**The effects of spinal anesthesia vs epidural anesthesia on 3 potential postoperative complications: Pain, urinary retention, and mobility following inguinal herniorrhaphy**

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This study was conducted to determine the effects of spinal (n = 113) vs epidural (n = 31) anesthetic techniques on 3 common postoperative complications: pain, urinary retention, and mobility for patients undergoing inguinal herniorrhaphy. The study design was a retrospective chart review. Data were collected on 144 subjects who underwent herniorrhaphy between January 1 and December 31, 1999, had an ASA classification of I to III, and were older than 18 years. The local anesthetics used to provide spinal anesthesia were 5% lidocaine, 0.75% bupivacaine, and 1% tetracaine solutions. The anesthetics used to provide epidural anesthesia were a solution of 2% lidocaine with epinephrine or 3% chlorprocaine with epinephrine. Results revealed that pain was not significantly different between the 2 anesthetic groups (P = .65); however, subjects in the epidural anesthesia group were able to ambulate (P = .008) and void (P = .02) sooner than subjects in the spinal anesthesia group. This study demonstrates that epidural anesthesia results in less urinary retention and earlier mobility than spinal anesthesia in men undergoing inguinal herniorrhaphy. Minimizing postoperative complications is essential in order for the nurse anesthetist to provide a satisfactory anesthetic experience. This study’s findings suggest that epidural anesthesia optimizes recovery for the patient undergoing inguinal herniorrhaphy.

Key words: Inguinal herniorrhaphy, mobility, pain, outpatient anesthesia, urinary retention.

Inguinal hernias account for 80% of all types of hernias diagnosed, and more than 50% are repaired during outpatient procedures. One reason for the high number of outpatient inguinal hernia repairs is the improvement of surgical and anesthetic techniques. Outpatient procedures provide efficient care without jeopardizing patient outcomes, offer minimal interference with the patient’s daily activities, and inherently have economic benefits to the patient, hospital, and insurers. Ambulatory surgery offers a means of providing high level care while expediting the patient’s return to optimal health.

Efforts to minimize postoperative complications following outpatient inguinal hernia surgery are important for Certified Registered Nurse Anesthetists (CRNAs) since most patients undergoing inguinal hernia repair will care for themselves at home after their procedures. It is the goal of the CRNA to plan a course of action to maximize the health of the patient in relation to the chosen anesthetic technique. The healthcare consumer expects ambulatory surgery to produce only minor and transitory lifestyle interruptions. As a result, anesthesia care providers are challenged to provide high quality care in a cost-effective manner.

The emphasis in outpatient-based anesthesia is prompt recovery while maintaining a quality of care that is comparable to that provided for inpatients. The anesthetic technique that best optimizes recovery for the patient undergoing outpatient inguinal hernia repair is not clear. Postoperative complications persist despite numerous advances in anesthetic and surgical
techniques. Urinary retention remains a common undesirable consequence of various anesthetic approaches. Pain has remained a problem despite the preemptive use of opioids, nonsteroidal anti-inflammatory drugs, and local anesthesia. Last, early ambulation is an essential determinant in the success of an anesthetic technique. These 3 factors are significant in achieving patient satisfaction following inguinal hernia repair and in reducing costs and hospital admissions related to inguinal hernia.

There have been conflicting reports in the literature regarding which anesthetic technique is superior for minimizing postoperative pain and urinary retention and for encouraging early mobility. Several studies emphasize the need for further research to develop strategies to deal with clinically significant patient outcomes related to anesthetic techniques for herniorrhaphy. The lack of consensus regarding the most effective anesthetic for the patient undergoing an inguinal hernia repair on an outpatient basis is significant, especially as the number of these procedures performed continues to rise.

Outpatient procedures require anesthetic agents that have brief duration and minimal complications yet maintain sensory anesthesia to facilitate pain control after surgery. Adequate pain relief is essential for the patient who has undergone inguinal hernia repair to ambulate and void during the postoperative period. Furthermore, several studies have concluded that the infiltration of a local anesthetic into the hernia repair site provides sustained pain relief lasting up to 10 days. For inguinal hernia repair procedures, the use of local anesthetics has decreased narcotic requirements, shortened hospital stay, and reduced costs.

Several studies have concluded that persistent postoperative pain hinders perineal relaxation, thereby inhibiting the micturition reflex that contributes to urinary retention. Factors that have been highly associated with urinary retention after inguinal herniorrhaphy include general anesthesia, increased age, and increased intravenous fluid administration. There has been little in the literature regarding the efficacy of spinal vs epidural anesthesia in inguinal herniorrhaphy related to urinary retention. However, Davis et al compared the efficacy of spinal and epidural anesthesia in hip arthroplasty and found that epidural anesthesia resulted in greater urinary retention and subsequent catheterization. The literature supports that short-acting regional techniques with the use of local anesthetic infiltration in inguinal hernia repair aids in pain control and allows for early return of bladder function and mobility.

Mobility is a key criterion for discharge after inguinal hernia repair; however, the literature was devoid of studies with findings indicating that one anesthetic technique was any better than the other at facilitating mobility outcomes after inguinal hernia repair. The study by Davis et al discussed mobility as an outcome variable and its relationship to anesthetic technique (spinal vs epidural) for hip arthroplasty. While spinal anesthesia provided a safe, motionless field for the surgeon to operate, increased mobility associated with epidural anesthesia was important for the prevention of venous stasis and for decreasing the time to ambulation postoperatively.

The findings in the literature review support the use of short-acting regional techniques with the use of local anesthetic infiltration for the patient undergoing elective inguinal hernia repair. Minimizing postoperative complications following inguinal hernia repairs is essential for the CRNA to provide a satisfactory anesthetic experience and for facilitating the patient’s return to the previous lifestyle. Deleterious physiologic and psychologic effects following inguinal hernia repair can result from uncontrolled pain, urinary retention, and impaired mobility. In an attempt to provide high quality anesthesia care and prevent postoperative complications, each inguinal hernia case should be individualized with respect to anesthetic technique to achieve desired postoperative outcomes. Furthermore, evaluation of all anesthetic techniques should be performed to determine their effectiveness and to improve the quality of CRNA care. A comprehensive comparison between spinal and epidural anesthetic techniques for patients undergoing inguinal hernia repairs with respect to pain, urinary retention, and mobility has not been performed. The purpose of this study was to describe which technique (epidural or spinal) was more successful in preventing 3 common postoperative complications of inguinal hernia repair: pain, decreased mobility, and urinary retention.

**Methods**

This study was conducted at a large midwestern tertiary healthcare system that served a primarily suburban and middle to upper middle class clientele. Approval for the study was obtained before the study's commencement.

The design was a retrospective chart review. The independent variable was anesthetic technique: spinal or epidural. The dependent variables were pain, mobility, and urinary retention.

Subjects were men, 18 years of age or older, who had undergone outpatient unilateral inguinal herniorrhaphy between January 1 and December 31, 1999. For the 1999 surgical year, the study hospital per-
formed a total of 617 unilateral inguinal herniorrhaphies on adult males.

Exclusion criteria for this study included the following:
1. Voiding difficulties related to various genitourinary or renal conditions (ie, benign prostatic hypertrophy or chronic renal failure);
2. Conversion from the initial anesthetic technique to an alternative during procedure;
3. Repair of a previously repaired inguinal hernia; and
4. Impairment of mobility related to various disease processes (eg, spinal cord injury, cerebrovascular accident with residual effects affecting mobility).

An investigator-designed data collection tool was developed for the study. Examples of data collected were age, type of anesthesia, ASA status, medications received, fluid given, estimated blood loss, various demographic variables, postoperative pain status, mobility, and urinary retention rate.

Measures
Pain status for this study was measured by time to first analgesic postoperatively. Any repeated postoperative pain therapy also was recorded, as was the use of local anesthetic infiltration of the incision at the end of the procedure by the surgeon. Measurement of pain by analgesic use in the recovery area was recognized as a valid measure of pain by Roberge and McEwen.1

Mobility was measured by the subjects' abilities to ambulate unassisted postoperatively, and the time interval (in minutes) until this event occurred was recorded. Unassisted ambulation was a criterion for discharge from the postanesthesia care unit at the study hospital. Mobility was recorded as the ability to walk without assistance.1

Urinary retention was measured by the time to voiding or the need for catheterization, with a resulting volume of greater than 400 mL. Urinary retention previously was measured by time to voiding by Petros et al.9

For the present study, patient records were obtained from the medical records department of the institution where the study was conducted. Patient records were reviewed by members of the research team, and the appropriate information was documented using the study's data collection tools. Subjects were identified by use of code numbers instead of names, and all data collection took place in the hospital's medical records department to ensure confidentiality.

Results
Data originally were obtained from 150 patient charts. Subjects who had inguinal hernia repairs performed under general anesthesia (n = 4) or monitored anesthesia care (n = 1) were excluded from further analyses because of the small samples. Of the 145 remaining subjects, 1 from the spinal anesthesia group was admitted to the hospital postoperatively, necessitating exclusion from the study. Of the final 144 subjects, 113 (78.5%) were in the spinal anesthesia group compared with 31 (21%) in the epidural anesthesia group. For this study, P values less than or equal to .05 were considered statistically significant. Data are given as mean ± SD unless stated otherwise.

Statistical analyses revealed no significant differences between the 2 groups with respect to age or body weight and height (Table 1). Subjects' ages ranged from 18 to 89 years (54 ± 16 years). All subjects were discharged home on the same day that their operations were performed. Regarding ASA physical status, a2 analysis revealed no statistical difference between the 2 groups (Table 2). Furthermore, no significant differences were found between groups with respect to the total midazolam (6 ± 1.6 mg; P = .26), fentanyl (171 ± 44 µg; P = .45), or glycopyrrolate dose (0.2 ± 0.0 mg; P = .50). In the epidural anesthesia group, 16 (52%) of the subjects were given a local anesthetic at the incision site by the surgeon compared with 43 (38.1%) of the subjects in the spinal anesthesia group; this difference was not statistically significant (P = .17). All subjects received short-acting local anesthetic agents for their regional blocks, except 1 subject who received a tetracaine spinal anes-

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<th>Table 1. Demographic data*</th>
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<td>Age (y)</td>
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<tr>
<td>Weight (kg)</td>
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<td>Height (cm)</td>
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* Values are expressed as mean ± SD.

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<th>Table 2. ASA physical status*</th>
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<td>ASA II</td>
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<td>ASA III</td>
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* Data are given as number (percentage).

P = .17; a2
thetic (Table 3). Subjects receiving spinal anesthetics were given a 5% lidocaine, a 0.75% bupivacaine, a 10% novocaine, or a 1% tetracaine anesthetic. Subjects in the epidural anesthesia group received a 2% lidocaine or a 3% chloroprocaine anesthetic. Last, differences in operating room times between the 2 groups were evident; the spinal anesthesia group had an operating room time of 71 ± 22 minutes vs 62 ± 19 minutes for the epidural anesthesia group (P = .03).

To answer the first research question regarding the subjects’ pain status, no significant differences were found between the 2 anesthetic groups. Pain status was assessed by the time from end of surgery to the first analgesic administration (77 ± 48 minutes in the spinal anesthetic group vs 73 ± 38 minutes in the epidural anesthetic group; P = .65). Furthermore, there was no significant difference between the 2 groups with respect to time to second analgesic administration (P = .45). The time between administration of the first analgesic to the time of administration of the second analgesic was 111 ± 90 minutes for the spinal anesthesia group vs 90 ± 79 minutes for the epidural anesthesia group. The time to voiding was affected significantly by the administration of a local anesthetic into the operative site by the surgeon (P = .05). The time to first voiding was 186 ± 79 minutes for subjects who received local infiltration by the surgeon compared with 219 ± 112 minutes for subjects who did not receive local infiltration.

With respect to the third dependent variable, mobility, subjects in the epidural anesthesia group were able to ambulate earlier than subjects in the spinal anesthesia group. Analysis revealed a statistically significant difference in mobility measured as the time to unassisted ambulation (P = .008). The mean time to unassisted ambulation for subjects in the epidural anesthesia group was 171 ± 81 minutes compared with 229 ± 113 minutes for subjects in the spinal anesthesia group. Subjects in either group who received local anesthetic infiltration by the surgeon were able to ambulate sooner than subjects who did not (P = .048). Interestingly, there was an inverse relationship between age and mobility; as subject age increased, the time to unassisted ambulation decreased (r = -0.18; P = .04).

Discussion

A comprehensive comparison between spinal and epidural anesthetic techniques for patients undergoing inguinal hernia repairs with respect to pain, urinary retention, and mobility had not been performed before this study.

Subjects in the spinal anesthesia group remained in

<table>
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<tr>
<th>Anesthetic agent (method of administration)</th>
<th>No. of subjects</th>
<th>Dose range (mg)*</th>
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<tbody>
<tr>
<td>Lidocaine 5% (spinal)</td>
<td>77</td>
<td>50-100</td>
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<tr>
<td>Bupivacaine 0.75% (spinal)</td>
<td>19</td>
<td>9.75-15.0</td>
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<tr>
<td>Tetracaine 1% (spinal)</td>
<td>1</td>
<td>10.0</td>
</tr>
<tr>
<td>Novocaine 10% (spinal)</td>
<td>16</td>
<td>9.0-16.0</td>
</tr>
<tr>
<td>Lidocaine 2% with epinephrine 1:200,000 (epidural)</td>
<td>7</td>
<td>400-600</td>
</tr>
<tr>
<td>Chloroprocaine 3% (epidural)</td>
<td>24</td>
<td>33-105</td>
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* At the discretion of the anesthesia provider

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<th>Table 4. Dependent variables*</th>
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<td>Time to first analgesic (min)</td>
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<td>Time to second analgesic (min)</td>
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<tr>
<td>Time to void (min)</td>
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<td>Time to unassisted ambulation (min)</td>
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* Values are expressed as mean ± SD.
the operating room significantly longer than subjects in the epidural anesthesia group (71 ± 22 minutes vs 62 ± 19 minutes, respectively). Because this study was conducted retrospectively, it is difficult to determine the cause of this difference. According to Oberhelman and Howard, the surgical time for inguinal hernia repair averages between 1 and 1.5 hours. One possible explanation for the difference between groups with regard to operating room time is that various anesthesiologists performed the regional blocks. The inguinal hernia repairs were performed by a number of different surgeons, which also may account for differences in operating room times.

Pain following hernia repair remains an issue despite advances in surgical and anesthetic techniques. As in previous studies, the findings of the present study do not elucidate an anesthetic technique that leads to decreased reports of postoperative pain. There was no significant difference in anesthetic type for subjects who did not require postoperative analgesia during their hospital stay (P = .17), nor was there a difference in time to first and second analgesics between subjects in the spinal and epidural anesthesia groups (P = .65 and P = .45, respectively). A possible explanation for the lack of significant difference in pain relief between the 2 study groups was the measurement of pain as time to first and second analgesics administration rather than the measurement of patients' subjective complaints of pain. According to McCaffery and Ferrell the patient's self-report of pain is the single most reliable indicator of pain. It is unknown whether a difference may have existed between the groups if a tool such as the visual analog scale had been used, which allows for the gradation of pain intensity.

Several studies have concluded that the infiltration of a local anesthetic into the hernia repair site provides sustained pain relief lasting up to 10 days. Subramaniam et al performed a retrospective chart review of 93 subjects who underwent elective inguinal hernia repair operations performed under local anesthesia or general anesthesia with local anesthetic infiltration. The researchers found that subjects in the local anesthesia group had shorter hospital stays and lower postoperative narcotic requirements than subjects in the general anesthesia group. In contrast with the findings of Subramaniam et al, results from the present study did not show a significant relationship between local anesthetic infiltration and time to first analgesic administration (P = .39). However, our results demonstrated that 79% (11/14) of subjects who required no postoperative pain medication during their hospital stay received local anesthetic infiltration into the wound site by the surgeon (P = .003), and the majority of them had epidural anesthesia.

Urinary retention is a common complication following inguinal herniotomy, but few studies have attempted to identify factors that contribute to retention. Previous studies concluded that the most efficacious anesthetic for reducing the incidence of urinary retention in men older than 50 years who underwent elective inguinal herniotomy was spinal anesthesia (vs general), in addition to restriction of intravenous fluid administration. The study by Petros et al revealed a higher incidence of urinary retention with general anesthesia, age older than 50 years, and administration of more than 1,200 mL of intravenous fluid. The findings of Petros et al are similar to those of Tamella et al, who found that increasing age, intraoperative fluid administration of more than 1,200 mL, and pain were associated with urinary retention. Postoperative pain resulting from herniotomy can stimulate the α receptors in the bladder neck and proximal urethra, increasing urethral resistance. As a result, attempts to void encounter increased outlet resistance, which may lead to urinary retention.

The findings of Petros et al and Tamella et al do not fully support the findings of the present study since there was no significant relationship among age, fluid administration, and subsequent urinary retention. Even though a significantly shorter time to voiding was found for subjects in the epidural anesthesia group (167 ± 83 minutes) than in the spinal anesthesia group (217 ± 104 minutes), further analysis demonstrated no significant difference, by anesthetic technique, in the number of subjects requiring catheterization for urinary retention. Subjects who received local infiltration at the hernia repair site by the surgeon were able to void sooner than subjects who did not, although no significant difference was found between the 2 anesthetic groups. Perhaps this difference can be explained by the quality of the regional block; subjects with longer acting or more solid blocks may have been judged not to require local infiltration by the surgeon. Subsequently, these subjects may have experienced a longer time to voiding, as a high incidence of urinary retention has been associated with long-acting regional anesthetic blocks.

A significant finding in the present study was that subjects who received epidural anesthesia were able to ambulate sooner than subjects who received spinal anesthesia. Subjects in the epidural anesthesia group were able to ambulate unassisted on average of 58 minutes earlier than subjects in the spinal anesthesia group. These findings support those of Davis et al.
related to the efficacy of epidural vs spinal anesthesia for hip arthroplasty, specifically a decreased time to ambulation in the epidural anesthesia group postoperatively. Furthermore, subjects who received local infiltration of the hernia repair site by the surgeon were able to ambulate sooner than subjects who did not (P = .048), but no significant difference was found between the 2 anesthetic groups.

A statistically significant negative correlation was found for age and mobility (Pearson r = -0.18; P = .04). This finding supports the findings of Callesen et al., who found that younger patients had more function-related pain and greater difficulty resuming activities of daily living than did older patients. In comparison with older patients, younger patients may have a higher level of physical activity and perhaps higher expectations for the postoperative course.

A review of the literature and the findings from the present study support the use of short-acting regional techniques with local anesthetic infiltration for patients undergoing elective inguinal hernia repair to minimize postoperative complications. The present study demonstrated that an epidural is superior to a spinal anesthetic for facilitating early mobility and voiding postoperatively. Furthermore, the present study demonstrated that local anesthetic infiltration by the surgeon can positively affect a patient's ability to void and ambulate. We propose that earlier voiding and earlier mobility lead to prompt discharge, decreased cost, and increased patient satisfaction.

Of note is the difference in sample size between the 2 anesthesia groups (spinal, n = 113; epidural, n = 31). This difference reflects the anesthetic practices of the institution where the study was conducted, which, in 2000, was ranked first in the United States for number of inpatient admissions and for the total number of outpatient surgeries.15

One limitation of this study was postoperative documentation. In a retrospective chart review, the researcher must rely on the selective deposition of information. As a result, the researchers could not ascertain the quality of ambulation or the effectiveness of analgesic regimens, as this information was not documented. We further note that the time from completion of surgery to the administration of analgesics is an indirect method for assessing the superiority of one anesthetic technique over another in providing pain relief.

Another possible limitation of this study could be the differences in the practices of individuals providing anesthesia. At the institution where the study was conducted, various anesthesiologists administered the regional blocks, and a number of different nurse anesthetists were responsible for the intraoperative case management. It is unknown whether provider differences affected this study's results.

The findings of this study need to be replicated. A prospective study with a larger sample and one that controls for the type and dose of anesthetic used is suggested. We recommend an expanded study to investigate pain, voiding, and mobility beyond the immediate postoperative period. A study to determine length of stay, cost, and patient satisfaction related to the 2 anesthetic types also would be beneficial.

Conclusion
The multifactorial relationship among primary anesthetic, intraoperative management, and individual patient characteristics should be considered when evaluating patient outcomes. Postoperative outcomes may be dependent on complex interactions; therefore, anesthetic choice is perhaps best individualized for each patient rather than generalized for the population at large.

In this era of ambulatory surgery, resuming normal activities is a major concern of perioperative nurses and CRNAs alike. In the ambulatory surgery setting, significant causes of delayed patient discharge or unanticipated hospital admissions are urinary retention and impaired mobility. Preparing the patient for discharge to home after inguinal hernia repair is a team effort and must begin preoperatively. Patient education is an important nursing responsibility; common postoperative complications such as the ones targeted in this study and the benefits of the various anesthetic choices should be shared with patients so that they can make informed decisions before inguinal hernia repair.

REFERENCES

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