ORIGINAL RESEARCH

To compare the effectiveness of scalp nerve block and morphine for providing transitional analgesia after remifentanil-based anesthesia in neurosurgery

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ABSTRACT

Aim: To compare the effectiveness of scalp nerve block and morphine for providing transitional analgesia after remifentanil-based anesthesia in neurosurgery. **Material and methods:**A total of 100 patients, ranging in age from 20 to 72 years and classified as ASA I-III, who were scheduled to have an elective supratentorial craniotomy, were included in this research. The patients were allocated into two groups using a process of randomization utilizing sealed envelopes. Patients in the morphine group were administered morphine at a dosage of 0.1 mg per kilogram intravenously, diluted in 10 mL of normal saline, following the closure of the dura. Additionally, a scalp nerve block was performed using 0.9% normal saline as a placebo instead of the local anesthetic combination, as described in the Scalp Nerve Block section, at the conclusion of the operation. In the block group, patients were given 10 mL of 0.9% normal saline (placebo) intravenously following dural closure instead of morphine. The evaluation of pain after surgery was conducted at 1, 2, 4, 8, 12, 16, and 24 hours using a 10-point numerical rating scale. **Results:**There were a total of 100 patients included in the study, with 50 patients in each group. Group A is classified as a block group, whereas group B is classified as a morphine group. There were no discernible disparities in demographic and preoperative data across the groups. The intraoperative results were generally similar, except for the total minimum alveolar concentration-hours (MAC-h) of sevoflurane, which was higher in the morphine group. The statistical significance of this difference was due to a prolonged time of operation in the morphine group. The mean sevoflurane concentrations were 0.56 and 0.71 for the block and morphine groups, respectively. Patients in the morphine group had a higher incidence of nausea and vomiting at 12 and 24 hours after the surgery, but this difference did not reach statistical significance. There was no significant difference in the time it took to administer the first dosage of codeine between the two groups: 46 minutes for the block group and 31 minutes for the morphine group, with the median values. **Conclusion:** Ultimately, and in contrast to our first assumption, SNB seems to be comparable to morphine in terms of providing pain relief throughout the transition period in this group of patients. Further research is required to evaluate the advantages of alternative pain relief methods for managing transitional pain in individuals having intracranial surgery.

Keywords: Scalp nerve block,Morphine,Transitional analgesia,Remifentanil

INTRODUCTION

Remifentanil is a viable substitute for fentanyl or sufentanil in intracranial surgery, providing rapid neurological recovery (1-6). Nevertheless, due to the brief duration of action of remifentanil, a transitional approach is necessary to provide pain relief and guarantee a seamless and painless recovery from general anesthesia. Patients who are anesthetized with remifentanil but do not get transitional analgesia have the need for pain medication at an earlier stage and are more likely to develop early postoperative hypertension (7-9). Our research team has shown that administering a postoperative scalp nerve block (SNB) reduces the intensity of pain experienced after a craniotomy. As far as we know, there has been no research conducted to evaluate the effectiveness of this method as a kind of pain relief during the transition period after anesthesia with remifentanil in intracranial surgery. Consequently, we conducted a research that was prospective, randomized, controlled, and double-blinded in order to evaluate the effectiveness of SNB (superior nerve block) compared

to IV morphine for providing pain relief during the transition period following general anesthesia for supratentorial craniotomy. The general anesthetic consisted of remifentanil and sevoflurane. Our hypothesis was that implementing SNB would lead to decreased pain ratings, a decrease in opioid-related adverse effects (such as disorientation, nausea, and vomiting), and a reduction in the overall amount of opioids needed during the first 24 hours after surgery.

MATERIAL AND METHODS

Following permission from the ethics board and obtaining written informed consent, a total of 100 patients, classified as ASA I-III and aged between 20 and 72 years, who were scheduled to have an elective supratentorial craniotomy, were included in this research. The exclusion criteria for this study were those who were unable to comprehend a numerical rating scale (NRS), those with a confirmed or suspected allergy to local anesthetics or morphine, and individuals with a craniotomy incision that extended beyond the area covered by the SNB. Patients who had been consistently using opioid prescriptions for more than two weeks, had a history of alcohol consumption, and had current mental illnesses were not included in the study. Uniform anesthesia protocols were implemented for all patients. Patients received a premedication of intravenous midazolam at a dosage of 2 mg in the operation room. The process of inducing anesthesia included administering propofol at a dosage of 1.0-3.0 mg per kilogram and remifentanil at a dosage of 1.0 micrograms per kilogram. Tracheal intubation was facilitated with rocuronium (0.9–1.2 mg kg 1) or cisatracurium (0.15–0.20 mg kg 1). An infusion of remifentanil was started immediately after induction at a rate of 0.1 μg kg 1 min 1. The remifentanil infusion rate was adjusted between 0.1 and0.5 g kg 1 min 1,byincrementsordecrements of 0.1 μg kg 1 min 1, to maintain the mean arterial blood pressure between 60 and 80 mm Hg and the heart rate within 20% of the baseline value. Anesthesia was maintained with sevoflurane (0.5–1.0 MAC) in oxygen and air(Fio2 0.40) along with the remifentanil infusion. The attending anesthesiologist was asked to keep the sevoflurane-inspired concentration close to 0.5 MAC and make adjustments with the remifentanil infusion first and then increase the sevoflurane concentration as necessary. Remifentanil 1.0–1.5 μg kg 1 was given 1 min before the application of the Mayfield's head holder to prevent a hemodynamic reaction. There was no infiltration of the scalp by the surgeon. Muscle relaxants were used as needed to maintain a single twitch on train-of four stimulation. Patients were randomly divided into two groups using sealed envelopes. Patients in the morphine group received morphine 0.1 mg kg 1 IV, diluted in 10 mL of normal saline after dural closure and a SNB was per formed with 0.9% normal saline (placebo) instead of the local anesthetic mixture (compare Scalp Nerve Block section) at the end of surgery. For patients in the block group, 10 mL of 0.9% normal saline (placebo) was given IV after dural closure instead of morphine, and a SNB was performed using the same technique with bupivacaine and lidocaine at the end of the procedure. The syringes were prepared by an anesthesiologist not in volved in the study or care of study patients.

SCALP NERVE BLOCK

The supraorbital nerve block (SNB) was performed bilaterally at the conclusion of the surgical procedure, while the patient was still under general anesthesia and before to the removal of the head holder. The block was conducted by a researcher who was unaware of the details, using a method originally outlined by Pinosky et al. (10) and subsequently adopted by our team (9). The anesthetic solution included a combination of 10 mL of lidocaine 2% and 10 mL of bupivacaine 0.5% in the group block, whereas the group morphine received 20 mL of 0.9% saline. The supraorbital and supratrochlear nerves were blocked with 2 mL of solution as they emerged from the orbit with a 25-gauge needle introduced above the eyebrow perpendicular to the skin. The auriculotem poral nerves were blocked with 3 mL of solution, 1.5 cm anterior to the ear at the level of the tragus. With the needle perpendicular to the skin, infiltration of 1.5 Mlwasmadedeepinto the fascia and another 1.5 mL superficially as the needle was withdrawn. The post auricular branches of the greater auricular nerves were blocked with 2 mL of solution between skin and bone, 1.5 cm posterior to the ear at the level of the tragus. The greater, lesser, and third occipital nerves were blocked with 3 mL of solution by infiltrating along the superior nuchal line, approximately halfway between the occipital protuberance and the mastoid process. Patients were awakened and the trachea was extubated after completion of the block as they met standard extubation criteria.

POSTOPERATIVE PAIN

The patients were instructed to assess their level of pain using a 10-point Numeric Rating Scale (NRS), where 0 represented the absence of pain and 10 represented the most severe pain imaginable. This assessment was conducted by a nurse who had received specialized training in the method. The evaluations took place at 1, 2, 4, 8, 12, 16, and 24 hours after the surgical procedure. Observations were made about the cumulative administration of codeine, the occurrence of nausea and vomiting, and episodes of confusion. Only NRS data obtained from patients who were fully oriented and with a Glasgow coma score of at least 14 were considered for statistical analysis. Codeine phosphate (30–60 mg) was given subcutaneously to treat pain as needed every 4 h. Acetaminophen was given only in case of fever. Nonsteroidalanti-inflammatory drugs were not allowed duringthe study period. We noted the delay

before the first analgesic request in the postoperative period. Patients whodidnotrequest analgesic for the entire study period (48 h) were arbitrarily attributed a value of 2880 min.

STATISTICAL ANALYSIS

The data was gathered and stored in an Excel database. The results are reported as the mean standard deviation (SD), unless otherwise specified. The study compared demographic and intraoperative data across the two groups using the chi-square test for categorical factors and the unpaired Student's t-test for continuous variables. The chi-square test was used for nonparametric variables, while the unpaired Student's t-test was used for parametric ones. The study included a repeated measure analysis of variance and t-tests to assess variations in NRS score across different groups and over different time periods. An unpaired Student's t-test was used to examine the time gap between the conclusion of surgery and the first dose of codeine. A significance level of 0.05 was used throughout.

RESULTS

A total of 110 participants were enrolled for the trial. 10 participants were removed from the study before the protocol was completed due to problems during surgery that prevented them from being immediately taken off the breathing tube after the operation. There were a total of 100 patients included in the study, with 50 patients in each group. Group A is a control group, whereas Group B is an experimental group administered with morphine. The demographic and preoperative statistics were similar across the groups, as shown in Table 1. The intraoperative results were similar, except for the total minimum alveolar concentration-hours (MAC-h) of sevoflurane, which was higher in the morphine group (Table 2). The observed discrepancy achieved statistical significance due to a prolonged surgical procedure in the morphine group. The mean sevoflurane concentrations were 0.56 and 0.71 for the block and morphine groups, respectively.345 NRS scores were available for analysis. 10 scores were excluded because of a Glasgow Coma Score 14; 7 in the block group and 5 in the morphine group. Median NRS values with a range for each time interval are provided in Table 3. There was no difference in the NRS score between groups over the 24-h period. Table 4 lists the cumulative doses of codeine as well as delay before the administration of the first dose of codeine. The difference in codeine dosage reached statistical significance only at 4 h postoperatively, with a lower dose in the morphine group. There was no difference between groups in postoperative hemodynamics at postanesthesia care unit arrival and at 1 and 2 h postoperatively (Table 4). 7 patients in the block group and 5 patients in the morphine group received Treatment with antihypertensive drugs in the recovery room after anesthesia. The patients in the morphine group had a higher incidence of nausea and vomiting at 12 and 24 hours after the surgery, but this difference did not reach statistical significance. A single patient in each trial group received an intravenous dose of 12.5 mg of dolasetron during surgery to prevent nausea and vomiting, despite this being a breach of the protocol. However, these patients were not disqualified from the study.

Table: 1. Basic parameter of the participants

	Group block =50	**Group morphine=50**
Gender		
Male	29	32
Female	21	18
Age	50.98 ±3.39	48.47±5.48
Weight	70.53±8.48	78.19±6.62
Corticosteroids(cerebraledemaprophylaxis)	34	30
Acetaminophen (for postoperative fever	12	8
Preoperative diagnosis		
Tumor	32	30
Neurovascular	4	2
Epilepsy	6	4
Meningioma	8	14

Table 2. Intraoperative Data

	Group block	**Group morphine**
Body temperature	35.87±0.76	36.12±0.65
Baseline MAP(mmHg)	69.05±3.47	71.99±4.38
Sevoflurane(MAC-h)	3.34±1.66	4.56±2.6*1.64
Remifentanil(total,mg)	5.55±1.56	7.76±1.87
Duration of surgery(h)	6.54±1.88	7.76±1.21
Types of craniotomy		
Frontal	20	20

Fronto-temporal	12	14
Temporal	8	14
Parietal	10	2

Table: 3 Median Pain Scores

	Group block	**Group morphine**
1h	7 (0–10)	6 (0–10)
2h	6 (0–9)	5 (0–9)
4h	5 (0–9)	5(0–8)
8h	3 (0–8)	3 (0–7)
12h	3 (0–10)	3 (0–7)
16h	2 (0–8)	3 (0–7)
24h	2 (0–9)	3 (0–8)

Table: 4. Postoperative Data

	Group block	**Group morphine**
Delay before administration of codeine in minutes (median)	46	31
Cumulative dosage of codeine (mg)		
4h	79.21±12.54	54.34±11.95
12h	145.65±10.87	114.43±9.48
24h	218.05±13.54	213.23±13.42
48h	223.65±8.87	341.11±9.56
Percentage of patients with nausea and/or vomiting [cumulative n (%)]		
4h	25 (50)	27 (54)
12h	25 (50)	35 (70) (P =0.21)
24h	27 (54)	37(74) (P =0.21)
Postoperativehemodynamics PACUarrival		
SBP	141.54±7.65	149.21±7.36(P =0.16)
HR	82.32±6.54	91.54 ±5.87(P =0.07)
1hpostoperative		
SBP	141.87±8.98	140.02±7.67 (ns)
HR	77.32±6.54	79.13 ±7.43 (ns)
2hpostoperative		
SBP	133.54±5.45	138.05±6.78 (ns)
HR	78.98±3.32	82.98 ±3.65 (ns)

DISCUSSION

This research demonstrates that SNB (saphenous nerve block) offers analgesia throughout the transition period that is comparable to the analgesic effect of administering 0.1 mg/kg of morphine intravenously after closing the dura. The incidence of adverse events typically linked to opioid administration was comparable in both groups. The pain severity was moderate for the first 4 hours after the operation and mild for the next 16 hours. Several trials investigating the use of remifentanil as the primary opioid for intracranial surgery have included some kind of transitional analgesia, although not all of them have done so (11-14).Guy et al. (7) were the first to publish a study comparing remifentanil and fentanyl for intracranial surgery. They did not use transitional analgesia and found that patients in the remifentanil group required analgesia earlier than those in the fentanyl group, with no difference in the incidence of nausea and vomiting. Emergence hypertension was also more common in the remifentanil group. These pitfalls led the authors to believe that devising techniques to improve emergence and recovery analgesia was warranted. In a study with a similar design, Gelb et al. (6) showed that giving morphine 0.08 mg kg 1 IV at bone flap replacement did not affect the recovery profile in patients receiving a remifentanil infusion compared with those who received fentanyl. Remifentanil was superior in time to achieve preoperative neurological examination and quality of emergence. Remifentanil patients required analgesia earlier than fentanyl patients, but the analgesia provided by morphine was deemed adequate. There was no difference between the two groups in postoperative hemodynamics, nausea, and vomiting. The present study is, therefore, in

agreement with the literature in that some form of transitional analgesia improves pain control as well as hemodynamics early in the recovery process of neurosurgical patients, and that SNB is equivalent to morphine in doing so (11,12).

CONCLUSION

The scope of our investigation was restricted to individuals who had supratentorial craniotomies, since the SNB technique does not include the posterior fossa. This hinders the ability to compare with other research that include a wider range of patients. Ultimately, and in contrast to our first assumption, SNB seems to be comparable to morphine in terms of providing pain relief throughout the transition period in this group of patients. Further research is required to evaluate the advantages of alternative pain relief methods for managing transitional pain in individuals having intracranial surgery.

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