Original Article

Effect of Scalp Block on Postoperative Nausea and Vomiting & Recovery Profile after Craniotomy: A Randomized, Double-Blind, Controlled Study

Raham Hasan Mostafa[1]*, Mohamed Abdel-Fattah Ghoneim[1], Doaa Mohammed Kamal El-Din[1], Mohamed Abdulmohsen Abdulnaiem Ismaiel[1], Ibrahim Abdelmohsen[2], Sameh Ahmed Refaat[1]

Abstract

Background: Scalp block with bupivacaine has been shown to provide perioperative analgesia with a subsequent decrease in intraoperative opioids consumption. We performed a prospective randomized controlled study to evaluate the efficacy of preemptive scalp block in preventing Postoperative nausea and vomiting (PONV) after elective supratentorial craniotomy.

Materials and Methods: 40 patients were randomly allocated to either the control group or the preemptive scalp block group. Postoperative nausea & vomiting incidence & severity during 1st 24 hours after operation were recorded.

Results: PONV prevalence was statistically insignificant between the 2 study groups; 50% in the control group, 45% in the scalp block group. On the other hand, scalp block blunted response of both mean arterial blood pressure and heart rate with noxious stimuli during pinning and skin incision together with improvement in recovery profile.

Conclusions: Scalp block, combined with general anesthesia provided good hemodynamic stability and better recovery profile during craniotomy but on the other hand, did not affect PONV incidence during 1st 24 h.

Keywords: Craniotomy, Neurosurgery, Postoperative nausea and vomiting, PONV, Recovery Profile, Rescue Antiemetics, Scalp Block

1. Department of Anesthesia, Intensive Care and Pain Management, Faculty of Medicine, Ain Shams University, Cairo, Egypt
2. Department of Neurosurgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt

Corresponding Author: Raham Hasan Mostafa, MD, Assistant Professor, Department of Anesthesia, Intensive Care and Pain Management, El-hay El-Sabee, Nasr City, Cairo, Egypt
Phone: 002/01222530020
Email: rahamhasan@yahoo.com

Please cite this article as: Hasan Mostafa R, Ghoneim MA, Kamal EL-Din DM, Ismaiel MAA, Abdelmohsen I, Refaat SA. Effect of Scalp Block on Postoperative Nausea and Vomiting & Recovery Profile after Craniotomy: A Randomized, Double-Blind, Controlled Study. J Cell Mol Anesth. 2020;5(4):235-45. https://doi.org/10.22037/jcma.v5i4.32015

Introduction

The incidence of reported Postoperative nausea and vomiting (PONV) after craniotomy is 22% to 70% if no prophylaxis is administered and 6% to 60% with prophylaxis. (1) If left untreated, postoperative vomiting will lead to serious complications in neurosurgical patients, such as dehydration, electrolyte disturbances, aspiration, and alkalosis. Also, the physical act of vomiting may elevate intracranial pressure, affecting cerebral perfusion and hemostasis and so, postoperative outcomes. (2)

The general surgical population's risk factors for PONV can be categorized as patient factors, surgical factors, and anesthetic factors. A very simple score given by Apfel et al. (3), describes four predictors for PONV. They are female gender, history of motion sickness or PONV, use of postoperative opioids, and a nonsmoking status. To be noted, the Apfel risk score is evaluated for patients undergoing inhalational anesthesia and not receiving antiemetic drugs. In this score, each factor was given a score of 1. A total score of 0, 1, 2, 3, or 4 of these risk factors increases the risk of PONV by 10%, 20%, 40%, 60%, and 80%, respectively. (4). The procedural risk (the type of operation) is not included in Apfel scores; although intracranial surgeries specifically, pose an independent risk for vomiting. This could be attributed to; the vomiting center (area postrema) is directly manipulated by the surgical procedure or it is activated by humoral factors released during surgery. (5)

All patients who had a PONV risk > 40% according to the simplified risk score were evaluated as high-risk populations. Commonly used antiemetics reduce the risk of PONV by approximately 25 %. The absolute benefit of an antiemetic depends on the degree of baseline risk, with higher-risk patients benefiting more than low-risk patients. (3)

The most commonly used prophylactic antiemetics include serotonin (5-HT3) receptor antagonists, usually in combination with either droperidol or steroids. (6) Antiemetic agents are known to have side-effects ranging from mild headache to severe QTc (QT interval corrected) prolongations or cardiac arrest. (4) The 5-HT3 receptor has the advantage of not producing sedation, extrapyramidal reactions, or drug interactions with other anesthetic drugs. (7) The corticosteroid, dexamethasone, is as efficacious as ondansetron. It is recommended that dexamethasone to be administered after the induction of anesthesia as its onset of action is delayed but is prolonged. (4) Dexamethasone, either alone or in combination with traditional antiemetics, may decrease the incidence of PONV by a central mechanism involving endogenous prostaglandin and opioid production. Higher doses of dexamethasone (8 to 16 mg) are more effective than smaller doses (8)

The purpose of this study was to determine if scalp blocks could reduce PONV incidence and improve recovery profile in patients undergoing supratentorial craniotomy. In this study, we hypothesized that performing preemptive scalp blocks in conjunction with the usual prophylaxis of patients undergoing craniotomy might decrease the incidence of PONV through decreasing perioperative opioids consumption.

Methods

Ethics approval and consent to participate: All procedures performed in studies involving human participants were by the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The work was approved by the Ethics committee of Ain Shams University hospital (FMASU R 54/ 2019) on 27/10/2019. It also was registered at Clinical trial Registry ClinicalTrials.gov Identifier: NCT04240236 following WHO and ICMJE standards. Consent for publication was obtained through written informed consent from all patients. Besides, the datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

We designed a double-blind study (during the period of November 2019 and April 2020), which meant that surgeons, patients, and patient interviewers were blinded toward patient exposure. 40 American society of anesthesiologists- Physical status (ASA-PS) I and II patients, aged 18 to 80 years, 70-80 kg, both sexes, undergoing elective supratentorial craniotomy for tumor resection requiring the use of head pinning were included in the study. All patients were given a complete explanation of the study protocol during the preoperative evaluation. Operations were performed in the supine position with an estimated time range of 4–8 h. The study exclusion criteria were: patients under 18 years of age, pregnancy, diabetes mellitus, emergency surgery, and recipients of chemotherapy or radiation therapy during the previous 7 days before surgery, patients with a Glasgow Coma Score (GCS) less than 15, those with documented allergy to bupivacaine. Withdrawal criteria also included: procedures requiring only one bur hole or duration of surgery longer than 8 hours. Patients were recruited after admission to the hospital for surgery. Baseline

blood pressure and heart rate were recorded. Randomization was performed using computer-generated random number tables in opaque sealed envelopes prepared by an anesthesiologist who was not part of the study.

Anesthetic plan and perioperative care: Patients received 0.03 mg/kg intravenous (IV) midazolam as a pre-anesthetic medication, and 1 mg Granisetron together with 8 mg dexamethasone as PONV prophylaxis after application of routine monitoring (electrocardiogram, noninvasive blood pressure monitoring, oxygen saturation (SPO2)).

A standard anesthetic technique was followed. After preoxygenation for three minutes, anesthesia was induced with: propofol 2-3 mg/kg, fentanyl 1µg/kg, morphine 0.05 mg/kg. Atracurium besylate 0.5 mg/kg was used to provide muscle relaxation.

After intubation and securing the endotracheal tube, the scalp block was performed using aseptic precautions by the same anesthesiologist in all patients of the scalp block group. Patients were randomly divided into two groups. Scalp block group (Group S) received bilateral scalp block with a total volume of 20 ml of 0.5% bupivacaine, whereas Control Group (Group C) didn't receive scalp block. The anesthetist performing the block did not participate in the postoperative data collection. The scalp block was performed as described by Pinosky et al (9). The following nerves were blocked bilaterally: The supraorbital and supratrochlear nerves; The auriculotemporal nerves; The zygomaticotemporal nerves; The postauricular branches of the greater auricular nerves and finally, The greater, lesser, and third occipital nerves. We blocked 6 sensory nerves at their typical anatomical places where they emerge from the skull; with direct infiltration of local anesthetic (LA). Bupivacaine 0.5% was administered very slowly to avoid drug toxicity with frequent needle aspiration to avoid accidental intra-arterial injection. After making sure that there was no blood, the local anesthetic agent was injected. A vasoconstrictor was not added to bupivacaine for fear of an inadvertent intravascular injection or systemic absorption that could cause hypertension

The total volume of the solution used was 20 ml in all patients. This dosing regimen was following existing guidelines (10) The higher dose limits of LA were calculated individually for each patient as 2–3 mg/kg for bupivacaine. After block performance, we placed: an arterial catheter to monitor mean arterial blood pressure (MABP), central venous pressure monitoring, core temperature monitoring by a nasopharyngeal probe, capnography, and indwelling urinary catheter.

A Mayfield head holder was used for all patients in the study. The Mayfield head holder uses pointed pins that are inserted simultaneously through the dermis engaging in the periosteum to secure the head in a stable position for surgery.

All patients were mechanically ventilated with a tidal volume of 8 ml/kg, and the respiratory rate was adjusted accordingly to maintain 30-35 mmHg of PaCO2 (partial pressure of carbon dioxide in the artery). 1-2 minimum alveolar concentration (MAC) of isoflurane mixed with oxygen (50%) and air (50%) was used for maintenance of anesthesia. Although isoflurane is a commonly used safe agent in the context of neuroanesthesia; even low-dose isoflurane may have the potential to precipitate increases in intracranial pressure in patients with malignant brain tumors or swollen brains. Thus, this volatile agent may harm the damaged cortical tissue. Additionally, prolonged use of a high-dose volatile anesthetic agent may prolong the emergence after surgery and thereby impede rapid postoperative neurological assessment. An anesthetic protocol with a small amount of inhalation agents has been suggested (2 minimum alveolar concentration (MAC) of isoflurane was our maximum limit) (11)

Mear arterial blood pressure (MABP) and heart rate (HR) were measured at specific time points. Any increase or decrease in HR or blood pressure was managed as required after the exclusion of a surgical cause. For example, MABP or HR rise of > 20% above baseline was treated by administering a 0.5 µg/kg intravenous bolus of fentanyl, MABP drop of > 20% below baseline was dealt with the reduction of the isoflurane concentration to 0.6%. If the patient was still hypotensive, 6 mg ephedrine was given intravenously. Finally, bradycardia was treated with: 0.6 mg IV atropine bolus and repeated as required.

Mannitol (0.5 gm/kg over 20 min after induction of anesthesia) and phenytoin (5 mg/kg if already loaded with 15 mg/kg) were given. Crystalloid

was limited to 3 mL/kg/h of normal saline with the replacement of blood losses by an equal volume of blood or colloids. Fentanyl (0.5µg/kg IV) was titrated intraoperatively at the discretion of the attending anesthesiologists up to one hour before the end of surgery. No other intraoperative adjunct analgesia was given. At the end of the procedure, the neuromuscular blockade was reversed with neostigmine 0.05 mg/kg and atropine 0.02 mg/kg. Patients were extubated when they were able to obey simple commands.

Postoperative Nalbuphine was prescribed in our patients of both groups when a patient's pain VAS score was greater than 4. Also, a fixed-dose of 1 gm intravenous acetaminophen was given /8h.

Outcome Measurements: Our primary outcome was PONV incidence & severity during the 1st 24 hours in the intensive care unit (ICU). The intensity of the PONV was classified as:

0: Without PONV
1: Nausea
2: Vomiting
3: Vomiting of more than 2 times (12).

With PONV score ≥ 1, we used 1 mg granisetron as a diluted intravenous infusion and administered very slowly. Further maintenance doses of Granisetron may be administered at least 6 hours apart. The maximum dose to be administered over 24 hours should not exceed 3 mg. A PONV score of ≥1 but the last granisetron dose was given < 6 hours; patients would be treated with metoclopramide 10 mg IV as a second line rescue antiemetic.

Secondary outcomes were:

1. Demographic data & patients' characteristics (age, gender, body mass index (BMI), ASA-PS
2. Glasgow coma score (preoperative & postoperative)
3. Intraoperative hemodynamics: Mean blood pressure and heart rate were recorded at the following timings:

T0: preoperatively as the baseline
T1: After intubation
T2: 10 minutes from intubation in Group C or immediately after block performance in Group S
T3: During the pinning
T4: At skin incision
T-end: At skin closure

Changes in heart rate and blood pressure value less than 20% after painful stimuli were considered as good hemodynamic stability of applied anesthetic technique.

4. Total intraoperative fentanyl consumption in micrograms.
5. The duration of surgery (time from skin incision till the end of skin closure)
6. Recovery time in minutes (time interval between discontinuation of isoflurane and extubation).
7. Total postoperative nalbuphine consumption in mg during 1st postoperative day (POD1)

We designed this randomized, double-blind study to evaluate the efficacy of preemptive scalp block in neurosurgical patients in decreasing incidence & severity of PONV. To our knowledge, the present study was the first that evaluated the effect of scalp block on PONV for patients undergoing neurosurgical procedures.

Statistical analysis: The group sample size of at least 19 patients in each group achieves 82% power to detect a difference of 40% in the incidence of PONV between 2 groups assuming that the incidence in Group S is 50% and in Group C is 90% at 0.05 significance level using PASS 11 program for sample size calculation.

The statistical analysis was performed using a standard SPSS software package version 25 (Chicago, IL, United States). Normally distributed numerical data are presented as mean ± SD and differences between groups were compared using the independent Student's t-test, data not normally distributed were compared using Mann-Whitney test and are presented as median (IQR) and categorical variables were analyzed using the $\chi 2$ test or Fisher exact test and are presented as number (%). All P values are two-sided. $P < 0.05$ is considered statistically significant.

Results

Patient demographics and perioperative characteristics: Forty patients were enrolled, and all of them completed the study (Figure 1). Demographic data, duration of surgery, preoperative Apfel score; and preoperative& postoperative GCS were statistically

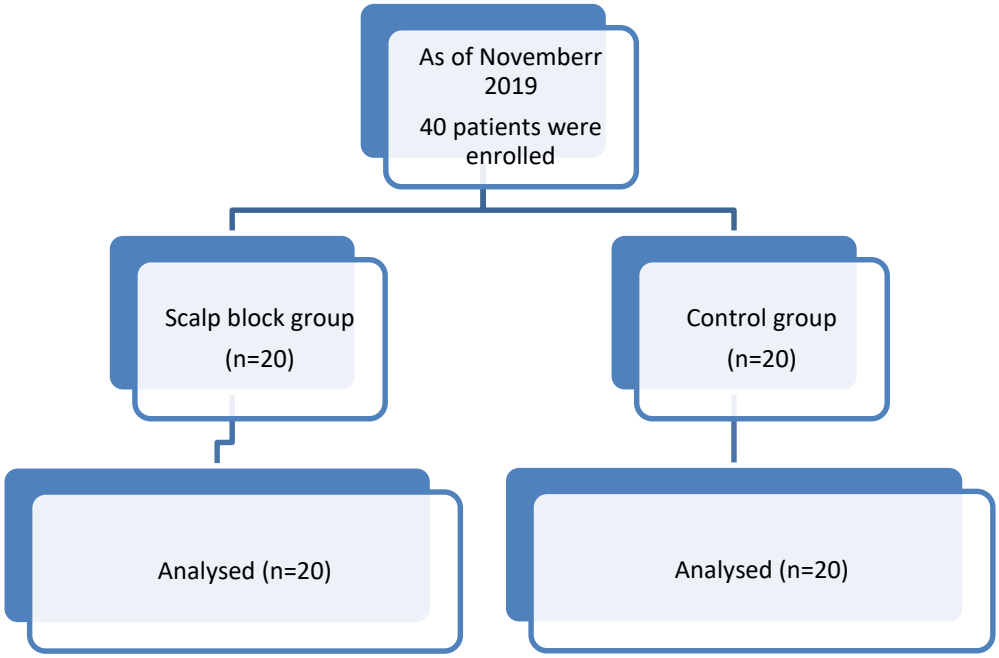

Figure 1. Flow diagram of the patients.

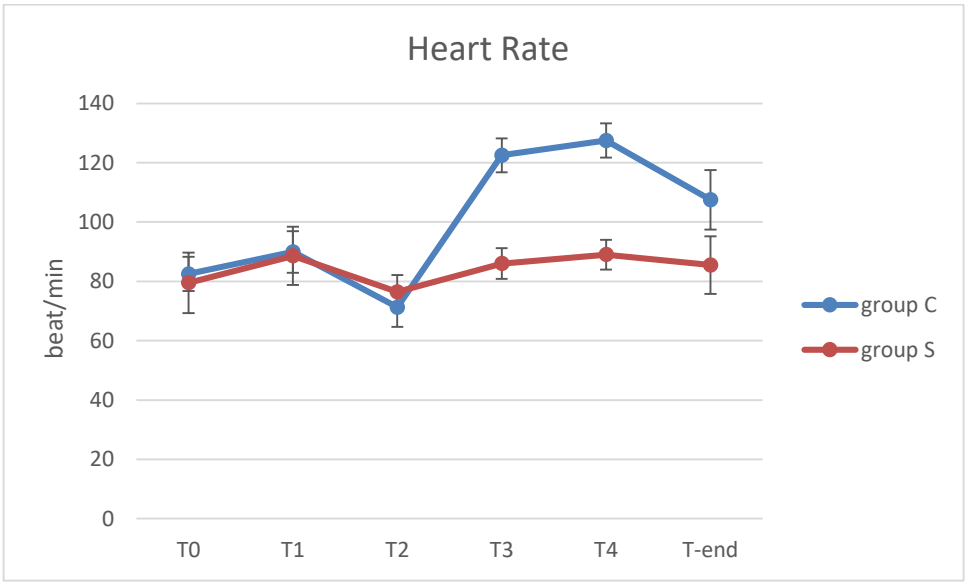

Figure 2. Heart rate variations throughout specific time points. Lines are mean values and error bars are SD;
Group C= Control Group, Group S= Scalp block group.
T0: preoperatively as baseline; T1: After intubation; T2: 10 minutes from intubation in Group C or immediately after block performance in Group S; T3: During pinning; T4: At skin incision; T-end: At skin closure.

similar in both groups (Table 1, 2, 3).

Regarding i**ntraoperative hemodynamic parameters** (HR and MABP), intraoperative (IO) fentanyl consumption & recovery profile, There were no significant differences in baseline readings among groups in terms of hemodynamic parameters. Whereas patients in the scalp block group did not have a significant increase in MABP or HR at T 3, T 4, and T-

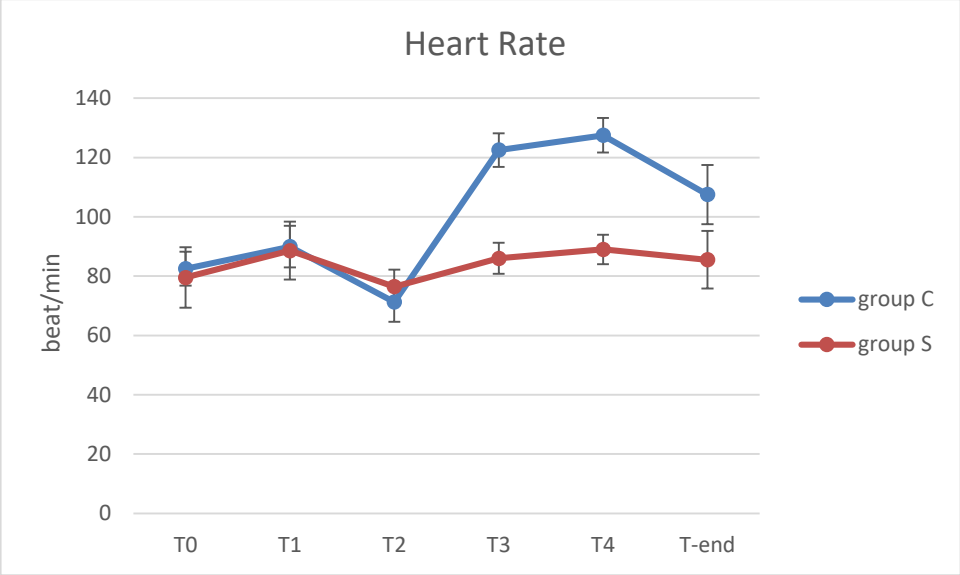

Figure 3. Mean arterial blood pressure (MABP) variations throughout specific time points.
Lines are mean values and error bars are SD
Group C= Control Group, Group S= Scalp block group, MABP= mean arterial blood pressure
T0: preoperatively as baseline; T1: After intubation; T2: 10 minutes from intubation in Group C or immediately after block performance in Group S; T3: During pinning; T4: At skin incision; T-end: At skin closure.

Table 1: Demographic data.

	Group C (n=20)	**Group S (n=20)**	**p-value**
Age (in years)	49.9 ± 13.31	50.45± 11.722	0.89
ASA physical status (I/II)	10/10	12/8	0.524
Sex (Male/Female)	11/9	10/10	1
BMI(Kg/m^2)	26.7 ± 2.36	26.35 ± 2.05	0.62

Data are presented as mean ±SD or ratio
p-value > 0.05 is considered statistically non-significant.
Group C= Control Group, Group S= Scalp block group

Table 2: IO hemodynamic parameters (HR, MBP), Perioperative narcotic consumption & recovery profile.

	Group C (n=20)	**Group S (n=20)**	**p-value**
Surgery duration (min)	341.2± 53.57	328±41.7	0.392
Recovery time (min)	21.25± 5.1	9.7± 4.11	<0.001*
Intraoperative fentanyl (microgram)	360±38.38	125± 36.64	<0.001*
Postoperative Naluphin consumption (mg)	7.28± 2.82	7.5± 2.67	0.731
Increased HR at pinning by >20% of baseline	20	1	<0.001*
Increased MBP at pinning by >20% of baseline	20	1	<0.001*

Data are presented as mean ±SD, number of patients; p-value < 0.05 is considered statistically significan; p-value >0.05 is considered statistically non-significant
Group C= Control Group, Group S= Scalp block group; HR= Heart rate, MBP= Mean blood pressure

end (when compared to their baseline readings; after intubation (T1) or immediately after block

Table 3: Incidence & Severity of PONV.

	Group C (n=20)	Group S (n=20)	p-value
Preoperative Apfel score	2(2-2)	2(2-2)	1
Patients having PONV score >1	10/20 (50%)	9/20 (45%)	1
Number of patients who received Zero RAE in 24hours = Complete response	10/20 (50%)	11/20 (55%)	1
Number of patients who received RAE (granisetron) ≥ 1 dose in 24hours	10/20 (50%)	9/20 (45%)	
Once in 24h	7/20 (35%)	6/20 (30%)	0.94
Twice in 24h	3/20 (15%)	3/20 (15%)	
Trice in 24h	0/20 (0%)	0/20 (0%)	
Maximal PONV score achieved by a participant in 24 h postoperatively			
Score 0	10/20 (50%)	11/20 (55%)	0.723
Score 1	7/20 (35%)	6/20 (30%)	
Score 2	2/20 (10%)	3/20 (15%)	
Score 3	1/20 (5%)	0/20 (0 %)	

Data are presented as median (IQR), the number of patients (percentage).
P value >0.05 is considered statistically non-significant
Group C= Control Group, Group S= Scalp block group, PONV= Postoperative nausea and vomiting, RAE= rescue antiemetics

performance (T2)); patients in the control group had a significant increase in MABP and HR at T 3, T 4 and T-end (despite the ability of the anesthesiologist to give IV fentanyl boluses as needed at T3 & T4) (Figure 2,3).

The number of patients with more than 20 % increase in MABP & HR at pinning was significantly higher in the control group (20 of 20) than in the scalp block group (1 of 20) p=<0.001 (Table 2). Table2 also shows that mean intraoperative additional fentanyl requirements were significantly higher in the control group than scalp block group (360±38 µg versus 125±37 µg respectively). Finally, recovery time was significantly longer in the control group than the scalp block group (21.25±5 minute versus 9.7±4 minute, respectively).

The two primary goals of this study were to assess the PONV (incidence & severity) and total rescue antiemetics (RAE) consumption during POD1. The preoperative PONV risk assessment (Apfel score) was calculated for all patients in the two groups. And it was statistically insignificant (Table 3). Table 3 shows that there were no statistical differences between the two groups with regards to PONV incidence (50% versus 45% in the control group & scalp block group, respectively). Regarding the severity of PONV, it was also statistically insignificant between the 2 groups.

Also, Table 3 shows that there was no difference in the rate of complete response (Zero RAE) between the two groups on POD 1 (p = 1). Complete response in both groups = no PONV or RAE: was 50% in the control group versus 55 % in the Scalp NB group. The total number of doses of rescue antiemetics (RAE) given in the first 24 postoperative hours was statistically insignificant between the 2 groups. No patients in both groups needed the 2nd line rescue antiemetics “metoclopramide”.

Discussion

Previous studies have established an association between scalp block and improved hemodynamic stability in patients undergoing craniotomy. According to the literature, the scalp block is effective, simple to use, easy to learn, with known yet rare side effects. It

likewise has a favorable advantage over local infiltration in that the neurosurgeon has an opportunity to reposition the pins without the need for further maneuvers to blunt the sympathetic response to pinning. Various local anesthetics such as lidocaine, bupivacaine, ropivacaine, with or without adrenaline, could be used. Papers report the application of block preoperatively or postoperatively after wound closure (13) The main problem can result from the fact that local anesthetics should be given in relatively high amount in the very vascularized area. Thus, careful administration of local anesthetics and caution about maximum doses is extremely important. (13) We used bupivacaine without adrenaline, because unintentional intravascular injection of adrenaline containing local anesthetic may have harmful effects in the neurosurgical patient.

If pre-incision scalp block could decrease perioperative narcotic consumption, it should decrease expected postoperative systemic side effects of opioids including sedation and PONV. We hypothesized that preemptive scalp block would decrease perioperative narcotic consumption with subsequent lesser recovery time and lesser incidence & severity of PONV in POD1. However, our results showed that there was no statistical difference between the Control group & the Scalp block group in PONV incidence (50% versus 45% respectively). Also, there was no difference between groups in 24-hour total amounts of antiemetics requirement and total postoperative nalbuphine consumption. These results could be attributed to multiple factors; first; Local anesthetic used in scalp block was without adjuvants prolonging its analgesic effects. Second; scalp block was given before skin incision as a preemptive block & surgical duration is known to be prolonged in craniotomy surgeries with expected tear-off of injected LA especially with scalp is known high vascularity. Pharmacokinetic studies of plasma levels of local anesthetic used in scalp infiltration; imply that systemic absorption occurs within minutes and in amounts of 50% of the dose infiltrated due to the rich vascularity of the scalp. Thus, whereas a bupivacaine LA may have a clinical duration of nearly 6-15 h hours in some models, the duration may be significantly shorter in the scalp block procedure. (9) Finally, prophylactic dual antiemetics were given in both groups showing no additional benefit of Preemptive scalp nerve block regarding PONV incidence per se.

Multiple studies go with our results whether scalp block was given before (14, 15, 16) or after (17) skin incision. Tuchinda & her colleagues' study (14) is in concordance with our study. Although their primary goal was to evaluate mainly the effectiveness of scalp block on hemodynamic response to noxious stimuli, they did observe that there were no differences between their 3 groups in 24-hour nausea/vomiting scores and amounts of rescue antiemetics requirement. Their study was done on sixty patients undergoing elective craniotomy who were randomly assigned to receive a scalp block with either 0.5% bupivacaine or 0.25% bupivacaine and 1:200,000 adrenaline (group A and B) or normal saline with 1:200,000 adrenaline (group C). RAE over 24 h was 47%, 42%, 40% in their 3 groups respectively.

Also, Gazoni and his colleagues (15) & Yang and his colleagues (16) observed the ineffectiveness of scalp block to lessen PONV incidence after craniotomy surgeries. Both of them used Ropivacaine with different concentrations in the scalp block which was given before surgical incision. Finally, Rigamonti & his colleagues (17) noted that PONV incidence was not statistically significant between their two groups (19.5% in scalp block group versus 15.9% in Control group) although they gave scalp block at the end of the operation with expected prolonged effect on postoperative analgesic requirements and subsequent lesser incidence of PONV. They used 0.5% bupivacaine with 1:200,000 adrenaline in the scalp block group. To be noted, in the previous studies (14, 15, 17), we could relate these disappointing results to the inability of scalp block to control postoperative pain with subsequent similar postoperative opioid consumption when compared with the control group. In Yang's study (16), although lower VAS scores were achieved till the 4th postoperative hour in the "ropivacaine 0.5%" group but still, no effect on the prevalence of PONV.

On the contrary, 2 studies are confirming the beneficial effect of scalp block on PONV (18, 19). To be noted, both studies were done on the different types of surgery "frontoparietal craniotomy for unruptured aneurysm clipping" using TIVA. Also, both studies showed the excellent postoperative analgesic effect of

scalp block groups. In the study done by Hwang and his colleagues (18), they observed lesser PONV incidence in the scalp block group (30%) when compared to the Control group (65%). They used low volume 0.75% levobupivacaine in the scalp block group (7 mL with adrenaline adjunct), & normal saline in the control group. These findings would be related to better controlled postoperative pain and lower consumption of fentanyl-based patient-controlled analgesia (PCA) in those patients who received a scalp block with levobupivacaine especially that it was given at the end of the operation. To be noted, their measured PONV incidence was after 72 h from the operation. The other study done by Yang & his colleagues (19) showed also a lesser incidence of PONV in the scalp block group when compared with their other 2 groups (local anesthetic infiltration & control groups (11%, 25%, 29.4% respectively). Possibly, the lower incidence of PONV in the scalp block group was related to less intraoperative remifentanil consumption and lesser postoperative oxycodone use in addition to their timing of measurement; 48 after the operation.

Although in our study we reported that scalp block did not bring along significant advantage in terms of PONV & postoperative analgesic consumption in POD1 when compared to the Control group, we observed that scalp block blunted hemodynamic stress response during pinning & skin incision. That even, only 1 patient out of 20 in the scalp block group had increased MABP & HR > 20% of baseline. In contrast, in the control group, all of the 20 patients had increased MABP & HR > 20% of baseline. Our finding is in accordance to a lot of studies who administer scalp block after induction of GA; whether LA used was bupivacaine (9,11,14,20,21,22) or ropivacaine (15, 16), or levobupivacaine (22,23) or Chirochaine(13); whether an adjuvant (adrenaline) was added (13,14,21,23) or not; or even whether a Sham block was used (9,11,14,16,22) or not.

In a very unique study done by Abbass & his colleagues (21) on scalp block given in geriatric patients undergoing supratentorial craniotomy, they proved the effectiveness of scalp block in blunting hemodynamic response during pinning. They also showed its valuable effect on the recovery profile and this goes with our results. As both studies (ours & Abbass's) consumed less intraoperative fentanyl in the scalp block group; this led to more rapid recovery. On the other hand, Gazoni & his colleagues (15) showed no more added effect of scalp block on quality of recovery. They attributed their results to their use of remifentanil infusion in both groups which had a very short duration with no effect on recovery profile whether scalp block was given or not.

According to different authors, the side effects of scalp block are rare (13). But we do emphasize the importance of careful administration of local anesthetics, and caution about maximum doses. No reported side effects due to LA toxicity were observed in our study.

Limitations

This study had some limitations. First, we reported data concerning a relatively small number of patients. Future studies with a larger sample size may be required to further elucidate the postoperative benefits of scalp block on PONV scores.

Secondly, only supratentorial craniotomy was included. Subsequently, further researches are needed to explore the effect of scalp block on awake craniotomy & infratentorial craniotomy; both of which have even a larger incidence of PONV than supratentorial craniotomy.

Thirdly, we only analyzed PONV during POD1, while previous research suggests nearly 30% of patients still have PONV up to the third postoperative day.

Fourthly, we didn't add adjuncts such as dexmedetomidine and dexamethasone to LA in scalp block to prolong its analgesic and antiemetic effects (if present).

Finally, the scalp is a highly vascularized tissue, and this characteristic can increase the risk of local anesthetic toxicity. In the present study, no intraoperative or postoperative local anesthetic-related toxicity was observed. However, the QTc interval was not monitored and the blood levels of the drugs were not measured, both of which may represent important limitations of this study.

Conclusion

Scalp block, combined with general anesthesia, provides good hemodynamic stability and better recovery profile during craniotomy but, on the other hand, did not affect PONV during 1st 24 h especially it had no added adjuvant.

Acknowledgment

We have no affiliations with or involvement in any organization or entity that we have any financial interests

Conflicts of Interest

We declare that there were no conflicts of interest. The study was Self-funded.

References

1. Uribe AA, Stoicea N, Echeverria-Villalobos M, Todeschini AB, Esparza Gutierrez A, Folea AR, et al. Postoperative Nausea and Vomiting After Craniotomy: An Evidence-based Review of General Considerations, Risk Factors, and Management. J Neurosurg Anesthesiol. 2019.

2. Lu D, Wang Y, Zhao T, Liu B, Ye L, Zhao L, et al. Successful implementation of an enhanced recovery after surgery (ERAS) protocol reduces nausea and vomiting after infratentorial craniotomy for tumour resection: a randomized controlled trial. BMC Neurol. 2020;20(1):150.

3. Apfel CC, Korttila K, Abdalla M, Kerger H, Turan A, Vedder I, et al. A factorial trial of six interventions for the prevention of postoperative nausea and vomiting. N Engl J Med. 2004;350(24):2441-51.

4. Jangra K, Kumari K, Panda NB, Samagh N, Luthra A. Postoperative nausea and vomiting in neurosurgical patients: Current concepts and management. Neurol India. 2018;66(4):1117-23.

5. Latz B, Mordhorst C, Kerz T, Schmidt A, Schneider A, Wisser G, et al. Postoperative nausea and vomiting in patients after craniotomy: incidence and risk factors. J Neurosurg. 2011;114(2):491-6.

6. Lv JQ, Wang C, Yang Y, Li Y, Xu TH, Jian LQ. Intradermal thumbtack needle buried Neiguan (P6) point for prevention of postoperative nausea and vomiting in patients undergoing craniotomy: study protocol for a randomised controlled trial. BMJ Open. 2019;9(11):e032417.

7. Andrews PL, Sanger GJ. Nausea and the quest for the perfect anti-emetic. Eur J Pharmacol. 2014;722:108-21.

8. Jain V, Mitra JK, Rath GP, Prabhakar H, Bithal PK, Dash HH. A randomized, double-blinded comparison of ondansetron, granisetron, and placebo for prevention of postoperative nausea and vomiting after supratentorial craniotomy. J Neurosurg Anesthesiol. 2009;21(3):226-30.

9. Pinosky ML, Fishman RL, Reeves ST, Harvey SC, Patel S, Palesch Y, et al. The effect of bupivacaine skull block on the hemodynamic response to craniotomy. Anesth Analg. 1996;83(6):1256-61.

10. Bala I, Gupta B, Bhardwaj N, Ghai B, Khosla VK. Effect of scalp block on postoperative pain relief in craniotomy patients. Anaesth Intensive Care. 2006;34(2):224-7.

11. Lee EJ, Lee MY, Shyr MH, Cheng JT, Toung TJ, Mirski MA, et al. Adjuvant bupivacaine scalp block facilitates stabilization of hemodynamics in patients undergoing craniotomy with general anesthesia: a preliminary report. J Clin Anesth. 2006;18(7):490-4.

12. Zhang D, Shen Z, You J, Zhu X, Tang QF. Effect of ondansetron in preventing postoperative nausea and vomiting under different conditions of general anesthesia: a preliminary, randomized, controlled study. Ups J Med Sci. 2013;118(2):87-90.

13. Tonković D, Stambolija V, Lozić M, Martinović P, Pavlović D, Sekulić A, et al. Scalp block for hemodynamic stability during neurosurgery. Period Biol. 2015;117:247-50.

14. Tuchinda L, Somboonviboon W, Supbornsug K, Worathongchai S, Limutaitip s. Bupivacaine scalp nerve block: hemodynamic response during craniotomy, intraoperative and post-operative analgesia. Asian Biomed. 2018;4(2):243-51.

15. Gazoni FM, Pouratian N, Nemergut EC. Effect of ropivacaine skull block on perioperative outcomes in patients with supratentorial brain tumors and comparison with remifentanil: a pilot study. J Neurosurg. 2008;109(1):44-9.

16. Yang Y, Ou M, Zhou H, Tan L, Hu Y, Li Y, et al. Effect of Scalp Nerve Block with Ropivacaine on Postoperative Pain in Patients Undergoing Craniotomy: A Randomized, Double Blinded Study. Sci Rep. 2020;10(1):2529.

17. Rigamonti A, Garavaglia MM, Ma K, Crescini C, Mistry N, Thorpe K, et al. Effect of bilateral scalp nerve blocks on postoperative pain and discharge times in patients undergoing supratentorial craniotomy and general anesthesia: a randomized-controlled trial. Can J Anaesth. 2020;67(4):452-61.

18. Hwang JY, Bang JS, Oh CW, Joo JD, Park SJ, Do SH, et al. Effect of scalp blocks with levobupivacaine on recovery profiles after craniotomy for aneurysm clipping: a randomized, double-blind, and controlled study. World Neurosurg. 2015;83(1):108-13.

19. Yang X, Ma J, Li K, Chen L, Dong R, Lu Y, et al. A comparison of effects of scalp nerve block and local anesthetic infiltration on inflammatory response, hemodynamic response, and postoperative pain in patients undergoing craniotomy for cerebral aneurysms: a randomized controlled trial. BMC Anesthesiol. 2019;19(1):91.

20. Geze S, Yilmaz AA, Tuzuner F. The effect of scalp block and local infiltration on the haemodynamic and stress response to skull-pin placement for craniotomy. Eur J Anaesthesiol. 2009;26(4):298-

303.
21. Abbass O, Hussien G, Aboeldahab H, Othman S, Fareed M. Does scalp block with general anesthesia in craniotomy affect the intraoperative course and outcome in geriatric patients? Ain-Shams J Anaesthesiol. 2015;8(1):25-30.
22. Can BO, Bilgin H. Effects of scalp block with bupivacaine versus levobupivacaine on haemodynamic response to head pinning and comparative efficacies in postoperative analgesia: A randomized controlled trial. J Int Med Res. 2017;45(2):439-50.
23. Bracho P, Alne R, Barcelos G, Sindou M, Naous H. Levobupivacaine scalp nerve block: haemodynamics and anaesthesia requirements in supratentorial craniotomy P 096. Eur J Anaesthesiol. 2008;25:33-4.