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THE EFFECT OF BUPIVACAINE SCALP BLOCK VERSUS ROPIVACAINE SCALP BLOCK ON HEMODYNAMIC RESPONSES TO SKULL PIN INSERTION IN PATIENTS UNDERGOING CRANIOTOMY

Anesthesiology

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ABSTRACT

Introduction: The use of a skull pin head holder (MAYFIELD SKULL CLAMP) to stabilise the head during neurosurgical procedures produces an intense nociceptive stimulus and results in an abrupt increase in blood pressure and cerebral blood flow while under general anaesthesia. **Aims:** To assess and compare the efficacy of scalp block with 0.5% bupivacaine and 0.75% Ropivacaine in patients undergoing craniotomy based on intraoperative hemodynamic status. The objectives of this study are: to assess whether the scalp block with 0.75% Ropivacaine is as effective as the 0.5%Bupivacaine scalp block in obtunding the hemodynamic response to the pin application and to determine whether the 0.75% Ropivacaine scalp block would be an alternative to the 0.5% Bupivacaine scalp block in terms of hemodynamic stability. **Materials and method:** The current study was an observational study conducted at a hospital. This research was carried out at Jorhat Medical College and Hospital from June 2021 to May 2022. This study included 90 participants. **Result:** The study found that Craniotomy Surgery was performed in an equal proportion in both groups R and B. And it was discovered that group R had a lower number of patients who required additional analgesia [5(11.1%)] than group B [8 (17.8%)]. This, however, was not statistically significant (p=0.3683). **Conclusion:** The efficacy of scalp block with 0.5% bupivacaine and 0.75% Ropivacaine in patients undergoing craniotomy was not significantly different based on intraoperative hemodynamic status.

KEYWORDS

Blood pressure, Craniotomy, Ropivacaine Scalp Block and Bupivacaine Scalp Block.

INTRODUCTION:

Under general anaesthesia, the use of a skull pin head holder (MAYFIELD SKULL CLAMP) to stabilise the head during neurosurgical procedures produces an intense nociceptive stimulus and results in an abrupt increase in blood pressure and cerebral blood flow. It also reduces morbidity following craniotomy. Furthermore, scalp blocks may lessen the severity of craniotomy-related post-operative pain.

For blunting hemodynamic responses during head pinning, both Bupivacaine and Ropivacaine for scalp block are equally effective. Ropivacaine, a levorotatory isomer (S-), has fewer cardiovascular side effects, less toxicity in the central nervous system, and provides a shorter duration of motor block than racemic Bupivacaine.

The following study compares the efficacy of Bupivacaine scalp block versus Ropivacaine for attenuating hemodynamic responses during craniotomy skull pin insertion[3].

Several factors, including haemodynamic stability, adequate cerebral perfusion pressure, and avoidance of agents or procedures that increase intracranial pressure, should be considered during craniotomy anaesthesia. Scalp pin insertion is a basic and frequently used manoeuvre for head stabilisation during surgery. Despite an adequate depth of anaesthesia, skull pins can cause unexpected haemodynamic changes. A sudden increase in systemic blood pressure can cause an abrupt increase in intracranial pressure in patients with impaired cerebral autoregulation, precipitating intracranial hypertension. Even under deep anaesthesia, the insertion of a scalp pin produces strong noxious stimuli.

Controlling high blood pressure and tachycardia can be helped by blunting these noxious stimuli by blocking the nerves that supply the relevant region of the scalp. Furthermore, scalp blocks may lessen the severity of craniotomy-related postoperative pain. When choosing the most appropriate local anaesthetic agent, the onset and duration of action, sensory block level to motor block level, and cardiotoxicity should all be considered. Bupivacaine 0.5% is commonly used for scalp blocks.

Aim

To assess and compare the efficacy of scalp block with 0.5% Bupivacaine and 0.75% Ropivacaine in patients undergoing craniotomy based on intraoperative hemodynamic status

OBJECTIVES

1. To assess whether the scalp block with 0.75% Ropivacaine is as effective as the 0.5%Bupivacaine scalp block in obtunding the hemodynamic response to the pin application
2. To determine whether the 0.75% Ropivacaine scalp block would be an alternative to the 0.5% Bupivacaine scalp block in terms of hemodynamic stability.

In 2022 Han *et al*. conducted a prospective, single-centre, blinded, randomised, controlled clinical study that included patients between the ages of 18 and 64 who were scheduled for elective supratentorial craniotomy and had an American Society of Anaesthesiologists (ASA) physical status of I to III. Ropivacaine and Diprospan infiltration can provide satisfactory postoperative pain relief after craniotomy; it is a simple, easy, and safe technique that deserves clinical promotion.

METHODS:

Sources Of Data

Study Design:

Hospital based observational study.

Study Setting:

Jorhat Medical College and Hospital.

Study Duration:

June, 2021 to May, 2022.

Study Population:

Patients admitted in Neurosurgery Department of JMCH for craniotomy under general anaesthesia.

Selection Of Sample:

Patients was divided into two groups.

Group B- Patients receiving 0.5 per cent Bupivacaine scalp block.
Group R- Patients receiving 0.75 per cent Ropivacaine scalp block.

Patient Selection

Inclusion Criteria

1. ASA Class 1 and 2.
2. Age 18-65 years.
3. Pre-operative GCS 15.
4. Patients who have given valid consent.

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Exclusion Criteria
1. ASA Class 3 or more.
2. Pre-operative GCS<15.
3. Pregnancy.
4. Known allergic to Bupivacaine or Ropivacaine.
5. Patient refusal.
6. Skin conditions precluding the block.

Study Variables
1. Heart rate.
2. Systolic Blood Pressure (SBP).
3. Diastolic Blood Pressure (DBP).
4. Mean Arterial Pressure (MAP).
5. Oxygen saturation (SPO2).

Sample Size Calculation
Sample size was calculated based on previous studies with 95 per cent confidence interval, α=0.05 or 5 per cent level of significance and power of 80 per cent (1-β).
- n=sample size
- Z=confidence interval (95%)
- e=sample error (6%)
- p=variability (0.9), q=1-p = 0.1

Hence, $n = \frac{z^2 (pq)}{e^2} = \frac{(1.9)^2 (0.9)(0.1)}{(0.06)^2} = \frac{3.61 \times 0.09}{0.0036} = 90.25 \approx 90$

Sampling Technique:
Purposive sampling.

Ethical Clearance:
Ethical clearance was obtained from the institutional ethics committee of Jorhat Medical College and Hospital.

Consent:
Written and informed consent was taken from all patients (Annexure II and III).

Statistical Analysis:
For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data was presented in terms of mean +/-SD and t test was applied for testing the significance.

Any cost incurred during the study was borne by the researcher.

RESULTS:
Demographic data
Table 1 Association between age in groups

Age in group	Group B		Group R		Chi-square value	p-value
	n	%	n	%	12.3167	0.0307
<20	2	4.40	3	5.60		
21-30	7	15.60	7	15.60		
31-40	13	28.90	3	17.80		
41-50	7	15.60	13	22.20		
51-60	12	26.70	8	22.20		
61-70	4	8.90	11	16.70		
Total	45	100.00	45	100.00		

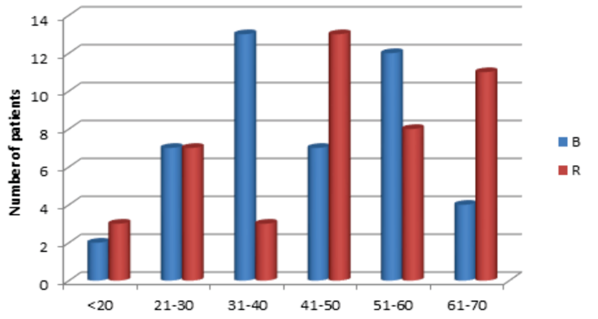

Figure 1 Age Wise Distribution

In group B, 2 (4.4%) patients were <20 years of age, 7(15.6%) patients were 21-30years of age, 13 (28.9%) patient were 31-40 years of age, 7 (15.6%) patient were 41-50 years of age, 12 (26.7%) patient were 51-60years of age and 4 (8.9%) patients were 61-70 years of age.

In group R, 3 (6.7%) patients were <20 years of age, 7(15.6%) patients were 21-30years of age, 3 (6.7%) patient were 31-40 years of age, 13 (28.9%) patient were 41-50 years of age, 8(17.8%) patient were 51-60years of age and 11 (24.4%) patients were 61-70 years of age. Association of Age in group with group was statistically significant (p=0.0307).

Table 10 Distribution of mean Heart Rate at different time interval

Heart rate	Groups	Number	Mean	SD	Minimum	Maximum	Median	Pvalue
Heart Rate(B)	B	45	82.2889	8.6224	70.0000	102.0000	82.0000	0.68
	R	45	81.5778	7.9929	70.0000	98.0000	81.0000	59
HR1	B	45	83.9778	8.5586	70.0000	102.0000	82.0000	0.07
	R	45	80.9111	7.5763	70.0000	94.0000	79.0000	53
HR2	B	45	83.1111	8.1442	70.0000	102.0000	82.0000	0.59
	R	45	82.2000	7.9017	70.0000	98.0000	84.0000	15
HR4	B	45	83.4667	8.9737	70.0000	102.0000	82.0000	0.09
	R	45	80.5333	7.3472	70.0000	99.0000	79.0000	33
HR10	B	45	82.9111	9.0021	70.0000	102.0000	82.0000	0.40
	R	45	84.4000	7.6942	70.0000	102.0000	86.0000	13
HR15	B	45	83.7778	8.8186	70.0000	102.0000	82.0000	0.07
	R	45	80.7111	7.1846	70.0000	92.0000	79.0000	39
HR30	B	45	82.8444	9.1053	70.0000	102.0000	82.0000	0.42
	R	45	81.4222	7.6113	70.0000	94.0000	79.0000	36

Heart Rate
- In group B, the mean Heart Rate (mean± s.d.) of patients was 82.2889± 8.6224.
- In group R, the mean Heart Rate (mean± s.d.) of patients was 81.5778± 7.9929.
- Distribution of mean Heart Rate with group was not statistically significant (p=0.6859).

HR1
- In group B, the mean HR1(mean± s.d.) of patients was 83.9778± 8.5586.
- In group R, the mean HR1(mean± s.d.) of patients was 80.9111± 7.5763.
- Distribution of mean HR1 with group was not statistically significant (p=0.0753).

HR2
- In group B, the mean HR2 (mean± s.d.) of patients was 83.1111± 8.1442.
- In group R, the mean HR2 (mean± s.d.) of patients was 82.2000± 7.9017.
- Distribution of mean HR2 with group was not statistically significant (p=0.5915).

HR4
- In group B, the mean HR4 (mean± s.d.) of patients was 83.4667± 8.9737.
- In group R, the mean HR4 (mean± s.d.) of patients was 80.5333±7.3472.
- Distribution of mean HR4 with group was not statistically significant (p=0.0933).

HR10
- In group B, the mean HR10 (mean± s.d.) of patients was 82.9111± 9.0021.
- In group R, the mean HR10 (mean± s.d.) of patients was 84.4000± 7.6942.
- Distribution of mean HR10 with group was not statistically significant (p=0.4013).

HR15
- In group B, the mean HR15 (mean± s.d.) of patients was 83.7778± 8.8186.
- In group R, the mean HR15(mean± s.d.) of patients was 80.7111± 7.1846.
- Distribution of mean HR15 with group was not statistically significant (p=0.0739).

Hr30

- In group B, the mean HR30 (mean± s.d.) of patients was 82.8444± 9.1053.
- In group R, the mean HR30 (mean± s.d.) of patients was 81.4222±7.6113.
- Distribution of mean HR30 with group was not statistically significant (p=0.4236).

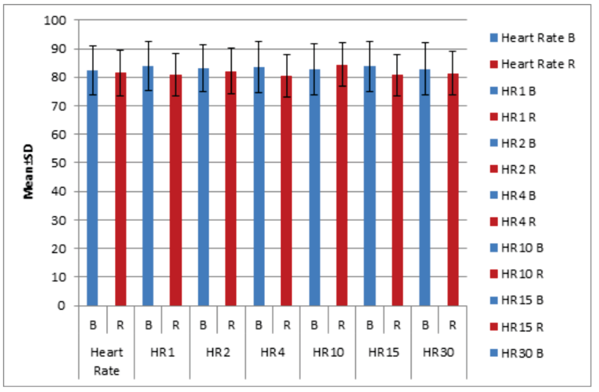

Figure 10 Distribution Of Mean Heart Rate At Different Time Interval

Table 14 Distribution of mean MAP (B) at different time interval

MAP	Group	Number	Mean	SD	Minimum	Maximum	Median	P-value
MAP (B)	B	45	90.6741	4.6864	83.3333	102.6667	88.6667	0.1226
	R	45	92.0889	3.8850	85.3333	100.0000	92.0000	
MAP 1	B	45	90.4000	4.3097	84.6667	100.0000	89.3333	0.0651
	R	45	92.0370	3.9989	84.0000	102.6667	92.0000	
MAP 2	B	45	90.3333	4.5494	83.3333	100.0000	89.3333	0.1013
	R	45	91.8444	4.0958	85.3333	104.0000	90.6667	
MAP 4	B	45	90.1556	90.1556	83.3333	100.6667	90.0000	0.0520
	R	45	91.7630	91.7630	85.3333	100.0000	92.0000	
MAP 10	B	45	90.2000	3.8326	84.6667	98.6667	89.3333	0.2226
	R	45	91.2889	4.5469	84.0000	100.6667	90.0000	
MAP 15	B	45	90.0074	4.3731	83.3333	100.0000	88.6667	0.1095
	R	45	91.3778	3.6332	84.6667	99.3333	92.0000	
MAP 30	B	45	89.9481	3.7939	84.0000	100.0000	88.6667	0.1279
	R	45	91.1852	3.8426	84.0000	98.6667	90.6667	

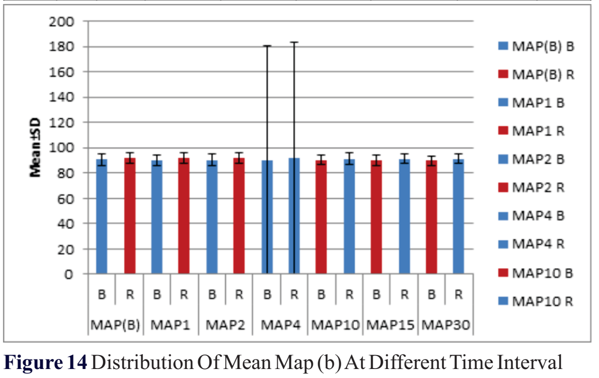

Figure 14 Distribution Of Mean Map (b) At Different Time Interval

MAP(B)

- In group B, the mean MAP (B) (mean± s.d.) of patients was 90.6741 ± 4.6864.
- In group R, the mean MAP (B) (mean± s.d.) of patients was 92.0889 ± 3.8850.
- Distribution of mean MAP (B) with group was not statistically significant (p=0.1226).

MAP1

- In group B, the mean MAP1 (mean± s.d.) of patients was 90.4000 ± 4.3097.
- In group R, the mean MAP1 (mean± s.d.) of patients was 92.0370 ± 3.9989.
- Distribution of mean MAP1with group was not statistically significant (p=0.0651).

MAP2

- In group B, the mean MAP2 (mean± s.d.) of patients was 90.3333 ± 4.5494.
- In group R, the mean MAP2 (mean± s.d.) of patients was 91.8444 ± 4.0958.
- Distribution of mean MAP2 with group was not statistically significant (p=0.1013).

MAP4

- In group B, the mean MAP4 (mean± s.d.) of patients was 90.1556 ± 90.1556.
- In group R, the mean MAP4 (mean± s.d.) of patients was 91.7630 ± 91.7630.
- Distribution of mean MAP4 with group was not statistically significant (p=0.0520).

MAP10

- In group B, the mean MAP10 (mean± s.d.) of patients was 90.2000± 3.8326.
- In group R, the mean MAP10 (mean± s.d.) of patients was 91.2889± 4.5469.
- Distribution of mean MAP10 with group was not statistically significant (p=0.2226).

MAP15

- In group B, the mean MAP15 (mean± s.d.) of patients was 90.0074 ± 4.3731.
- In group R, the mean MAP15 (mean± s.d.) of patients was 91.3778 ± 3.6332.
- Distribution of mean MAP15 with group was not statistically significant (p=0.1095).

MAP30

- In group B, the mean MAP30 (mean± s.d.) of patients was 89.9481 ± 3.7939.
- In group R, the mean MAP30 (mean± s.d.) of patients was 91.1852 ± 3.8426.
- Distribution of mean MAP30with group was not statistically significant (p=0.1279).

DISCUSSION:

Our study showed that, Craniotomy Surgery was equal proportion in both group R and group B. And we also found that, lower number of patients had Requirement of Additional Analgesia [5(11.1%)] in group R compared to group B [8 (17.8%)] but this was not statistically significant (p=0.3683).

Carella M *et al* (2021), It was discovered that tight intraoperative hemodynamic control is required for the anaesthetic management of supratentorial craniotomy. This type of surgery may also result in significant postoperative pain. They wanted to see how regional scalp block (SB) affected hemodynamic stability during the noxious events of supratentorial craniotomies and total intravenous anaesthesia, how it affected intraoperative anaesthetic agent consumption, and how it affected postoperative pain control.

We found that, the mean MAP (B) (p=0.1226), MAP 1 (p=0.0651), MAP 2 (p=0.1013), MAP 4 (p=0.0520), MAP 10 (p=0.2226), MAP 15 (p=0.1095) and MAP 30 (p=0.1279) in both group R and group B was not statistically significant.

TONKOVIĆ D *et al* (2015), discovered that maintaining perioperative hemodynamic stability and optimal cerebral perfusion is critical for elective neurosurgery procedures. Before anaesthesia induction, after induction, after pin placement, after craniotomy, and at the end of surgery, heart rate and blood pressure were measured. A good hemodynamic stability of the used anaesthetic technique was defined as changes in heart rate and blood pressure values of less than 20% after painful stimuli.

Thus, the comparison of the effects of the two studied drugs on intraoperative haemodynamic parameters in the current study is justified, as the demographic data, other patient variables, and baseline haemodynamic parameters were all comparable, and the type of surgery, anaesthetic procedure, anaesthetic agents, and equipment used were all the same between the two groups.

Patients with GCS15, emergency surgeries, and patients at the extremes of age (age 18years, age>65 years) were also excluded from the study. The only difference between the two groups was the study drugs used.

Limitations Of The Study

1. Only ASA I and ASA II patients were included
2. No patients with Glasgow Coma Scale (GCS) below 15 were included in the study
3. Plasma catecholamine levels were not considered for comparison between the two groups which would have effected the sympatho-adrenal response.
4. Direct estimation of ICP or the increase in ICP as a response to pinning was not measured . Only the hemodynamic responses were studied.
5. No placebo group included to highlight the differences in the hemodynamic responses, since both the groups have been proven superior to placebo in different studies.
6. The use of bispectral index monitor would have been ideal to assess depth of anaesthesia during skull pin application, this would have been due to non availability at the time when the study was initiated and this would be the limitation of this study
7. The Visual Analog Scale (VAS) is limited by ceiling effects that often leaves patients with no ability to quantify worsening pain.

CONCLUSION:

Ropivacaine 0.75% scalp block is as effective as Bupivacaine 0.5% scalp block in obtunding the hemodynamic responses which occurred due to the insertion of skull pin before craniotomy. Hence Ropivacaine 0.75% can be used as an alternative to Bupivacaine 0.5% for scalp block before craniotomy.

We concluded that the efficacy of scalp block with 0.5% bupivacaine and 0.75% Ropivacaine in patients were not significant different undergoing craniotomy based on intraoperative hemodynamic status.

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