five participants (~10%) with epidural catheters between T3 and T5 with bupivacaine/hydromorphone epidural solution were recatheterized. No association was established between catheter level, drug type, infusion rate, and urinary retention. Although 76% of patients did not report any physical discomfort with the indwelling urinary catheter, 66% felt relief after its removal and 18% did not ambulate with the inserted urinary catheter. The inci-
idence of postoperative urine retention was low (10%), indicating that unless required for other purposes, indwelling urinary catheters may be removed between 12 and 48 h after surgery while receiving TPCEA.

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Epidural analgesia is an integral component of perioperative pain management for patients undergoing major thoracic surgery. It reduces postoperative cardiac complications and improves pain control and respiratory function (Scott, et al. 2001). However, epidural analgesia is thought to increase the risk of urinary retention (Dolin & Cashman, 2005), and indwelling urinary catheters are often left in place until after epidural analgesia is discontinued. Long-term indwelling urinary catheters increase urinary tract infection rates (Gastmeier, 2001). Patients appear to be self-conscious regarding ambulating with a urinary catheter in place.

Studies assessing the incidence of urinary retention with concurrent use of epidural analgesia have focused mostly on patients with lumbar epidural analgesia for labor or for lower-extremity surgery (Dolin & Cashman, 2005). Weiniger, et al. (2006) reported that 83% of women with lumbar epidural analgesia for labor required bladder catheterization. Capdevila, et al. (1999) reported 53% of urinary retention in the early postoperative period in patients with lumbar patient-controlled epidural anesthesia (PCEA) after reconstructive knee surgery. The reported incidence of urinary retention in patients receiving thoracic PCEA (TPCEA) for intra-abdominal surgery is lower, ranging between 9% and 43%. George, et al. (1994) compared TPCEA with intravenous patient-controlled analgesia (PCA) in patients undergoing upper abdominal surgery and found a similar incidence (50%) in both groups.

The present authors’ clinical experience suggests that patients receiving epidural analgesia for thoracotomy are at no greater risk of experiencing urinary retention than those who did not receive epidural analgesia for postoperative pain management, but they were not able to identify studies that address this issue. The purpose of the present study was to determine whether the early removal of urinary catheters results in urinary retention in patients receiving TPCEA after thoracic surgery, and to determine the patients’ perception during and after urinary catheterization.

METHODS

A prospective exploratory observational study was designed to report the incidence of urinary retention. Power analysis was not performed, because the literature review revealed a paucity of data related to urinary retention in patients undergoing thoracotomy and receiving epidural analgesia after surgery. Furthermore, the exclusion criteria restricted the number of patients who could be enrolled in the study; therefore, a convenience sample was selected to study the question. After Research Ethics Board approval of the study, patients undergoing thoracotomy and receiving TPCEA were enrolled. The exclusion criteria included previous urologic surgery, men over the age of 65 years, history of urinary retention, history of prostate enlargement, admission to the intensive care unit after this surgery, thoracic epidurals placed below the 10th dermatome level, and epidural infusion greater than 6 mL/h using a combination of local anesthetic and/or opioid analgesic. The epidural catheter placement level was verified by review of chest X-rays.

Urinary catheters were removed from participants between 12 and 48 h after surgery, when hourly fluid monitoring was no longer indicated. Four hours later, patients were assessed for signs of urinary retention using bladder ultrasound. The residual bladder volumes were recorded, and if participants had already voided, these volumes were obtained from the clinical records. Urinary retention was defined as an inability to void at a bladder volume of >600 mL. Twenty-four hours after the urinary catheter removal, patients were requested to complete a fixed-choice and open-ended questionnaire to assess their perceptions about having a urinary catheter and after its removal. Clinical records were reviewed to determine whether late symptoms of urinary retention were experienced and whether recatheterization was required.

An association between urinary retention and the different variables of interest (epidural catheter level, drug type, infusion rate) was sought. Regarding the epidural catheter level, the patients were grouped into two categories: low (T6-T8) and high (T3-T5). Two tests were performed to understand the association between variables. For the categoric variables (gender, epidural catheter level, and drug type) Fisher exact test was performed, and for the continuous variables (age, weight, and drug rate) two-sample t test was performed. For the t test, pooled variance estimate was used if the variances of the two groups were equal (according to an F test for variance equality), or Satterthwaite approximation method if the two groups’ variances are unequal. Before application of t test, the continuous variables were assessed for proximity to normality using visual inspection of histograms and Q-Q plots (a graphical method for diagnosing differ-
ences between the probability distribution of a variable and the normal distribution).

RESULTS
Forty-nine patients (18 men and 31 women) who underwent thoracic surgery and received TPCEA for postoperative pain management were included in this study. Forty-four patients received hydromorphone 0.015 mg/ml in 0.1% bupivacaine, and five patients received 0.2% ropivacaine. Five participants (10%) experienced urinary retention and were recatheterized. There was no difference in any of the demographic characteristics between the patients who developed urinary retention and those who did not (Table 1). All five patients with urinary retention had the epidural catheter inserted at the high thoracic level (T3-T5) and received the bupivacaine/hydromorphone epidural solution (Table 2). The mean rate of epidural infusion was 4.6 mL/h. The amount of urine obtained at time of catheterization was 530 ± 165 mL.

Patients who did not develop urinary retention received bupivacaine plus hydromorphone infusion in 93.2% of the cases. They had either a T3-T5 or a T6-T8 epidural catheter insertion (Table 2). No association was discovered between any of the variables of interest (catheter level, drug type, infusion rate) and the development of urinary retention (p values 1, 1, and .93, respectively; Table 2).

All patients completed the questionnaire. Although 76% of patients did not experience any physical discomfort with the indwelling urinary catheter, 66% felt significant relief after the urinary catheter was removed, owing to the sensitivity of the area in which the catheter was placed (Table 3) and 18% did not ambulate with the indwelling urinary catheter and did not indicate why.

DISCUSSION
The results of this study reflect an incidence of urinary retention similar to that reported by Basse, et al. (2001) in patients undergoing intra-abdominal surgery and TPCEA, with 10% of patients in the present study requiring recatheterization. No association was discovered between urinary retention and epidural catheter insertion level, administered drug (local anesthetic with opiate versus only local anesthetic), or rate of infusion.

Although there is a known relationship between epidural opiate administration and postoperative urinary retention (Rawal, Mollefors, Axelsson, Lingardh & Widman, 1983), we could not demonstrate it in this study. A possible explanation is the dermatomal level at which hydromorphone was administered. Hydromorphone is an opiate that is more hydrophobic than morphine and less lipophilic than fentanyl. It has been demonstrated that lumbar epidural hydromorphone causes urinary retention significantly less than lumbar epidural morphine and slightly more than lumbar epidural fentanyl (Goodrazi, 1999). Most likely, the absorption of hydromorphone infused at the thoracic level is limited only at the thoracic and high lumbar segments and did not directly affect detrusor innerva-

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<th>Table 1. Demographic Characteristics</th>
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<td>Urinary Retention (n = 5)</td>
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<td>Age (yrs) 56.6 ± 12.7</td>
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<td>Gender (male) 1 (20%)</td>
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<td>Weight (kg)* 71 ± 4.3</td>
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*Urinary retention n = 3; no urinary retention n = 27.
†Using pooled method, p value for testing equal variances was .064.

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<th>Table 2. Epidural Analgesia Characteristics</th>
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<td>Urinary Retention (n = 5)</td>
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<td>Epidural catheter level high (T3-T6)</td>
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<td>Epidural catheter level low (T6-T8)</td>
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<td>Bupivacaine 0.1% + hydromorphone 0.015 mg/ml</td>
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<td>Ropivacaine 0.2%</td>
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<td>Epidural infusion rate (mL) 4.6 ± 0.5</td>
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tion and contractility. In the present study, patients received either hydromorphone mixed with bupivacaine or plain ropivacaine infusion. This local anesthetic infusion, at a mean rate of infusion of 4.6 mL/h at the thoracic level, should not affect sacral innervation that controls bladder, urethral sphincter, and peritoneal muscles and thus should not interfere with postoperative micturition.

The mechanism of postoperative urinary retention is complex and not completely understood. Urinary bladder emptying depends on relaxation of the urethral sphincter and contraction of detrusor muscle in response to increased bladder pressure. The process of intact voluntary urination relies on coordinated control of central, peripheral, and autonomic nervous systems. Postoperative urinary retention can be provoked by intraoperative damage of the pelvic autonomic nerve, usage of sympathomimetic and anticholinergic drugs in the perioperative period, and stress-induced activation of inhibitory sympathetic reflexes (Petros & Bradley, 1991).

The role of postoperative pain control modalities in developing postoperative urinary retention is not clear. Studies comparing different modes of postoperative analgesia demonstrate conflicting results. George, et al. (1994) did not find any difference in the incidence of postoperative urinary retention between patients receiving IV PCA with morphine and those receiving thoracic epidural fentanyl/bupivacaine infusion. In their review of adverse effects of PCA, Dolin and Cashman (2005) reported that the incidence of postoperative retention was higher in patients receiving epidural analgesia versus intravenous PCA (29% vs. 13%). However, this difference was not adjusted to the type and length of surgical procedures or site of placement of the epidural catheter.

Several studies indicate that surgical procedure and anesthesia >60 min are associated with urinary retention. Tammila, Kontturri, and Lukkarinen (1986) retrospectively reviewed the incidence and risk factors of postoperative urinary retention in 5,220 patients and found that age, thoracic and hip surgeries, abnormal voiding history, and lack of ambulation in the early postoperative period were associated with higher incidence of postoperative urinary retention. They did not find any relationship between type of premedication, anesthesia, or postoperative analgesia with postoperative urinary retention. Keita, et al. (2005) studied the incidence of postoperative urinary retention in the postanesthesia care unit (PACU). They found that older age, intraoperative overhydration, and large bladder volume on entry to the PACU were the only predictors of urinary retention in the immediate postoperative period. They also did not find that the type of anesthesia (spinal vs. general) was associated with impaired postoperative urination. It seems that the perioperative factors, such as type and length of surgery, intraoperative fluid management, and previous history of micturition problems could play a more important role in immediate postoperative urinary retention than type of postoperative pain control.

Eighteen percent of the subjects in the present study with indwelling urinary catheters did not ambulate. Early postoperative ambulation is a very important factor in preventing postoperative urinary retention. It is possible that early ambulation of these patients could reduce incidence of postoperative urinary retention.

Limitations of the present study include the sample size. A larger sample size could determine further contributing factors to urinary retention. In this study, the majority of patients (44 out of 49) received an epidural catheter at the high thoracic level, and a large majority of patients (45 out of 49) received bupivacaine/hydromorphone epidural solution. This imbalance in the data reduced the power of testing those
exposure variables as potential risk factors for urinary retention. More balanced data would offer a better chance of uncovering potential associations.

In conclusion, the authors demonstrated that routine maintenance of an indwelling urinary catheter in patients receiving TPCEA after thoracic surgery should be reconsidered within the first 12-24 h, and that surgical outcomes may provide more direction in the use of indwelling urinary catheters versus TPCEA treatment (Kim, et al., 2006).

REFERENCES


