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Original Article

A CLINICAL COMPARATIVE STUDY OF SCALP BLOCK WITH 0.5% BUPIVACAINE VERSUS LEVOBUPIVACAINE 0.5% FOR MAYFIELD INSERTION ON HAEMODYNAMIC RESPONSE AND EFFICACIES OF POSTOPERATIVE ANALGESIA

KALAPALA RAMESH[1*], BANDRAPALLI EMEEMA[2], K. INDIRA PRIYADARSHINI[2], CHANDRASEKHAR VALLEPALLI[3], MADHULIKA YELURU[4]

[1*]Department of Anaesthesiology, Government Medical College and General Hospital, Madanapalle-517325, Andhra Pradesh, India. [2]Department of Anaesthesiology, Guntur Medical College and Government General Hospital, Guntur-522001, Andhra Pradesh, India. [3]Department of Community Medicine, SVIMS Sri Padmavathi Medical College for Women, Tirupathi, Andhra Pradesh, India. [4]Mother Hospital, Tirupati, Andhra Pradesh, India

[*]Corresponding author: Kalapala Ramesh; [*]Email: ramyams619@gmail.com

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ABSTRACT

Objective: Present study was performed to compare the effectiveness of 0.5% bupivacaine hydrochloride and 0.5% levobupivacaine for scalp block on the haemodynamic response, efficacy and additional analgesic requirement of these drugs in the post operative period during Mayfield insertion for craniotomy.

Methods: 60 patients of American society of anaesthesiologists physical status I and II who underwent elective craniotomies were randomly divided into two groups Group B (n=30) who received scalp block with 0.5% bupivacaine hydrochloride 25 ml, Group L (n=30) received 25 ml of 0.5% levobupivacaine 5 min prior to Mayfield insertion. Mean arterial pressure (MAP), pulse rate, pain score (VAS score), additional intraoperative and postoperative analgesic requirement were recorded at different time points.

Results: Pulse rate, mean arterial pressure were stable during and after Mayfield insertion in both groups at all time points.

Conclusion: Both bupivacaine and levobupivacaine for scalp block are equally effective in attenuating haemoynamic responses during Mayfield insertion. Levobupivacaine being less toxic can be a safe alternative for scalp block.

Keywords: Mayfield insertion, Scalp block, 0.5% levobupivacaine, 0.5% bupivacaine haemodynamic response

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INTRODUCTION

Moderate to severe post operative pain after craniotomy has an incidence as high as 80% [1] immobilization of head is required during neurosurgical procedures. In order to maintain the desired position application and fixation of Mayfield on the scalp is required. But it causes an intense noxious stimulus with profound stimulating effect [2]. In patients with impaired cerebral auto regulation a sudden increase in systemic blood pressure can cause and abrupt increase in intracranial pressure, which precipitates intracranial hypertension [3]. Scalp block technique consists of blocking of six nerves: supraorbital nerve, supratrochlear nerve, Auriculotemporal nerve, Zygomatico Temporal nerve, Greater and Lesser Occipital nerves. Many researches shows that scalp block attenuate autonomic responses and provided sufficient post operative analgesia [4, 5]. About 10%-20% patients undergoing craniotomy experienced severe pain and more than 30% experienced moderate pain as per Guilfoyle *et al.* [5]. 0.5% bupivacaine hydrochloride is widely used to provide scalp blocks. Levobupivacaine is a pure s-enantiomer of bupivacaine and is increasing in popularity because of its fewer cardiovascular side effects and is less toxic to central nervous system [6, 7]. The aim of our study was to compare the efficacy in attenuating haemodynamic response with 0.5% bupivacaine hydrochloride versus 0.5% levobupivacaine for scalp block before Mayfield insertion during craniotomies.

MATERIALS AND METHODS

This randomized clinical comparative prospective study was done after obtaining institutional ethics and scientific committee approval from Guntur medical college and general hospital, Guntur between April 2023 to September 2023. After obtaining verbal and written informed consent, 60 patients of American society of anaesthesiologists physical status I and II, either sex, aged between 18 to 65 y of age who are undergoing elective craniotomy were enrolled in this study. Patients were randomly divided into two groups group B and group L. Group B (n=30) who received scalp block with 0.5% bupivacaine hydrochloride 25 ml, Group L (n=30) received 25 ml of 0.5% levobupivacaine 5 min prior to Mayfield insertion. Mean arterial pressure (MAP), pulse rate, pain score (VAS score), additional intraoperative and postoperative analgesic requirement. Patients with ASA-class III, preoperative GCS less than 15 with midline shift more than 5 mm on CT scan, previous brain surgery, patients with intracranial aneurysms, patients with cardiovascular diseases, and those who are allergic to local anaesthetics, patients with coagulopathy, hepatic and renal failure were excluded from the study. Patients were shifted to operation theatre after obtaining written and informed consent from the patients multichannel monitor was connected to record the blood pressure, ECG, Spo2, pulse rate, mean arterial pressure. All patients were pre oxygenated with 100% O2 for 3-5 min before induction. And induced with 2 mg/kg propofol I. V, 2Mcg/kg fentanyl muscle relaxation and intubation with vecuronium bromide 0.1 mg/kg I. V. For maintaining anesthesia mixture of N2O and O2 50:50, 1-1.5 MAC of isoflurane and maintenance doses of vecuronium intermittently all patients were ventilated with tidal volume of 8-10 ml/kg and respiratory rate was 12-15/min to achieve end tidal CO2 level of 30-35MmHg. A 20G arterial catheter was placed in the radial artery prior to induction for invasive arterial blood pressure monitoring. Scalp block was performed bilaterally after induction and 5 min prior to Mayfield insertion by an anesthesiologist according to the technique described by Pinosky *et al.* [8]. A 23 G needle was introduced with a 45 degrees angle into the skin and penetrated deeply to the outer margin of the skull. The needle was then gradually withdrawn while injecting the study solution. This was

done at several points over the scalp supraorbital, supratrochlear nerves bilaterally at their emergence from the orbit just above the eye brow 2 ml for each nerve. The auriculo temporal nerves bilaterally are blocked just anterior and 1 cm above the tragus 2 ml for each nerve. The post auricular branches of the greater auricular nerves over the mastoid process area 2 cm posterior to the ear on the tragus transverse Plain 2 ml for each nerve. The zygomatic temporal nerve 2 cm posterior to the lateral epicanthus on the tragus transverse plain 2 ml for each nerve. The greater, lesser, third occipital nerves along the superior nuchal line half way between the occipital protrubranace and the mastoid process 2 ml for each nerve. Mean arterial pressure, pulse rate, Spo2, Etco2 were recorded at following time points.

t B: Time point at baseline

t IND (60): 60 seconds after induction

t IND (300): 300 seconds after induction

t SNB (0): During scalp nerve

t SNB (60): 60 seconds after scalp nerve block

t MFI (0): During Mayfield insertion

t MFI (60): 60 seconds after Mayfield insertion

t INCI (0): During incision

t INCI (60): 60 seconds after incision

t s close (0): During skin closure.

t s close (60): 60 seconds after skin closure.

Any increase in pulse rate, MAP>20% of base line was treated by increasing isoflurane concentration and fentanyl 1mcg/kg intravenously. Decrease in MAP>20% from baseline was defined as hypotension and was treated with Ephedrine 5 mg bolus intravenously. Any decrease in heart rate>20% from baseline was defined as bradycardia and was treated with atropine sulphate 0.6 mg intravenously. Patient who developed any intraoperative complications were shifted to the neurosurgical intensive care unit under deep sedation for further management. After complete recovery from anaesthesia their severity of pain was assessed at 2, 4, 8, 16, and 24 h post operatively by using visual analogue scale (VAS) (0-no pain at all, 10-the worst possible). Patients who developed postoperative nausea and vomiting were treated with metoclopramide 10 mg intravenously.

RESULTS

There was no statistically significant difference among the two groups in their demographic characteristics and ASA physical status. Table 2 showed that the mean arterial pressure between the two groups was exemplified at different time points in table 2. In group B, the mean arterial pressure at tBASE is 98.23±1.48 mmhg. The mean arterial pressures at tIND 60, tIND 300, tSNB 0, tSNB 60, tMFI 60, tINCI0, tINCI 60, tS CLOSE 0, tS CLOSE 60 were significantly lower than tBASE. Similarly in Group L the mean arterial pressure measured at tBASE was 97.12±4.84 mmhg. The mean arterial pressures at tIND60, tIND 300, tSNB 0, tSNB 60, tMFI 60, tINCI 0, tINCI 60, tS CLOSE 0, tS CLOSE 60 were significantly lower than tBASE. The mean arterial pressure measured during Mayfield insertion tMFI0 was 101.2±4.23 mmhg, 102.2±3.64 mmhg in Group B and Group L respectively there was no statistically significant difference between the two groups(P=0.33). Table 3 showed that the mean pulse rate among the two groups were illustrated in table 3 fig. 2. The mean pulse rate in group B at tBASE was (80±2.3), the mean pulse rates at tMFI 0 (78.18±3.4), t MFI 60 (76.36±1.3), t INCI 0 (68.42±2.8) t INCI 60 (69.34±1.6) were significantly lower than at t(BASE) ($p<0.05$). Similarly the mean pulse rate in group L at t(BASE) was (79.12±2.6) and at tMFI 0 (77.48±3.6), t MFI 60 (75.46±5.4), t INCI 0 (70.44±5.7) t INCI 60 (70.54±3.6) were significantly lower than at t(BASE) ($p<0.05$). Their was no significant difference between group B and group L at all time points($p>0.05$). Visual analogue scale score was assessed after complete recovery from anaesthesia at 1st, 2nd, 4th, 8th, 16th, 24th post operative hours; 0-no pain at all, 10-the worst possible pain. In group B the VAS score at 2nd post operative hour was 1.9±0.3, in group L it was 1.8±0.1, ($p>0.05$). There was no non-significant difference in VAS score at 2nd post operative period between the two groups. The patients with VAS score>2 were given paracetamol 1 gram given intravenously. If the VAS score was>5 injection meperidine 100 milli grams given intramuscularly. Patients who developed nausea and vomiting were given injection metoclopramide 10 milli grams intravenously (table 4). There was no significant difference between the two groups in the post operative analgesic requirement P=0.97 which was statistically not significant. In our study post operative scalp infection or hematoma and local or general complications were absent in patients during the study period no intraoperative arrhythmia or systole were observed no central nervous system toxicity like tinnitus, paraesthesia or deafness related to local anaesthetic toxicity occurred during the post operative period (table 5).

Table 1: Demographic data

Dueration	Group B (n=30)	Group L (n=30)
Age	49.01±15.18	48.2±9.82
Male	19	15
Female	11	15
ASA 1	23	22
ASA 2	7	8

Table 2: Mean arterial pressure (mean±SD) in mmHg in two study groups at different time points

Arterial pressure	Group B (n=30)	Group L (n=30)	P-value
t(BASE)	98.23±1.48	97.12±4.84	0.234
t IND 60	81.56±7.24	82.42±6.85	0.638
t IND 300	83.46±5.42	83.16±6.82	0.851
t SNB 0	92.56±4.46	91.48±4.34	0.345
t SNB 60	82.12±4.82	81.34±4.64	0.525
t MFI 0	101.2±4.23	102.2±3.64	0.33
t MFI 60	88.12±3.42	87.0±3.46	0.21
t INCI 0	80.34±2.46	80.54±3.12	0.783
t INCI 60	81.12±3.34	82.32±1.54	0.079
t s close 0	80.36±4.54	81.47±2.34	0.238
t s close 60	88.64±3.46	87.54±2.43	0.16

Table 3: Pulse rate per min in two groups at different time points

Time points	Group B (n =30), P. R/Min	Group L, P. R/Min	P value
t(BASE)	80±2.3	79.12±3.2	0.23
t IND 60	75.12±1.6	75.16±1.5	0.92
t IND 300	78.34±2.2	79.14±2.2	0.16
t SNB 0	80.12±1.6	80.46±3.6	0.638
t SNB 60	76.14±1.2	76.54±3.2	0.524
t MFI 0	78.18±3.4	77.48±3.6	0.1
t MFI 60	76.36±1.3	75.46±5.4	0.378
t INCI 0	68.42±2.8	70.44±5.7	0.086
t INCI 60	69.34±1.6	70.54±3.6	0.1
t s close 0	68.32±2.3	67.32±4.2	0.257
t s close 60	70.36±2.4	70.16±3.4	0.793

Table 4: Average visual analogue scale score (mean±SD)

Post operative time	Group B (n=21)	Group L (n=18)	P value
1st post operative hour	0.8±0.1	0.6±0.2	
2nd post operative hour	1.9±0.3	1.8±0.1	>0.05
4rd post operative hour	2.5±0.6	2.8±0.3	
8th post operative hour	2.2±0.1	2.1±0.2	
16th post operative hour	2.3±0.2	2.2±0.2	
24th post operative hour	1.6±0.4	2.1±0.2	

Table 5: Number of patients requiring additional analgesia in post operative period

Post operative period	Group B (n=22)	Group L (n=21)
Immediate post operative period	1	1
2nd	3	4
4th	7	8
8th	7	5
16th	2	2
24th	2	1

DISCUSSION

Moderate to severe post operative pain after craniotomy has an incidence as high as 80% [1]. In order to maintain the desired position and immobilization of head during neurosurgical procedures, the application and fixation of Mayfield on the scalp acts as an intense noxious stimulus with profound stimulating effect [2] in patients with impaired cerebral auto regulation a sudden increase in systemic blood pressure can cause and abrupt increase in intracranial pressure, which precipitates intracranial hypertension. The scalp block method used in the present study was first described by Pinosky *et al.* [8]. Geze *et al.* [9] evaluated the effects of scalp blocks using 20 ml of 0.5% bupivacaine versus local Infiltration on the Haemodynamic and stress response to skull pin insertion during craniotomy and found that the scalp block provided better hemodynamics and reduced the stress response during and after skull pin placement. Scalp block technique consists of blocking six nerves: supra orbital nerve, supratrochlear nerve, auriculotemporal nerve, zygomaticotemporal nerve, greater occipital nerve and lesser occipital nerve [10]. Scalp block provides adequate and prolonged post operative pain control and decreased intra and post operative opioid consumption. Lee *et al.* [11] studied the efficacy of bupivacaine in blunting the heamodynamic response and reducing the need for rescue drugs due to hypertension and tachycardia. In our study in group B the mean arterial pressure at tBASE is 98.23±1.48 mmhg. The mean arterial pressures at tIND 60, tIND 300, tSNB 0, tSNB 60, tMFI 60, tINCI0, tINCI 60, tS CLOSE 0, tS CLOSE 60 were significantly lower than tBASE. Similarly in Group L the mean arterial pressure measured at tBASE was 97.12±4.84 mmhg. The mean arterial pressures at tIND60, tIND 300, tSNB 0, tSNB 60, tMFI 60, tINCI 0, tINCI 60, tS CLOSE 0, tS CLOSE 60 were significantly lower than tBASE. Our studies were very well correlated with Lee *et al.* [11] studies in reducing the hemodynamic response at different time haemodynamic response to head pinning. In another study, Geze *et al.* [9] evaluated the effects of scalp blocks using 20 ml of 0.5% bupivacaine versus local infiltration on the haemodynamic and stress responses to skull pin insertion during craniotomy and found that the scalp block provided better haemodynamics and reduced the stress response during and after skull pin placement points. Our findings are in accordance with Geze *et al.* [9] in reducing the stress response during May field insertion for craniotomies. A retrospective study by Pardey Bracho *et al.* [12] studied on scalp nerve block with levobupivacaine prior to skull pin placement and incision was compared with controls in terms of haemodynamic stability and analgesic requirements. The patient who received scalp nerve block with levobupivacaine shows good intraoperative haemodynamic stability and reduced opioid requirements. In our study the mean pulse rate in group B at tBASE was (80±2.3), the mean pulse rates at tMFI 0 (78.18±3.4), t MFI 60 (76.36±1.3), t INCI 0 (68.42±2.8) t INCI 60 (69.34±1.6) were significantly lower than at t(BASE) ($p<0.05$). Similarly the mean pulse rate in group L at t(BASE) was (79.12±2.6) and at tMFI 0 (77.48±3.6), t MFI 60 (75.46±5.4), t INCI 0 (70.44±5.7) t INCI 60 (70.54±3.6) were significantly lower than at t(BASE) ($p<0.05$). Their was no significant difference between group B and group L at all time points ($p>0.05$). Our studies were very well correlated with Pardey Bracho *et al.* [12] studies in maintaining haemodynamic stability during skull pin insertion and reduced intra and post operative analgesic requirements. Bala *et al.* [13] study shows the decrease in incidence and severity of post operative pain in patients undergoing supratentorial neurosurgical procedures when scalp block was performed using 0.5% bupivacaine with 1:400000 adrenaline. Hwang *et al.* [14] reported that Scalp nerve block with 0.75% levobupivacaine, at the end of surgery effectively improved recovery profiles including relieving postoperative pain, reducing patient control analgesia consumption. In our study in group B the VAS score at 2nd post operative hour was (1.9±0.3), in group L it was (1.8±0.1), ($p>0.05$) which are also very well correlated with Hwang *et al.* [14] study. Although bupivacaine with or without epinephrine has been most frequently used and recommended for scalp blocks in previous studies, its use is associated with an increased risk of depressed cardiac contractility and conductivity [10].

CONCLUSION

The analgesic effects of 0.5% bupivacaine hydrochloride and levobupivacaine are similar in clinical use without any observed difference in the post operative period when compared to

bupivacaine hydrochloride, Levobupivacaine is a safer, effective and less toxic agent for scalp blocks.

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AUTHORS CONTRIBUTIONS

All authors have contributed equally

CONFLICT OF INTERESTS

Declared none

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