Patient-controlled Analgesia after Major Shoulder Surgery

Patient-controlled Intercalane Analgesia versus Patient-controlled Analgesia

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Background: The authors compared patient-controlled interscalene analgesia (PCIA) with local anesthetics with intravenous patient-controlled analgesia (PCA) with opioids to manage postoperative pain after major shoulder surgery.

Methods: Forty patients scheduled for elective major shoulder surgery were prospectively randomized to receive either PCIA or PCA. Before surgery, all patients had an interscalene block. In the PCIA group, a catheter was introduced within the interscalene sheath. Six hours after the initial block, patients received either a continuous infusion of 0.15% bupivacaine through the interscalene catheter at a rate of 5 ml/h plus a bolus of 3 or 4 ml with a lock-time of 20 min (group PCIA) or a continuous intravenous infusion of nicomorphine at a rate of 0.5 mg/h plus a bolus of 2 or 3 mg with a lock-time of 20 min (group PCA). Pain relief was regularly assessed using a visual analog scale, side effects were noted, and the patients were asked to rate their satisfaction at the end of the study.

Results: Pain relief was significantly better controlled in the PCIA group at t = 12 and 18 h (P < 0.05). Vomiting and pruritus were 0 versus 25% and 0 versus 25% for the PCIA and PCA groups, respectively (P < 0.05). Patient satisfaction was greater in the PCA group (P < 0.05). Time of first bolus administration and paracetamol supplement were similar in both groups.

Conclusions: The use of the PCIA technique was uncomplicated and provided better pain relief than PCA during the first 18 h after operation. The incidence of side effects such as vomiting and pruritus was significantly decreased with the use of PCA, and patient satisfaction was superior in the PCIA group. (Key words: Anesthesia; shoulder. Anesthetics: bupivacaine; nicomorphine. Analgesic techniques: patient-controlled

Interscalene analgesia; patient-controlled analgesia. Side effects: pain; pruritus; nausea and vomiting.)

MAJOR shoulder surgery is often associated with severe postoperative pain, especially within the first 48 h. Pain control is important in this setting, not only to improve the patient's well being but also to facilitate rehabilitation. Patient-controlled analgesia (PCA) is considered a measurement standard for assessing acute postoperative pain treatment. This technique has proved to be popular because patients like the security of knowing they can achieve pain relief quickly and easily without involving a nurse. Nurses find the pumps easy to manipulate and time saving. A steady state of analgesia is easily obtained by the frequent use of small boluses, which avoids the peaks and troughs associated with administration on a 3- to 4-h basis. However, potent opioids result in several potential side effects, including nausea, pruritus, urinary retention, and respiratory depression.

Interscalene block provides effective anesthesia-analgesia for shoulder surgery. The use of long-acting local anesthetics gives prolonged postoperative analgesia and permits a decrease of opioid requirements and associated side effects. Interscalene block has been performed by either single shot bolus or continuous infusion. To our knowledge, the use of patient-controlled interscalene analgesia (PCIA) has not been described yet. In this trial, we assessed and compared the efficacy of the PCA and PCIA techniques after shoulder arthroplasty or rotator cuff repair.

Patients and Methods

After we obtained approval of our institutional ethics committee and written informed consent from patients,
we prospectively enrolled into the study 43 adults of both sexes (classified as American Society of Anesthesiologists physical status I or II; age, 18–75 yr; weight, 50–100 kg) scheduled for an elective shoulder arthroplasty or rotator cuff repair. Exclusion criteria were included any contraindications to interscalene block, including severe bronchopulmonary disease, known allergy to bupivacaine or opioids, previous analgesic treatments with opioids, and pain in the shoulder due to other conditions. Patients were assigned according to a computerized randomization list to either group PCA or PCA. All patients had an interscalene block performed before induction of general anesthesia. In both groups, the interscalene brachial plexus was identified using a nerve stimulator (Stimuplex-DIG; B. Braun, Melsungen, Germany) connected to the proximal end of the metal inner needle of a plastic cannula (Coniplex; B. Braun Melsungen AG). The placement of the needle was considered successful when a group of muscles distal to the deltoid was stimulated with a threshold stimulation less than 0.5 mA. In both groups, interscalene blockade was performed with 30 ml 0.5% bupivacaine. In the PCA group, a catheter (Coniplex; outer diameter, 85 mm) was introduced distally within the interscalene sheath for up to 7–8 cm and fixed to the skin with adhesive tapes. In this group, the interscalene block was performed by administering the bupivacaine through the catheter. In the PCA group, the interscalene block was performed by injecting bupivacaine once the stimulation needle was adequately placed. Interscalene block was confirmed in all patients by a sensory (inability to recognize cold temperature) and motor (inability to extend the arm, paresthesia in the tip of the second and third fingers) block involving the radial and median nerves, within 20 min after the administration of local anesthetic.

The general anesthetic technique was standardized for all patients. They were premedicated with 0.1 mg/kg midazolam given orally 1 h before anesthesia. After the interscalene block was complete, induction was performed with 1.5–2 mg/kg propofol and anesthesia was maintained with 8–10 mg kg−1 h−1 propofol. Endotracheal intubation was facilitated using 0.8 mg/kg rocuronium, and 3–5 µg/kg fentanyl was given within the first 15 min after induction. For all patients, an infusion of either bupivacaine through the interscalene catheter or intravenous nicomorphine was started in the recovery room 6 h after the initial interscalene block. The PCA group (Pain Management Provider/Abbott Laboratories, North Chicago, IL) received through the interscalene catheter a continuous infusion of 0.15% bupivacaine at a rate of 5 ml h−1 plus a bolus of 4 ml for patients weighing >65 kg and 3 ml for those weighing < 65 kg, with a lockout time of 20 min. At the same time, the PCA group (Pain Management Provider/Abbott Laboratories) received a continuous intravenous infusion of nicomorphine at a rate of 0.5 mg h−1 plus a bolus of 3 mg for patients weighing > 65 kg and 2 mg for those weighing < 65 kg, with a lockout time of 20 min. The study period ended 48 h after the interscalene block.

If pain was not adequately controlled (pain score >30 on the visual analog scale [VAS]), patients received 1 g paracetamol given intravenously to a maximum dose of 6 g/day.

A research nurse, not involved in the intraoperative part of the study, was responsible for asking the patient about the pain score, the appearance of side effects, and his or her satisfaction. Pain, by using a VAS ranging from 0 = no pain to 100 = worst pain imaginable, was assessed at the time PCA or PCA was started in the recovery room (t = 0) and every 6 h for the next 48 h. The appearance of nausea, vomiting, pruritus, or other side effects was noted. The time of the first PCA or PCA bolus was checked as was the number of paracetamol supplements needed. Nausea and pruritus were recorded only when patients asked for treatment. Nausea was treated by 2 mg tropisetron given intravenously, and pruritus was treated using 10 or 20 mg propofol given intravenously and repeated as necessary. A motor block was considered present when the patient reported difficulties in flexing or extending any of the fingers 12 h after the interscalene block. Patient satisfaction assessed 6 h after the end of the study period was evaluated using a VAS ranging from 0 = not satisfied to 10 = entirely satisfied.

Results were reported as mean ± SD. Demographic data were compared using one-way analysis of variance, pain scores (according to the VAS) were compared by the Mann-Whitney test with Bonferroni’s correction for multiple comparisons, time of first bolus and paracetamol supplement were assessed by the Mann-Whitney test, and side effects were analyzed using Fisher’s exact test. For all determinations, a probability value < 0.05 was considered significant.

Results

The two groups were comparable with regard to demographic and surgical data (table 1). Three patients...
were excluded from the study: two in the PCIA group and one in the PCA group. In the PCIA group, one patient “inadvertently” lost his catheter while in the other the insertion of the catheter within the interscalene sheath could not be achieved. In the PCA group, one patient was withdrawn from the study after 24 h because of intractable vomiting secondary to use of nicedorphine. The time of the first PCIA or PCA bolus was similar in both groups. No significant difference between the two groups in the mean dose of supplemental paracetamol was observed (table 2).

Pain score was similar in both groups when PCIA and PCA were started (t = 0) and 6 h later (t = 6). Significantly better pain control was observed in the PCIA group at t = 12 h and t = 18 h. At t = 24, 30, 36, 42, and 48 h, no significant difference in pain score between the two groups was observed (table 3).

Side effects observed during the study period are summarized in table 2. Vomiting and pruritus were observed significantly more frequently in the PCA group; nausea and motor block were comparable in both groups (table 3).

Patient satisfaction was 9.8 (range, 9–10) in the PCIA group compared with 7.6 (range, 2–10) in the PCA group (P < 0.05).

Discussion

Available studies with bolus or continuous interscalene plexus block have concentrated mainly on the feasibility, clinical efficacy, technical problems, and local anesthetic blood concentrations.7–9 Use of interscalene block was shown to be well suited for shoulder surgery,10 as confirmed by the results of the present trial. To date, none of these have compared the efficacy of pain relief with conventional PCA.

Continuous infusion of 7.5 mg/h bupivacaine was chosen, because patients in pilot studies (unpublished data) were generally satisfied with this dose. We decided to use a background continuous infusion, because patients in pilot studies found it unpleasant to be so frequently awake during the first two nights after operation to press the button. The PCIA was compared with the PCA, the latter technique being considered as the measurement standard for postoperative pain comparisons.11 It is noteworthy that the most important factor that increases patient satisfaction using PCA is not the large improvement in analgesia but the possibility of controlling their pain relief.12 A background continuous infusion of nicedorphine was also given to avoid a methodologic bias, because we knew that PCA with a concurrent infusion did not show any advantages compared with PCA alone.13 According to our patients in pilot studies, the dose chosen for both techniques gave a positive ratio in terms of analgesia and side effects. The study duration was limited to the first 48 h after operation, because after major shoulder surgery the most severe pain occurs within this time period.
In the PCA group, the VAS satisfaction score was 7.6, and this value is slightly lower than those found in the literature, which vary from 80% to 95%13,15; this may be explained by the different scale used in our protocol and the type of surgery. The incidence of vomiting (25%) is similar to that observed by Sümpelmann et al.16 and lies within the usual range of vomiting after general anesthesia and PCA technique.17 In our study, vomiting occurred exclusively after the 22nd postoperative hour; it may be possible that early vomiting was prevented by the total intravenous anesthetic technique used in our protocol.18 The observed incidence of pruritus seems high (25%), but Eisenach et al.15 and Harrison et al.19 found a tendency toward more pruritus in the PCA groups compared with that when intramuscular narcotics are used. Motor block (20%) may be explained by the residual effects of the initial interscalene block; no motor block was observed in this group 16 h after surgery.

In the PCIA group, the VAS satisfaction score was 9.8. Compared with the PCA group, this may be explained by the improved pain relief within the first 18 postoperative hours, the lower incidence of side effects, and the possibility, as expressed by the patients, to successfully and rapidly reinforce the block shortly before a shoulder physiotherapy session. D’Alessio et al.20 also observed a low incidence of nausea and vomiting and pruritus. The good control of postoperative nausea and vomiting in this group may be explained by both the total intravenous anesthesia (TIVA) technique and the use of a continuous infusion of bupivacaine in the postoperative period, which may prolong the beneficial effects of the preoperative interscalene block on the stress response induced by the surgical procedure.

In both groups no patient showed any signs of opioid toxicity, respiratory depression, local anesthetic toxicity, central nervous system excitation, or cardiac depression. The study design may be criticized for the unblinded nature of the trial. Indeed, whether a patient has an interscalene catheter is obvious. To minimize this bias, we asked a nurse working in the pain clinic to collect the data. She was neither involved in the study nor directly informed about its aims.

Use of the PCIA technique was uncomplicated in this study. The small number of patients does not permit us to make conclusions about relative safety, but we encountered no problems in either group.

We evaluate the feasibility and efficacy of using PCIA after major shoulder surgery. This technique offers excellent pain relief for the first 48 h after operation and is associated with a low incidence of side effects. It compares favorably with the PCA technique in terms of quality of analgesia, side effects, and patient satisfaction and may be considered a valuable alternative to intravenous PCA with opioids to manage postoperative pain after major shoulder surgery.

References
