Postoperative Pain Relief in Children Undergoing Tympanomastoid Surgery: Is a Regional Block Better than Opioids?

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Peripheral nerve blocks of the surgical site can reduce the need for perioperative opioids thereby decreasing their unwanted adverse effects, such as postoperative nausea and vomiting. In this prospective, randomized, double-blinded study, we examined the efficacy of a great auricular nerve (GAN) block compared with IV morphine sulfate in children undergoing tympanomastoid surgery.

After the induction of general anesthesia, children were randomized to receive either a GAN block with 2 mL of 0.25% bupivacaine with epinephrine (1:200,000) and a sham IV injection of 2 mL of saline solution or a sham GAN block with 2 mL of saline solution with an IV injection of 0.1 mg/kg morphine sulfate diluted to 2 mL. Patients’ objective pain scores were assessed by a blinded observer and the incidence of vomiting was recorded. The GAN-Block patients as a group required more pain rescue in the postanesthesia care unit; this difference was not statistically different from the IV-morphine group (P = 0.084). Nine GAN-Block patients never received opioid or other analgesics at any time in the first 24 h after surgery. The group that received the GAN block also had a less frequent incidence of vomiting requiring intervention (7 versus 19) during their entire hospitalization or at home (P = 0.027). The GAN-Block group also had more patients who never experienced vomiting (13 of 20 versus 5 of 20, P = 0.026). In this cohort, a peripheral nerve block decreased the overall incidence of postoperative vomiting thereby reducing associated costs.


R ecognition and management of postoperative pain in children have improved in the last decade. Regional anesthesia is often combined with general anesthesia to provide better postoperative outcomes (1). Surgery in the tympanomastoid area is performed in children who have chronic otitis media with associated mastoiditis and in patients with sensorineural deafness who undergo placement of a cochlear implant. Postoperative pain is usually treated with opioids which are associated with adverse side effects such as nausea, vomiting, and occasionally, respiratory depression (2,3). In addition, children who have had surgery to their middle ear have a frequent incidence of nausea and vomiting in the postoperative period (4,5). Peripheral nerve blocks performed while the patient is anesthetized reduce the need for analgesics in the postoperative period (6–8). Therefore, methods to provide analgesia while avoiding or reducing the need for opioids may help decrease postoperative opioid-associated morbidity.

The great auricular nerve (GAN), a branch of the superficial cervical plexus (C2-3), supplies the mastoid area (9). The purpose of our study was to compare the efficacy of an intraoperative local anesthetic block of the GAN (without supplemental opioid) to intraoperative IV opioids (without nerve block) in children undergoing tympanomastoid surgery for providing analgesia thereby reducing adverse opioid-induced side effects.

Methods

After IRB approval and written informed consent and assent if age appropriate, children between the age of 2 and 18 yr with ASA physical status I–II who were scheduled to undergo tympanomastoid surgery were enrolled in this prospective, randomized, double-blinded study. Patients with known allergy to amide-type local anesthetics or a history of clinically important renal, hepatic, respiratory, cardiac, or neurologic
conditions were excluded. Our experience with children who received continuous fentanyl infusions for this operation suggested an approximate incidence of vomiting of 80%. A power analysis estimated a sample size of 40 patients would have an 80% power at the 0.05 level of significance to detect a 50% reduction in the number of patients requiring rescue between IV opioids and a GAN block for associated vomiting (from approximately 80% to 40%). We did not estimate power for analgesic effects because we had no experience with which to make such a prediction. Patients were divided into 2 groups using a computer-generated table of random numbers such that each group would contain 20 patients. One group received a GAN block with 2 mL of 0.25% bupivacaine with 1:200,000 epinephrine followed by a sham IV injection of 2 mL of sterile preservative-free normal saline. The second group received a sham GAN block with 2 mL of sterile preservative-free normal saline followed by an IV injection of morphine [0.1 mg/kg diluted in saline to a volume of 2 mL (MS group)]. No additional analgesics including opioids or nonopioids (nonsteroidal antiinflammatory drugs or acetaminophen), antiemetics, or steroids were administered during the procedure.

After the induction of anesthesia, the airway was secured with an endotracheal tube. Anesthesia was maintained with N\textsubscript{2}O, O\textsubscript{2}, and a volatile anesthetic (halothane or isoflurane). The landmarks for performing the GAN block were determined. This area was included in the surgical field during preparation. Approximately 1 h before the end of the procedure, one of the investigators (SS, SLB) injected the area of the GAN with 2 mL of one study solution (saline or local anesthetic) in a sterile manner (10). An IV injection of 2 mL of the other study solution (morphine or saline) was administered at approximately the same time. All individuals involved in patient care were blinded as to the solutions administered. The depth of anesthesia was titrated to patient requirements as indicated by clinical signs and all patients were tracheally extubated by using standard extubation criteria. Patients were transported to the postanesthesia care unit (PACU) where a blinded observer evaluated pain by using an Objective Pain Scale (OPS).\textsuperscript{1} Parents were allowed to visit their children after initial vital signs were recorded. The OPS scores were obtained on admission to the PACU and every 5 min thereafter for 60 min. They were further recorded every 30 min for the next 6 h in the short-stay unit. If the OPS score was ≥6, 5 min apart or if the patient specifically complained of pain localized to the surgical site, an IV pain rescue bolus of morphine (0.05 mg/kg) was administered in the PACU. If pain relief was still inadequate, an additional 0.05 mg/kg morphine was administered. Patients were also observed for the adverse outcome of vomiting; active vomiting was the only indication for intervention. The initial episode of vomiting was treated with IV ondansetron (0.1 mg/kg up to 4 mg). The need for additional opioids or other analgesics as well as interventions for vomiting in the short-stay unit were also recorded. The indication for additional analgesics or antiemetics was determined by the patient’s nursing team who were blinded as to the treatment group. All patients were discharged home with a questionnaire to evaluate satisfaction, parent’s perception of pain and vomiting, and a diary to record the need for additional analgesic medications.

Statistical analyses were performed with a statistical package (SPSS version 11.0; SPSS, Chicago, IL). All data were expressed as mean ± sd. Demographic data were compared by using standard t-tests; comparison of incidence data between groups was performed by using Fisher’s exact tests. A P value ≤ 0.05 was considered significant.

Results

Forty patients were enrolled in this study with 20 patients assigned to each group. Thirty-one of the 40 parents (77.5%) returned the questionnaire. There was no difference between groups regarding age, sex, weight, and type of procedure performed (Table 1). All but one procedure was done by one surgeon. Patients in the GAN-Block group as a whole tended to have higher pain scores upon entry to the PACU, but there was a wide variation between patients in both groups; these differences were not statistically different and all patients were pain free at the time of discharge from the PACU (Fig. 1). Nine of 20 patients in the GAN-Block group and 3 of 20 in the MS group received morphine pain rescue in the PACU (P = 0.084); there was also no significant difference in additional pain interventions in the short-stay unit or at home (Table 2). There were 9 patients in the GAN-Block group compared with 12 patients in the MS group that did not receive any additional analgesics (P = not significant). There was no difference in the duration of stay in the PACU or the short-stay unit. According to the parent questionnaire, there was no difference in the number of patients in either group receiving pain medications at home (GAN Block = 9 versus MS group = 14 [P = not significant]).

There were 14 patients in the GAN-Block group and 6 patients in the MS group that never experienced vomiting in the hospital (P = 0.027). There was an infrequent incidence of vomiting in the hospital (P = 0.027). There was an infrequent incidence of vomiting in the hospital (P = 0.027). There was an infrequent incidence of vomiting in the hospital (P = 0.027).
not statistically significant (P = 0.057) (Table 3). The overall incidence of vomiting in the PACU, short-stay unit, or at home was 7 of 20 patients in the GAN-Block group and 15 of 20 in the MS group (P = 0.026). There were only 7 interventions in 7 patients for vomiting in the GAN-Block group compared with 19 interventions in 15 patients in the MS group (2 patients were rescued twice and 1 patient rescued 3 times). The parent’s perception of vomiting was different from the objective measure used in the PACU. Only 2 parents in the GAN-Block group thought their child had any incidence of vomiting compared with 9 patients in the MS group (P = 0.03). However, the parent’s questionnaire indicated that there were no differences in the short-stay unit or at home with regard to vomiting. Satisfaction questionnaires were returned by 14 families in the GAN-Block group and 17 in the MS group. Satisfaction was excellent in 9 and good in 5 GAN-Block patients. Satisfaction was excellent in 12, good in 3, and fair in 2 MS-group patients.

Discussion

The use of peripheral nerve blocks in patients undergoing a variety of surgical procedures is becoming more popular in the pediatric population. We examined pain relief as well as the reduction of the opioid-induced side effect of vomiting in children undergoing tympanomastoid surgery. Although not statistically different, more patients in the GAN-Block group required pain rescue in the PACU (9 of 20 versus 3 of 20); however, 9 of the GAN-Block patients never required any pain rescue medications at any time in the first 24 h after surgery.
group in the PACU. Although the total number of interventions for pain relief was not different between groups, because only 11 patients in the GAN-Block group received any interventions for pain but all 20 patients in the MS group received opioid, it is not surprising that there would be a difference in the incidence of interventions for vomiting. We did not elicit a preoperative history for motion sickness so this also could have been an unassessed variable. Although pain and vomiting may be important factors influencing discharge criteria from the PACU and the short-stay unit, we were unable to demonstrate differences in our cohort. This may be attributed, in part, to our study design which required a minimum of 60 minutes in the PACU and an institutional bias for overnight admissions of these patients after surgery.

The use of the GAN block has been studied in patients undergoing otoplasty (8,11), but our study is the first application of this block in pediatric patients undergoing tympanomastoid surgery. The anatomic location of this nerve and the ease with which this nerve block can be performed does not significantly increase the procedure time. It may, however, eliminate or reduce the need for opioids. Care must always be taken when performing any nerve block that is near vital structures. Because the neck is very vascular, intravascular injection of local anesthetic solution may occur. Accidental injection into the internal or external jugular vein during injection of local anesthetic could cause systemic toxicity. Tears or punctures of these vessels could also lead to hematoma formation. The recurrent laryngeal nerve can sometimes be blocked during cervical plexus blockade (12). This usually occurs if the injection is performed deep at the posterior border of the sternocleidomastoid. Sequelae from a unilateral recurrent laryngeal nerve block include hoarseness, aphony, and difficulty in breathing. Although rare, a deep injection in the area can block the phrenic nerve. Deep injection can also block the cervical sympathetic ganglia leading to Horner’s syndrome (ptosis, miosis, and anhydrosis). Care must be taken to avoid the vertebral artery; the injection of 0.2 mL of local anesthetic into the vertebral artery could cause seizures (13). In our study, it is possible that some patients developed blockade of other branches of the superficial cervical plexus such as the lesser occipital nerve. We did not observe evidence of deep cervical plexus blockade in any patients.

Surrogate end points of satisfactory interventions are usually finite end points, such as pain relief or reduced nausea and/or vomiting. Several authors have suggested additional benefits such as cost-saving analysis (shortened hospital stay or reduced need for nursing and pharmaceutical resources to treat adverse side effects) and patient satisfaction as important considerations (14–17). Although general anesthesia in this population may itself lead to nausea and vomiting, the aim of our study was to examine possible reduction of adverse opioid-induced side effects by avoiding or reducing the need for opioids in the perioperative period.

Our data suggest that a single GAN block can provide complete analgesia in nearly half the patients, thus reducing the overall opioid requirements in children undergoing tympanomastoid surgery. This in turn seems to significantly reduce the incidence of vomiting. The cost savings in terms of drugs required to treat vomiting, bed linens, nursing time, suction equipment, etc., will benefit both parents and hospitals. Our data also suggest that a GAN block with bupivacaine (0.25%) with 1:200,000 epinephrine provides better or equivalent parent/child satisfaction than morphine in pediatric patients undergoing tympanomastoid surgery.

References