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The Clinical Comparative Study between Scalp Block versus Local Infiltration on Hemodynamic Stress Response With 0.5% Bupivacaine on Insertion of Skull-Pins for Craniotomy.

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Abstract:

Introduction:

Scalp blocks with local anesthetic agents are increasingly being used along with general anesthesia in neurosurgical practice to reduce pin and incision response along with providing intraoperative and postoperative analgesia. Insertion of skull pins is a strong nociceptive stimulus even under deep anesthesia. Blockade of the nerves that supply the relevant region of the scalp in order to blunt these noxious stimuli could be highly valuable in reducing hypertension and tachycardia. Different anesthetic and pharmacologic techniques, including local anesthetics, narcotics, antihypertensive, and deepening of anesthesia with inhalational anesthetics, have been used to blunt this deleterious effect with variable success.

Aim: *To compare the hemodynamic effects of 0.5% bupivacaine on scalp block vs 0.5% bupivacaine local infiltration at scalp pin insertion site in neurosurgical patients.*

Materials And Methods*: We conducted a prospective randomized, double blind study in 60 patients who are undergoing supratentorial craniotomies in the age group of 18-65 years belonging to ASA physical status I or II in Guntur Medical College and General Hospital, Guntur during August 2018 to July 2019 were included in the study. The patients were randomly allocated into two groups and each group included 30 patients.*

Group SB (n = 30): *Patients received scalp block with 0.5% bupivacaine after intubation.*

Group L (n = 30): *Patients received local infiltration at pin insertion site with 0.5% bupivacaine after intubation.*

Results: *The heart rate increased immediately after pin fixation in both the groups. In group SB heart rate increased from 76.27±7.92bpm to 82.16±7.86 bpm which was highly significant, in group L heart rate increased from 76.84±10.12 bpm to 94.32±12.86, (p <0.0001), which was statistically highly significant.*

At the time of pin fixation in group SB, Mean arterial pressure was 84.56±17.46 mmhg, and in group L it was 98.87±16.42 mmhg with p 0.01, which was statistically significant. It was observed there was a statistically significant.

Conclusion: *We concluded that scalp block with 0.5% bupivacaine is more effective in attenuating hemodynamic stress response when compared to local anesthetic infiltration during Mayfield skull pin fixation. We also demonstrated that there was a significant hemodynamic stability in scalp block group when compared to local infiltration group.*

Key words

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I. Introduction

Insertion of Mayfield skull pins for stabilizing the skull for craniotomy elicits a significant hemodynamic response despite the optimal depth of general anesthesia (1). Insertion of skull pins is a strong nociceptive stimulus even under deep anesthesia. Blockade of the nerves that supply the relevant region of the scalp in order to blunt these noxious stimuli could be highly valuable in reducing hypertension and tachycardia (2). Different methods including local anesthetic infiltrations (4, 5), skull blocks, and narcotics and deepening of anesthesia with inhalational and intravenous anesthetics have been used to blunt this deleterious effect with variable success (3).

II. Materials And Methods

After obtaining an approval from the institutional ethical committee and written informed consent from the patients taken, the study was carried out in Guntur Medical College and General Hospital, Guntur, during the period of August 2018 to July 2019. 60 patients of ASA grade I and II aged between 18-65 years who are undergoing elective supra-tentorial craniotomies under general anesthesia were included in the study.

It is a randomized prospective comparative study. Random allocation was performed using a computer generated randomization system. Allocation was concealed in serially numbered opaque envelops that are opened after recruitment.

Patients with proven or suspected allergy to bupivacaine, a history of coronary artery disease, patient who had received antihypertensive therapy or who had uncontrolled hypertension, arrhythmia, coagulopathies or diabetes mellitus, with aneurysm or any other cerebrovascular disorder, and patients with raised ICP or a history of brain trauma were excluded from the study.

The patients were randomly allocated into two groups and each group included 30 patients.

Group SB (n = 30): Patients received scalp block with 0.5% bupivacaine after intubation.

Group L (n = 30): Patients received local infiltration at pin insertion site with 0.5% bupivacaine after intubation.

A routine pre-operative checkup was done in all patients and patient's demographic data such as sex, age, weight were recorded.

All patients were premedicated with Tab diazepam 10mg night before surgery. All the patients were kept overnight fasting. On arrival to operation theatre I.V line was secured and Base line values (Pre anesthetic) heart rate, noninvasive blood pressure (NIBP), peripheral O2 saturation, continuous electrocardiogram (ECG) and were recorded. All patients were preoxygenated with 100% oxygen for 5minutes. Anaesthesia was induced with thiopentone sodium 5mg/kg and fentanyl 2mic/kg IV. Tracheal intubation was done after giving injection vecuronium bromide 0.1mgkg IV and maintenance of anaesthesia was by 50% oxygen + 50% nitrous oxide + isoflurane 0.5 -1 % + intermittent vecuronium bromide. Ventilation was controlled by IPPV in such a way that ETCO2 was maintained between 28 to 32 mmhg.

In group SB, scalp block was performed as described by Pinosky et al under sterile precautions (12), immediately after induction and 5 minutes prior to pin head holder application. A 22 gauge needle was introduced at 45 degree angle, penetrating deeply to the outer margin of the skull, and was then gradually withdrawn with simultaneous injection of solutions throughout the entire thickness of the scalp. The supraorbital and supratrochlear nerves were blocked with 2 ml of solution as they emerged from the orbit, again using 22 gauge needle introduced above the eyebrow perpendicular to the skin. The auriculotemporal nerves were blocked bilaterally with 5ml of solution injected 1.5cm anterior to ear at the level of tragus. The post auricular branches of the greater auricular nerve were blocked with 2 ml of solution between the skin and bone, 1.5cm posterior to ear at the level of tragus. The greater, lesser and third occipital nerves were blocked with 5ml of solutionusing a 22guage needle, with infiltration along the superior nuchal line, approximately halfway between the occipital protuberance and mastoid process.

III. Results

A total of 60 patients were included in this study. Table 1 shows that there was no statistically significant difference (p >0.05) between the groups regarding age, sex, and American Society of Anesthesiologist classification.

Table 1: Demographic data

	Group SB	Group L	P value
Age (years)	46.76±16.6	46.2±17.8	>0.05
Weight (kgs)	55.04±7.6	53.46±7.8	>0.05
Male /female	15/15	21/9	>0.05
ASA status	17/13	18/12	>0.05

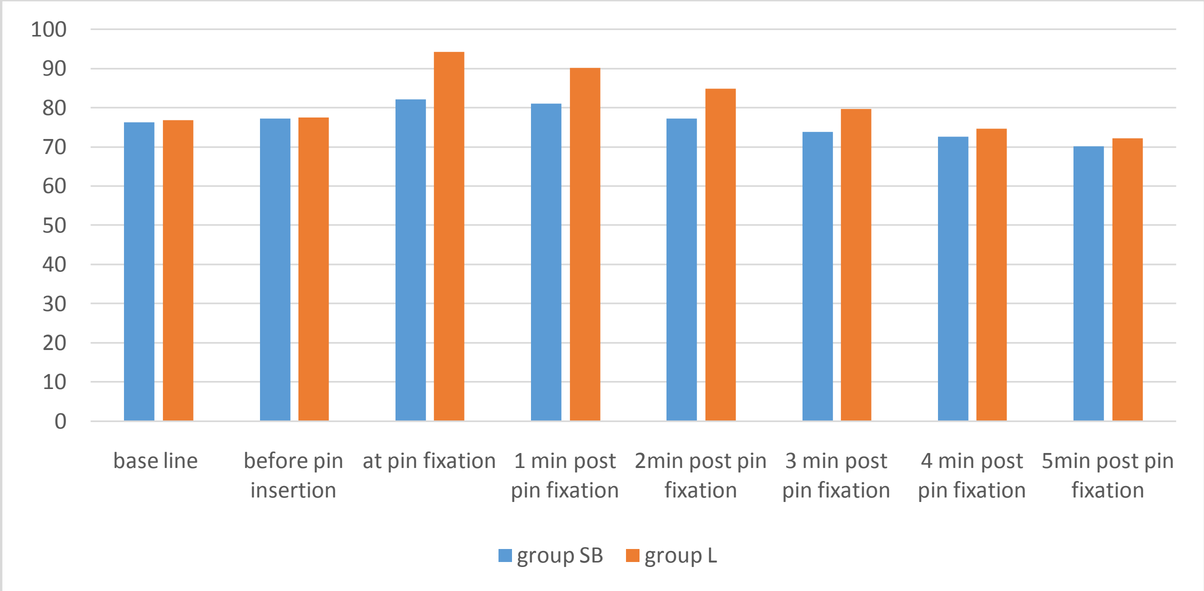
Table 2 and graph 1 shows heart rate changes at various time points (base line, before pin insertion, at pin fixation, 1st, 2nd, 3rd, 4th, 5th minute post pin fixation. The base line heart rate in group SB was 76.27±7.92 bpm, in group L it was 76.84±10.12 bpm, which was statistically not significant (p 0.81).

The heart rate increased immediately after pin fixation in both the groups. In group SB heart rate increased from 76.27±7.92bpm to 82.16±7.86 bpm which was highly significant, in group L heart rate increased from 76.84±10.12 bpm to 94.32±12.86, (p <0.0001), which was statistically highly significant. The increase in heart rate was limited to 2 minutes post pin fixation in group SB whereas the increase in heart rate was limited to 3minutes in group L.

Table 2: comparison of heart rate (bpm) changes in two groups

Heart rate (beats per minute) Mean ±S.D	Group SB (n = 30)	Group L (n = 30)	P value
Base line	76.27±7.92	76.84±10.12	0.81
Before pin insertion	77.26±6.26	77.49±10.94	0.92
At pin fixation	82.16±7.86	94.32±12.86	<0.0001
1 min post pin fixation	81.14±9.06	90.18±12.76	0.002
2 min post pin fixation	77.28±8.76	84.9±12.16	0.007
3 min post pin fixation	73.86±9.14	79.74±16.14	0.08
4 min post pin fixation	72.67±11	74.76±12.48	0.49
5 min post pin fixation	70.18±12.16	72.24±12.48	0.51

Graph 1: comparison of heart rate (beats per minute) changes in two groups



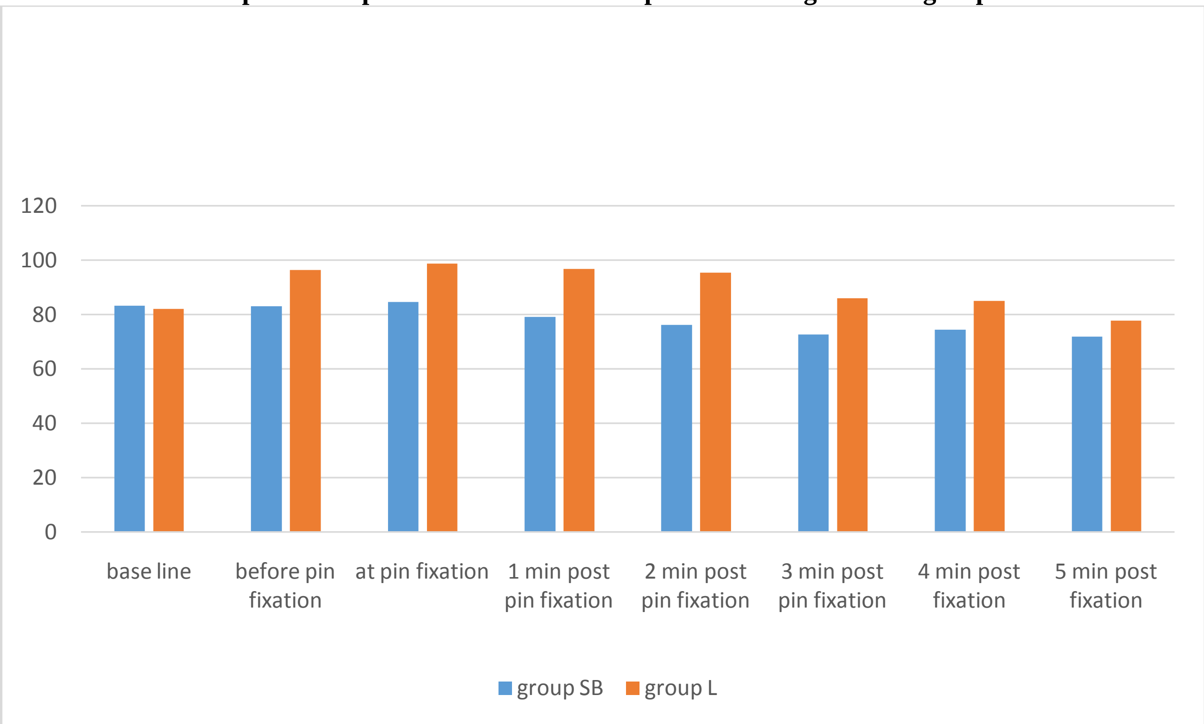
The baseline mean arterial pressure (MAP) in group SB was 83.18±12.46 mmhg and in group L it was 82.18±13.96, (p 0.77) which was statistically not significant. In group SB, at the time of pin fixation MAP was raised from 83.18±12.46mmhg to 84.56±17.46mmhg, followed by a decrease below baseline value at all subsequent time points. In group L, the MAP increased from time of pin application to 4minutes post pin fixation after that it was decreased (table 3, graph 2).

Table 3: comparison of mean arterial pressure changes in two groups

Mean arterial pressure (mm hg)	Group SB (n = 30)	Group L (n = 30)	P value
Base line	83.18±12.46	82.18±13.96	0.77
Before pin fixation	83.14±17.46	96.48±18.32	0.005
At pin fixation	84.56±17.46	98.87±16.42	0.001
1 min post pin fixation	79.16±16.48	96.82±18.76	0.0003
2 min post pin fixation	76.12±14.76	95.42±14.16	<0.0001
3 min post pin fixation	72.76±11.16	85.94±12.16	0.0001
4 min post pin fixation	74.48±12.16	85.12±14.54	0.003
5 min post pin fixation	71.89±10.18	77.86±12.15	0.04

At the time of pin fixation in group SB, Mean arterial pressure was 84.56±17.46 mmhg, and in group L it was 98.87±16.42 mmhg with p 0.01, which was statistically significant. It was observed there was a statistically significant difference in changes in mean arterial pressure in both the groups at 1st, 2nd,3rd,4th,5th min post pin fixation (table 3, graph 2)

Graph 2: comparison of mean arterial pressure changes in two groups



IV. Discussion

Acute increase in HR and arterial blood pressure can be deleterious in the neurosurgical patient with increased ICP or with cerebral aneurysms (8). Acute arterial hypertension can further increase ICP with a risk for herniation, and may also result in pulmonary edema and ruptured cerebral aneurysms (9). Therefore, prevention of acute hypertension in the neurosurgical patient due to noxious stimuli such as head pinning would be desirable.

In previous studies, various methods of preventing hemodynamic response to the placement of the Mayfield skull pin-head holder have been described (6, 7, 10)

In our study, we observed a significant increase in heart rate and MAP at the time of pin fixation in group L when compared to group SB, which were very well correlated with Geze et al studies (12), they compared the local anesthetic infiltrationwith 0.5% bupivacaine at each pin insertion site, and scalp blockade with 0.5% bupivacaine, and found that scalp blockade was superior in controlling hemodynamics during cranial fixation and for 3 min afterward.

Bloomfield et al conducted a double blind randomized controlled trail to test the hypothesis that preventive intraoperative scalp infiltrations with bupivacaine reduces intraoperative and post-operative HR and MAP.

Mark L. Pinosky et al studies the effect of 0.5% bupivacaine skull block on hemodynamic response to craniotomy and showed the successfully blunting of stress response to head pinning. Our studies are very well correlated with Pinoskystudies (11).

Schaffranietz et al reported no significance difference in the potency of either Short acting lidocaine or long acting bupivacaine in terms of preventing the hemodynamic response to Mayfield skull pin head holder placement (14).

Akcil et al found that both scalp block and local anaesthetic infiltration reduced the cumulative morphine consumption in postoperative 24hr. moreover, the pain intensity was lower after scalp block in the early postoperative period (15).

SukranGeze et al studied the effect of scalp block and local infiltration on craniotomy and concluded that the scalp block using 0.5% bupivacaine blunts the hemodynamic and stress response to head pinning better than routine anaesthesia and scalp infiltration with bupivacaine and should be considered in conjunction with general anaesthesia for craniotomy (16). Our studies are in accordance with SukranGeze et al.

V. Conclusion

We concluded that scalp block with 0.5% bupivacaine is more effective in attenuating hemodynamic stress response when compared to local anesthetic infiltration during Mayfield skull pin fixation. We also demonstrated that there was a significant hemodynamic stability in scalp block group when compared to local infiltration group.

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