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Original Research Article

# A Study Comparing Scalp Block Using 0.25% Bupivacaine versus Pre-Incisional Local Infiltration with 0.25% Bupivacaine with Adrenaline in Craniotomy Patients.

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**Conflict of interest: Nil**

**Abstract**

**Introduction:** Scalp nerve block involves blocking nerves supplying the surgical area on the scalp to reduce sensation during surgery. The aim of this study was to assess the analgesic efficacy of scalp block (SB) with 0.25% Bupivacaine vs pre incisional local infiltration with 0.25% Bupivacaine with Adrenaline (1:400,000) in patients undergoing elective craniotomy.

**Methods:** A prospective study was conducted at the Department of Anaesthesiology, KIMS, Amalapuram, from October 2023 to March 2024. Patients aged 18-65 years, ASA I & II, Mallampati scores I & II, and BMI <30 kg/m² were included. Group A received SB with 0.25% Bupivacaine, while group B had pre-incisional infiltration with 0.25% Bupivacaine with 1:400,000 Adrenaline. Intraoperative hemodynamics and postoperative pain were assessed. Statistical analysis included descriptive statistics and inferential tests using SPSS version 20.0, with a significance level of $P<0.05$. Results indicated significant differences in intraoperative parameters and postoperative pain scores between the groups.

**Results:** Total 60 members were included, 30 in each group. Statistically there was no significant difference in the mean HR, systolic blood pressure. The mean diastolic blood pressure and MAP showed no significant difference. Group S significantly lower VAS scores compared for the first 6 hours postoperatively; afterwards, no significant differences were observed between the groups.

**Conclusion:** Our study suggests that both scalp block with 0.25% Bupivacaine and pre-incisional local infiltration with 0.25% Bupivacaine with adrenaline are effective options for pain management in craniotomy patients.

**Keywords:** Scalp Block, Bupivacaine, Cortisol, Study.



## Introduction

Post-surgery pain, gaining prominence, demands heightened clinical focus, reflecting contemporary medical concerns and prompting intensified research and management efforts. [1] The extent, duration, severity of pain among those underwent neurosurgery was quantified and reported. [2] Craniotomy, prevalent across elective cranial neurosurgical cases, stands as a primary source of headaches and pain, spanning various cranial pathologies.

The acute post-operative pain experienced by neurosurgical patients often triggers alarm, anxiety, and treatment uncertainty, potentially leading to feelings of failure and depression. This distress frequently escalates into chronic pain and headaches, particularly attributable to craniotomy procedures. [3] Recognizing the significance of craniotomy-related headaches, the International Headache Society's Committee has categorized them as a distinct nosological class. These headaches onset within seven days post-craniotomy and persist for less than three months, warranting specialized attention. [4]

Scalp nerve block (SNB) involves blocking nerves supplying the surgical area on the scalp to reduce sensation during surgery. [5] The aim of this study

was to assess and compare the analgesic efficacy of scalp block (SB) with 0.25% Bupivacaine vs pre incisional local infiltration with 0.25% Bupivacaine with Adrenaline (1:400,000) in patients undergoing elective craniotomy.

## Methods

It was a prospective research conducted in the department of Anaesthesiology, KIMS, Amalapuram. Study was conducted for 6 months period, October 2023 to March 2024. Study protocol was approved by the institutional ethics committee. Individuals of both gender aged between 18 – 65 years of ASA I & II, Mallampati scores I & II with BMI <30Kg/$m^2$ were included in the research. Exclusion criteria retrospectively barred patients from the block procedure due to emergency surgery, local anesthetic allergies, preoperative opioid dependence, lack of consent, non-compliance with inclusion criteria, or specific surgeries like aneurysmal clipping. Poor glasgow coma scale, need for postoperative ventilation, or coagulation abnormalities also disqualified participation.

In the study, group A patients received SB with 0.25% Bupivacaine, while group B patients underwent pre incisional infiltration with 0.25% Bupivacaine with 1:400,000 Adrenaline. A Mayfield head holder was utilized to stabilize the head during surgery. If heart rate (HR) increased by more than 10 beats per minute (BPM) or mean arterial pressure (MAP) rose by more than 15 mmHg over baseline values during pinning or any point in the procedure, efforts were made to control HR by increasing Sevoflurane concentration. If HR or MAP remained elevated, Inj. Fentanyl at a dose of 0.5µg/kg was administered. Anesthesia was maintained with 1 MAC value of Sevoflurane in a mixture of 30% O2 and 70% $N_2O$. Mannitol (0.5-1g/kg IV) was administered to prevent intracranial pressure (ICP) elevation, with patients having Intracranial Tumours also receiving 10mg of Dexamethasone IV. After adequate neuromuscular recovery, patients were reversed with Inj. Glycopyrrolate (0.005mg/kg) and Inj. Neostigmine (0.07mg/kg) before extubation. Intraoperative vitals were recorded at various stages, and patients were instructed on the visual analogue scale (VAS) for postoperative pain assessment. [6]

The primary outcome focused on assessing intraoperative hemodynamics and postoperative analgesia using VAS scores, while the secondary outcome evaluated intraoperative opioid requirements and time to first rescue analgesia. VAS scores were noted postoperatively, at half-hourly intervals for 6 hours, and then up to 24 hours, along with the initiation time of rescue analgesia in both groups.

**Statistical Analysis:** Descriptive statistics summarized data, with means and SDs for quantitative variables and frequency counts for qualitative ones. Inferential analysis employed unpaired t-tests for continuous variables and Chi-Square Test with Yates correction for categorical ones. Significance level was set at $P<0.05$, using two-tailed tests. SPSS version 20.0 was utilized.

## Results

Total 60 members were included, 30 in each group. The mean age was 41.20 $\pm$ 13.90 and 41.97 $\pm$ 13.59 years, respectively for the groups; statistically there was no significant difference. Statistically there was no significant difference in the mean HR. Comparison of mean systolic blood pressure (SBP) and between the groups during different stages of craniotomy revealed significant decreases in BP in group B during pin insertion, pericranial flap dissection, and closures. The mean diastolic blood pressure (DBP) and MAP showed no significant difference between the groups. Group S significantly lower VAS scores compared for the first 6 hours postoperatively; afterwards, no significant differences were observed between the groups. Observationally, only 6.67% (2) of group S patients required rescue analgesic in the initial 6 hours, indicating a substantial delay in first dose of paracetamol.

## Discussion

During craniotomy surgery, tissue damage leads to the release of inflammatory mediators, inducing peripheral sensitization and triggering a stress response. This response is attributed to stimulation during scalp incision, periosteal release, dural opening, and brain retraction, activating the hypothalamic-pituitary-adrenal (HPA) axis. The HPA axis secretes hormones crucial for pain modulation, tissue protection, regeneration, immune function, and metabolic regulation. Studies reveal a correlation between elevated cortisol levels and heightened postoperative pain. Increased cortisol levels can suppress immune function, impairing NK and T cell responses, and may lead to cognitive dysfunction. Hence, mitigating cortisol levels becomes essential to alleviate postoperative pain and its associated adverse effects on immune function and cognition. [7]

Osborn and Sebeo cited historical accounts by Harvey Cushing and George Crile who pioneered combining local anesthetic infiltration with general anesthesia in craniotomies. [8] Since the early 1900s, subcutaneous infiltration of local anesthetics with vasopressors has been utilized for hemostasis during scalp incision, as documented in multiple sources. Scalp infiltration with local anesthetics aims to reduce postoperative pain and has been a subject of study in this regard. [9]

In line with similar studies [10] on elective supratentorial craniotomy patients, an investigation

involving 60 subjects (33 male, 27 female) randomly assigned into two equal groups was conducted. Group A received general anesthesia with fentanyl, while group B underwent SBs utilizing bupivacaine (0.5%) and epinephrine (1:400,000), supplemented with fentanyl (2μg/kg) during anesthesia maintenance. Plasma cortisol levels were notably higher in the fentanyl group compared to Group B. Additionally, group B exhibited a swifter recovery period. These findings corroborate with prior research, suggesting the potential benefits of SBs in mitigating cortisol elevation and expediting postoperative recovery in patients undergoing elective supratentorial craniotomy.

In this research, there was statistical significance in the mean DBP and MAP between groups. It was reported that decreased systemic vascular resistance and increased vagal tone. Consequently, this induces a reduction in MAP and heart rate. In our study, there was a notable distinction in MAP within the initial 40 minutes, consistent with findings observed in the study conducted by Dash et al. [11] Small sample size, short follow-up period, and lack of evaluation of long-term outcomes warrant further investigation.

## Conclusion

Our study suggests that both SB with 0.25% Bupivacaine and pre-incisional local infiltration with 0.25% Bupivacaine with adrenaline are effective options for pain management in craniotomy patients.

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