# Ambulatory Discharge After Long-Acting Peripheral Nerve Blockade: 2382 Blocks with Ropivacaine

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Discharging patients with a long-acting peripheral nerve block remains controversial. Concerns about accidental injury of the limb or surgical site because of an insensate extremity are common despite a lack of data on the subject. We report a study examining the efficacy and complications of discharge after long-acting block. This prospective study included 1791 patients receiving an upper or lower extremity nerve block with 0.5% ropivacaine and discharged the day of surgery. Efficacy (conversion to general anesthesia and opioid use), persistent motor or sensory weakness, complications, satisfaction, and unscheduled health care visits were assessed in the postanesthesia care unit (PACU) and at 24 h and 7 days postoperatively using a detailed questionnaire. There were 2382 blocks placed: 1119 upper extremity blocks and 1263 lower extremity blocks. Efficacy was demonstrated by a small conversion to general anesthesia (1%–6%) and a lack of patients requiring opioids in the PACU (89%–92%). A large percentage of patients continued to use opioids at 7 days (17%-22%). Despite the requirement for opioids, satisfaction with the anesthesia experience was high at 24 h and 7 days (Liekert scale [1–5] mean at 24 h, 4.88 $\pm$ 0.44; mean at 7 days, 4.77 $\pm$ 0.69) and most (98%) would choose the same anesthetic again. Thirty-seven patients (1.6%) were identified with symptoms or complaints at 7 days. After review, 6 of them (0.25%) had a persistent paresthesia that may have been related to the block or discharge. We conclude that long-acting peripheral nerve blockade may be safely used in the ambulatory setting with a high degree of efficacy, safety, and satisfaction. This technique is associated with an infrequent incidence of neurologic complications and injuries. Given the frequent incidence of persistent pain at 7 days, prolongation of the analgesia would be beneficial.

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Discharging patients with a long-acting peripheral nerve block remains controversial. Long-acting blockade provides anesthesia and analgesia but also leads to a loss of proprioception and the protective reflex of pain. Anesthesiologists are often concerned that an insensate upper or lower extremity may place outpatients at risk for accidental injury of the limb or surgical site. Patients with lower extremity peripheral nerve blockade are also potentially at risk for falls, trauma, and the inability to ambulate (1).

In addition, surgeons complain that patient satisfaction with their analgesia is reduced when long-acting nerve blocks resolve at home or at night when there are few treatments for refractory pain, leading to unexpected admission. As a result, practitioners frequently restrict use of long-acting local anesthetics in the ambulatory setting or avoid use of these drugs in the lower extremity (2).

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Despite these concerns, ambulatory surgery using regional anesthesia with long-acting local anesthetics has the potential to provide excellent operating conditions, postoperative pain control, and an infrequent incidence of side effects, particularly in orthopedic patients. Providing these patients with improved analgesia and fewer side effects is imperative because postoperative pain and nausea are still the two most frequent complications after orthopedic surgery requiring treatment. In a large prospective study of 17,877 patients, Chung and Mezei (3) documented that 16% of ambulatory orthopedic surgery patients experience severe postoperative pain. This incidence was the most frequent of nine different surgical procedure categories.

Given the potential benefits of regional anesthesia and the degree of pain these patients experience, combined with a reluctance to discharge them with an insensate extremity, many patients may not be receiving beneficial treatment. Unfortunately, there are few studies, with a sufficient sample size, examining patients who have been discharged with an intact peripheral nerve block to reconcile these concerns.


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We report a prospective study examining the efficacy and complications of upper and lower extremity peripheral nerve blocks with ropivacaine 0.5% in ambulatory patients discharged the day of surgery.

## Methods

Approval for the study was obtained from our IRB. In this study, 1,791 patients classified as ASA physical status I–IV, aged 6 yr or older, participated in this prospective case collection. All patients receiving an upper or lower extremity peripheral nerve block with ropivacaine 0.5% and discharged the day of surgery between July 1998 and May 2000 at the Duke University Medical Center Ambulatory Surgery Center (ASC) were analyzed. Patients receiving a second injection after a failed initial block were also included. Exclusion criteria included planned or unplanned admission to the 23-h recovery care unit or hospital as well as the use of spinal or epidural anesthesia. Patients were not excluded for any other reason. Anesthetic techniques were determined at the discretion of the individual anesthesiologists and performed by attending staff, fellows, and residents (clinical anesthesia year three). Standard practice at our facility is to offer regional anesthetic options when possible for the majority of cases. Nerve blocks were performed using a nerve stimulator and different gauge (22–20-gauge) insulated needles (Stimuplex®; B. Braun, Bethlehem, PA). Patients were typically provided sedation with midazolam and fentanyl, being arousable to stimulation. Blocks were not placed after induction of general anesthesia except in pediatric cases.

Data for each patient were collected prospectively in the Duke University Medical Center Ambulatory Surgery Center Database (ASCDB) and automated anesthetic record. The ASC enrolled each surgical case in a database protocol. The ASCDB compiled information on demographic as well as surgical and anesthetic procedures. In addition, trained nurses collected data in the postanesthesia care unit (PACU) and at 24 h by telephone call. Trained research assistants collected 7-day postoperative data by telephone call. If the patients were unavailable at the first telephone call, a second call was placed 1 day later. Patients unavailable by telephone contact received a written questionnaire by mail.

Among the collected data, nurses recorded routine demographic data, ASA physical status, and the presence of coexisting disease. The type of peripheral nerve block and the local anesthetic and concentration were also documented. Blocks were classified as interscalene, supraclavicular, axillary, lumbar plexus, femoral, and sciatic. Combined blocks such as lumbar plexus and sciatic blocks were included in analysis.

The need for reblock at the discretion of the anesthesiologist and any acute complications related to injection (e.g., seizure, respiratory arrest, unexpected spinal) were also recorded. Data for patients receiving a reblock are included in all analyses, as well as presented in a separate subset to examine if this technique contributed to postoperative complications. Patients having a failed block requiring a general anesthetic were also noted.

In the PACU, patients were asked to record their pain at the surgical site using a verbal analog pain score (0 = no pain; 10 = worst pain imaginable). Patients requiring opioid analgesics were also noted. Efficacy of the block (based on the need for opioid analgesics) as well as final disposition from the PACU was also recorded.

At the 24-h and 7-day follow-up, patients were asked about the need to contact a nurse or doctor for pain, side effects, or any unexpected health care visit. In addition, to assess block resolution and the possibility of paresthesia or limb trauma, patients were asked at the 24-h and the 7-day follow-ups if they had any of the following symptoms: persistent numbness/tingling in the blocked extremity, persistent weakness in the blocked extremity, or inability to move the blocked extremity. Patients who responded positively to any of the above questions at the 7-day telephone call had their charts obtained for in-depth analysis. If a patient said they were unable to move the extremity they were asked if the problem was 1) secondary to pain; 2) secondary to cast or immobilizer; 3) patient tries, but is unable to move the extremity; 4) other. All positive responses at the 7-day telephone call to question 3) or 4) were also noted for future investigation.

To investigate the magnitude of postoperative pain, patients were asked at 7 days if they still required opioids for pain control. Patients were asked to rate their overall satisfaction with the anesthesia experience on a five-point scale (1 = dissatisfied to 5 = very satisfied) and "would you choose the same anesthetic again?"

Patients identified with positive responses to questions about block resolution from the 7-day telephone interview were considered suspicious for injury, either secondary to the neural blockade or postdischarge injury. These patients had their charts reviewed by two registered nurses. The nurses were unaware of the identified response or the nature of the study. They were asked to evaluate each patient's medical record for evidence of, documentation, diagnosis of, investigation for, treatment of, or admission for, any injury or complication related to their surgery. The patients identified were considered to have a complication because of anesthesia or surgery. All parametric data are presented as mean ± SD.

## Results

There were 2382 blocks performed on 1791 patients. Of these 2382 blocks, 1119 were upper extremity and 1263 were lower extremity. There were 733 interscalene, 193 supraclavicular, 193 axillary, 338 lumbar plexus, 263 femoral, and 662 sciatic blocks enrolled. Age, gender, weight, height, and ASA classification are listed in Table 1. Acute block complications were noted in 11 patients: 4 patients with oversedation (1 interscalene, 2 supraclavicular, 1 femoral); 1 axillary block patient with preseizure excitation; 1 lumbar plexus block with epidural spread that did not require treatment; and 5 that were not specifically documented. However, those five were not seizures or excitation; that is documented elsewhere. All complications were managed with conventional measures and none required the postponement or cancellation of surgery. Block efficacy, including data for failed blocks requiring conversion to general anesthesia as well as requirement for opioid analgesia in the PACU, is presented in Tables 2 and 3. Of the 115 patients receiving a reblock, 3 patients complained of neurologic symptoms at 7 days.

Follow-up telephone contacts were completed in the majority of patients at 24 h and 7 days. At 24 h/7 days the percent contacted were as follows: interscalene, 66/62; supraclavicular, 63/48; axillary, 65/65; lumbar plexus, 69/56; femoral, 71/60; sciatic, 70/59.

Although the analgesia efficacy in the PACU was profound, this was not maintained, and a large percentage of patients (17%–27%) continued to use opioids at 7 days (Table 3). Despite the requirement for opioids, satisfaction with the anesthesia experience was high at 24 h and 7 days. At 24 h, interscalene, 4.84 ± 0.55; supraclavicular, 4.93 ± 0.41; axillary, 4.89 ± 0.43; lumbar plexus, 4.89 ± 0.35; femoral, 4.83 ± 0.51; and sciatic, 4.87 ± 0.39. At 7 days, interscalene, 4.76 ± 0.71; supraclavicular, 4.78 ± 0.71; axillary, 4.75 ± 0.79; lumbar plexus, 4.81 ± 0.65; femoral, 4.73 ± 0.65; and sciatic, 4.78 ± 0.65. Supporting this was the fact that the majority (interscalene, 97.8%; supraclavicular, 99.5%; axillary, 98.9%; lumbar plexus, 98.8%; femoral, 97.3%; and sciatic, 98.4%) would choose the same anesthetic again.

Data from the 24-h and 7-day telephone interviews concerning complications after discharge are presented in Table 4, Figure 1, and Figure 2. Thirty-seven patients (1.6%) were identified with positive responses at the 7-day interview and had their charts reviewed. Eleven were reviewed because they indicated an unscheduled health care contact and reported a significant event. Twenty-six were reviewed because they indicated positive responses to the symptom questionnaire. Of these 37 patients, 3 patients were reblocked because the initial blockade was inadequate.

Of those 26 patients who responded positively to the symptom questionnaire, 4 (0.17%) had complaints attributed to neurologic issues that could have been related to the block or the surgery. One patient underwent a distal radius repair under interscalene block and complained of tingling in the radial distribution of her hand. This gradually resolved and was not present at her 6-mo follow-up. Another patient had a neurofibroma removed from the medial aspect of the elbow under supraclavicular block. Postoperatively, paresthesias were noted in the ulnar distribution of the hand. These also resolved, according to subsequent examination reports. A third patient who received a sciatic block was noted to have a subtle foot drop, which was attributed to prolonged immobilization in a cast, on a return visit. This subsequently resolved.

The most dramatic complaint occurred in a patient who received an interscalene block for open reduction and internal fixation of a clavicle fracture. He developed a complete brachial plexopathy postoperatively. Examination revealed an injury at the level of the cords, directly at the surgical site. The injury was attributed to surgery and was not related to the block. The patient had a gradual resolution of symptoms over 3 mo and recovered completely. Despite the likely surgical etiology, this patient was also included in subsequent data analysis as a complication.

Of those 11 (0.4%) reporting an unscheduled health care contact with a significant complaint, two patients reporting numbness were attributed to their prior disease (including one patient who was reblocked). In three other patients complaining of numbness, no mention of the problem could be ascertained from their charts. This included one patient who was reblocked. One patient who had an interscalene block complained of bilateral hand numbness at a physical therapy visit. Two patients had numbness documented in the operative extremity on their postoperative visits but the etiology could not be determined. One patient complained of a hematoma at the site of an axillary block injection site; this complication resolved without treatment. Another patient fell exiting the car after being discharged with a femoral and sciatic nerve block. There was no subsequent injury and this patient rated their anesthetic experience highly. Another patient reported a near-syncopal experience that was transient and did not result in a fall.

## Discussion

The results of this study demonstrate that discharging patients with a long-acting peripheral nerve block of the upper or lower extremity can be done effectively and safely in the ambulatory setting. In addition, the incidence of accidental injury to the limb or surgical site from block placement or discharge resulting in

**Table 1.** Demographics

| Block | Age (yr) | Gender (M/F) | Weight (kg) | Height (cm) | ASA Physical Status (I/II/III/IV) |
|---|---|---|---|---|---|
| Interscalene ($n$ = 733) | 41 ± 17 | 455/271 | 84 ± 22 | 172 ± 13 | 217/360/131/15 |
| Supraclavicular ($n$ = 193) | 43 ± 19 | 99/94 | 77 ± 23 | 168 ± 16 | 49/97/35/15 |
| Axillary ($n$ = 193) | 43 ± 20 | 103/90 | 79 ± 25 | 169 ± 17 | 47/95/43/3 |
| Lumbar Plexus ($n$ = 338) | 55 ± 16 | 196/142 | 85 ± 21 | 177 ± 77 | 127/162/39/1 |
| Femoral ($n$ = 263) | 41 ± 17 | 129/134 | 82 ± 22 | 171 ± 14 | 71/141/40/5 |
| Sciatic ($n$ = 662) | 37 ± 18 | 352/310 | 81 ± 26 | 172 ± 58 | 213/332/92/8 |

Data are expressed as mean ± SD.

**Table 2.** Block Effectiveness

| Block | Failed block requiring general anesthesia | Reblock | VAS of zero on arrival to PACU | Failed blocks requiring opioids in PACU |
|---|---|---|---|---|
| Interscalene ($n$ = 733) | 18 (2.5) | 26 | 15 | 6 |
| Supraclavicular ($n$ = 193) | 2 (1) | 11 | 2 | 0 |
| Axillary ($n$ = 193) | 5 (2.5) | 15 | 3 | 2 |
| Lumbar Plexus ($n$ = 338) | 13 (4) | 15 | 11 | 5 |
| Femoral ($n$ = 263) | 16 (6) | 15 | 14 | 3 |
| Sciatic ($n$ = 662) | 34 (5) | 33 | 29 | 11 |

Values are presented as the total for each block type. Numbers in parentheses are percent of each block.
VAS = Verbal Analogue Scale; PACU = Postanesthesia Care Unit.

**Table 3.** Postoperative Opioid Use

| Block | Requiring opioids in PACU | No opioids in PACU (%) | Requiring opioids at 7 days n (%) |
|---|---|---|---|
| Interscalene ($n$ = 733) | 64 (8.7) | 91.3 | 198 (27) |
| Supraclavicular ($n$ = 193) | 19 (9.8) | 90.2 | 33 (17) |
| Axillary ($n$ = 193) | 15 (7.8) | 92.2 | 43 (22) |
| Lumbar Plexus ($n$ = 338) | 32 (11.4) | 88.6 | 74 (22) |
| Femoral ($n$ = 263) | 30 (11.4) | 88.6 | 56 (22) |
| Sciatic ($n$ = 662) | 73 (11.0) | 89.0 | 140 (21) |

Values are presented as total number for each block type or percent of total as indicated. Numbers in parentheses are percent of each block.
PACU = Postanesthesia Care Unit.

**Table 4.** Follow-up at 24 Hours and 7 Days

| Block | Percent contacted by telephone | Persistent Numbness | Persistent Weakness | Inability to Move | Immobilized |
|---|---|---|---|---|---|
| 24-h follow-up | | | | | |
| Interscalene ($n$ = 733) | 66 | 53 | 47 | 38 | 13 |
| Supraclavicular ($n$ = 193) | 63 | 12 | 9 | 6 | 5 |
| Axillary ($n$ = 193) | 65 | 18 | 5 | 6 | 4 |
| Lumbar Plexus ($n$ = 338) | 69 | 24 | 18 | 22 | 35 |
| Femoral ($n$ = 263) | 71 | 12 | 10 | 15 | 12 |
| Sciatic ($n$ = 662) | 70 | 39 | 30 | 40 | 31 |
| 7-day follow-up | | | | | |
| Interscalene ($n$ = 733) | 62 | 1 | 1 | 0 | — |
| Supraclavicular ($n$ = 193) | 48 | 2 | 0 | 3 | — |
| Axillary ($n$ = 193) | 65 | 2 | 1 | 1 | — |
| Lumbar Plexus ($n$ = 338) | 56 | 2 | 2 | 1 | — |
| Femoral ($n$ = 263) | 60 | 2 | 2 | 1 | — |
| Sciatic ($n$ = 662) | 59 | 3 | 4 | 2 | — |

Values are the total number of patients for each block complaining of each symptom unless otherwise noted. Patients were allowed to report more than one symptom.

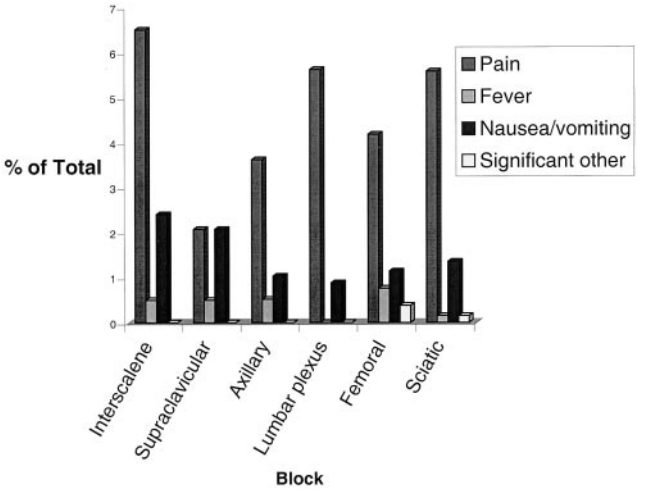


**Figure 1.** Percent of patients by block who responded that they had contacted a nurse or doctor at 24 h and complained of pain, fever, nausea/vomiting, or issues significant to the study. Patients were allowed to report more than one symptom. Contacts for questions relating to dressings, surgical visits, or issues unrelated to discharge are not included.

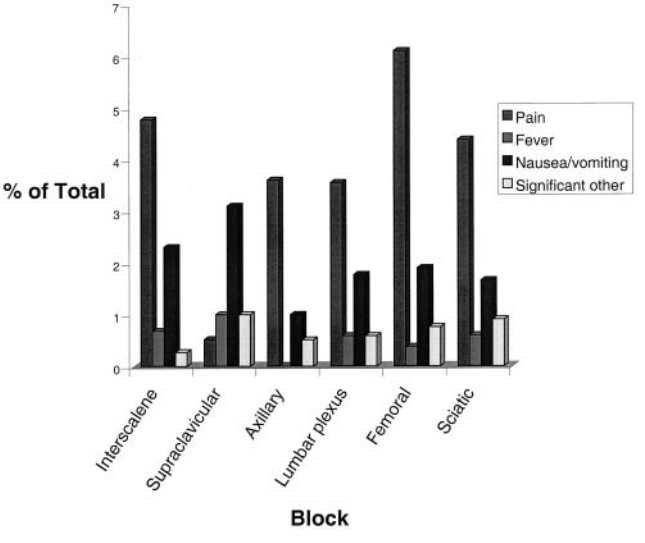


**Figure 2.** Percent of patients by block who responded that they had contacted a nurse or doctor at 7 days and complained of pain, fever, nausea/vomiting, or issues significant to the study. Patients were allowed to report more than one symptom. Contacts for questions relating to dressings, surgical visits, or issues unrelated to discharge are not included.

neurologic injury or surgical complication is very small. Further, despite concerns about the sudden resolution of analgesia and difficult pain management postoperatively, this problem was well tolerated and patient satisfaction remained high.

Efficacy of long-acting peripheral nerve blockade was demonstrated by the small conversion to general anesthesia (1%–6%) and the lack of patients requiring opioids in the PACU (89%–92%) (Table 2). Of particular note, the majority of those patients requiring conversion to general anesthesia were pain-free when reaching the PACU. This likely represents gradual onset of neural blockade over time in those particular cases.

Successful use of a long-acting local anesthetic in the ambulatory setting relies on several conditions, which makes this practice reliable and effective. Williams et al. (4) documented several of these factors in their process analysis of outpatient knee surgery comparing regional and general anesthesia. To allow adequate set-up time and evaluation, they illustrated that placing blocks in a monitored preoperative holding area is essential for operating room efficiency. This environment enables staff to perform techniques in a well-equipped area before the start of each case, assuring time for evaluation, and avoids using operating room time. At our institution, a core team of experienced regional anesthesiologists either places each block or supervises resident performance. Furthermore, there is strong surgical support and a group philosophy to aggressively implement these techniques, which is fundamental to its success. Hadzic et al. (2) speculated that these were some of the fundamental reasons why many of the respondents in their study on practice patterns in the United States performed regional anesthesia but avoided it in the ambulatory setting. Additional information that would be helpful, but that was not obtained in this study, is the time to perform each neural blockade and the length of stay in the PACU.

The incidence of accidental injury or complication from early discharge appears very small. Of particular interest was the fact that there were only 37 patients (1.6%) who were identified as having the potential for an injury or neurologic complaint at the 7-day interview. After careful review, only 7 (0.29%) of them had a persistent paresthesia that may have been related to the block. In each case the neurologic complaint resolved over a period of less than three months, and in most cases the etiology could not be differentiated from the primary surgery. This is supported by Stan et al. (5) who found sensory paresthesias in 0.2% of patients in their analysis of neurovascular complications after axillary block.

Concerns about falls and injury to the limb because of an insensate extremity seem rational but do not appear to be supported by the data in this study. Besides one patient who fell exiting a car, patients universally protected themselves from harm, even the 18% who were ASA III–IV. This may be a result of a cautious defensive nature postoperatively or of the fact that the majority was already immobilized for surgical reasons. The exact mechanism for this safety is likely multifactorial. However, strict written guidelines did not play a role because these were not in place. In fact, given the infrequent incidence of patient injury in this study, the problem appears to be rare, and withholding the analgesic benefits of long-acting

local anesthetics in ambulatory patients may be unjustified.

This study was specifically designed to evaluate block efficacy, neurologic injuries related to block placement and complications related to discharge. Despite the broad scope of the investigation, several limitations of the design exist. Foremost, although follow-up contacts were made with the majority of patients, it was not possible to reach every patient at 24 h and 7 days. Therefore, the exact incidence of complications could be larger. Another drawback was that injury data were documented by interview instead of comprehensive neurologic examination and electroneuromyography. Although possible, this would have proved difficult with such a large series. As a result, subtle injuries with a reduced level of impairment could have been missed. In addition, specific problems such as difficulties with activities of daily living and falls were not directly queried. Events that may have been worrisome but failed to reach the level of injury could also have been missed. However, there is a high likelihood that the questions asked would have revealed major complications. Additionally, a comparison with other methods such as general anesthesia was not made, eliminating the ability to make definitive comparisons between techniques.

Caregivers frequently laud regional anesthesia for the intense pain relief provided by neural blockade but complain that postoperative management can be difficult when there is the sudden onset of pain after block resolution. Despite this perception, only 2.0%–6.5% of patients contacted a doctor or a nurse to address issues of pain control within the first 24 h after discharge. This incidence was similar at 7 days and, to our knowledge, no patient required overnight admission. Furthermore, the majority of patients were highly satisfied (4.88 $\pm$ 44) with their anesthesia and would choose the same anesthetic again (98%). However, even with this success the magnitude of pain after extremity surgery supports the concept that prolonging the analgesia after neural blockade is still necessary. This need exists despite standard use of multimodal analgesic therapy, including nonsteroidal antiinflammatory drugs, frequent cryotherapy use, and instructions to take opioids before severe pain occurs. At our institution there is an effort to expand the scale of ambulatory surgery and to try and facilitate it with regional anesthesia; however, pain control remains the largest obstacle. Emphasizing this point was the 17%–22% incidence of patients still requiring opioid analgesics 7 days postoperatively. This concurs with the findings of Chung and Mezei (3), who found that 16% of patients found pain to be severe after outpatient orthopedic surgery.

Given this degree of postoperative pain and the potential for long-acting local anesthetics to provide analgesia in the immediate perioperative period, use in outpatients seems appropriate. The results of this study demonstrate that this practice may be done safely with a high degree of efficacy and satisfaction. This technique is associated with an infrequent incidence of neurologic complications and injuries despite discharge with an insensate extremity. Unfortunately, although the perioperative results are encouraging, the frequent incidence of pain at 7 days suggests that longer-acting local anesthetics are still needed.

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