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Dexmedetomidine Versus Levobupivacaine for Scalp Block in Maintaining Hemodynamic stability to Skull Pin Holder Application in Craniotomy

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Abstract:
Background*: Scalp nerve block (SNB) is the blockage of nerves that innervate the involved region of the scalp after surgery. Bupivacaine, levobupivacaine, and Ropivacaine of varying concentrations with and without epinephrine can be used in a scalp block. Dexmedetomidine, a selective α2 agonist, reduce the impact of hemodynamic effects in patients undergoing craniotomy. Levobupivacaine is an amide local anaesthetic drug that is an enantiomer of Bupivacaine.*
Aim:*To compare hemodynamic effects of IV Dexmedetomidine and levobupivacaine used for scalp block during skull pin holder application in craniotomy patients*
Materials and Methods:*Sixty patients belonging to American Society of Anaesthesiologists(ASA) grade I or II or IIIposted for craniotomy were allocated randomly into two groups. Group Dpatients received Dexmedetomidine and group L patients received levobupivacaine.Age, gender, heart rate, blood pressure, pain scores, duration of analgesia were assessed.*
Results:*Most of the patients were aged 31 to 40 years. Most of the patients were females, and belonged to ASA grade I in our study. Mean arterial pressure and heart rate were significantly less among D group patients compared to L group patients. Duration of analgesia was significantly less in L group patients. Mean VAS score was significantly lessin D group patients.*
Conclusion:*Dexmedetomidine for scalp block attenuated hemodynamic responses better to skull pin insertion among patients undergoing craniotomy under general anaesthesia.*
Key Words: *Craniotomy, Dexmedetomidine, Hemodynamicstability, Levobupivacaine, Scalp block*

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I. Introduction

Scalp nerve block (SNB) is the blockage of nerves that innervate the involved region of the scalp after surgery[1]. It was developed due to its benefits for regional anaesthesia administration.[2] Many researchers demonstrated that SNB reduces autonomic responses and provided adequate postoperative analgesia.[3] Various agents like IV Alfentanil[4], sub-anaesthetic doses of ketamine[5], Fentanyl, Gabapentin[6] and Sufentanil have been administered before the skull pin insertion previously. Scalp block provides haemodynamic stability and reduces the stress response to painful stimuli.Bupivacaine, levobupivacaine, and Ropivacaine of varying concentrations with and without epinephrine can be used in a scalp block. The scalp block technique includes injecting local anaesthetic into 7 nerves on both sides. This block may be inserted during sedation or after the induction of anaesthesia. The skin is cleaned using chlorhexidine or betadine. The amount inserted at each site will be dependent upon the concentration and local anaesthetic used and whether it is mixed with epinephrine. Using sterile gloves and a 23-gauge needle, the local anaesthetic is infiltrated. Scalp nerve block using a local anaesthetic is an effective and well-established process to reduce sympathetic response.
It also provides the added advantage of relieving pain in the post-operative period.

Opioids too can provide analgesic effects but can interfere with neurological assessment. They can also cause respiratory depression leading to hypercapnia and Raised Intracranial pressure (ICP).[7] But they can produce more sedation and cause nausea and vomiting.

Scalp infiltration and block can provide adequate analgesia and allow neurological assessment with a lower chance of side effects.[8]Dexmedetomidine, a selective α2 agonist, reduce the impact of hemodynamic effects in patients undergoing craniotomy.Levobupivacaine is an amide local anaesthetic drug that is an enantiomer of Bupivacaine. In view of low-quality evidence of efficacy of scalp block compared to non-scalp block modalities for post craniotomy analgesia, the current study was undertaken,

Aim:

To comparehemodynamic effects of IV Dexmedetomidine and levobupivacaine used for scalp block during skull pin holder application in craniotomy patients.

II. Material And Methods

This study was carried out at a tertiary care centre in India from August 2022 to February2023.

Study Design: Interventionalstudy

Study Location: This study was done at a tertiary care teaching center named Katuri Medical College & Hospital, Guntur, Andhra Pradesh, India.in the Department of Anaesthesia.

Study Duration: August 2022 to February 2023

Sample size: 60 Patients

Simple random sampling was the sampling procedure used.

Sample size calculation: Sample size is calculated as per the previous study[9]where the maximum average raisein heart rate and arterial pressure was by 11bpmwith a standard deviation of 10.9 and 13.4 mmHg with a standard deviation of 16.9 at 1 min after scalp block. Assuming 10% difference in heart rate and mean arterial pressure,gives size with similar SD. At 80% confidence intervals, with an error of 5%, minimum sample size came to be 25. So, we included 30 patients in each group, considering few losses to follow up.

Subjects & selection method:

Patients were randomized into two groups, each group containing 30 patients.

Randomization was done using computer generated software. Group D patientsreceived Dexmedetomidine in the dose of 1-2mcg/kg body weight and GroupL patientsreceived 30 ml of 0.75% levobupivacaine.

Eligibility criteria:

Inclusion criteria:

1. Patients aged above 18 years scheduled for craniotomy
2. Patients who provided informed consent to participate in the study.
3. Patients with ASA grade I, II and III.

Exclusion criteria:

1. Pregnant and lactating women
2. Patients with known allergy to levobupivacaine or dexmedetomidine
3. Patients with severe hypertension or hypotension
4. Patients with severe cardiac, pulmonary, liver disorders

Methodology:

After obtaining the informed consent, patients were shifted to the OT and ASA standard monitors attached which are pulse oximetry, ECG leads, NIBP cuff.Baseline heart rate (HR), noninvasive blood pressure (NIBP), mean arterial pressure (MAP), oxygen saturation (SPO2), electrocardiography (ECG) was recorded.Premedication with Alprazolam 0.5mg is given on night before surgery in patients with anxiety.After shifting patients to surgical room, 18G and 16G IV cannulas are secured, and monitors were connected. Preanaesthetic medications used includeInj. Glycopyrrolate (5mcg/kg) IV, Inj. Midazolam (0.03mg/kg) IV and Inj. Fentanyl (2mcg/kg) IV induced with Inj. Propofol (2mg/kg) IV. Inj. Vecuronium (0.1mg/kg) IV is used as a muscle relaxant and endotracheal intubation is performed and maintained using Sevoflurane (0.2-1%), Nitrous oxide and oxygen were given in50:50 ratio. Neuromuscular blockage reversed with Inj. Neostigmine (0.05mcg/kg) IV and Inj. Glycopyrrolate (10mcg/kg) IV. Scalp block was done by blocking supraorbital nerve, supratrochlear nerve, preauricular nerve, lesser and greater occipital nerves on both sides. Visual analogue scale (VAS)[10] was used to determine pain score.

Parameters assessed:

- Demographic data
- Heart rate
- Mean arterial pressure (MAP)
- Duration of analgesia
- VAS score

Statistical analysis: Data was analyzed using SPSS software version 25.0. Results were expressed as percentages and mean with standard deviation. Student t-test was used to compare numerical parameters between two groups and chi-square test was used to compare categorical parameters between the two groups. P value below 0.05 is considered significant.

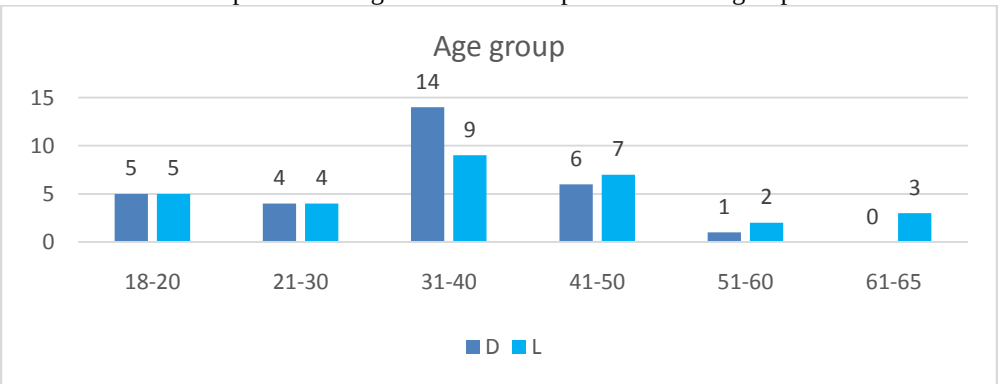
Ethical considerations:
Informed consent was taken from every patient who participated in the study.

III. Results

The current study included 60 patients scheduled for craniotomy.

Age distribution: Most of the patients were aged 31 to 40 years.

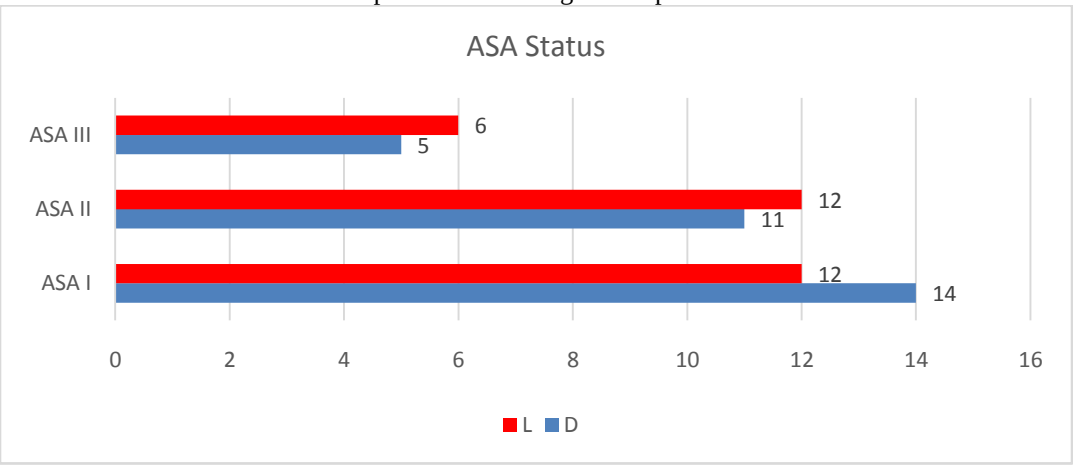
Graph 1 shows age distribution of patients in both groups



Gender: 28 patients were females and 32 patients weremales in the current study.

ASA grade:
Most of the patients belonged to ASA grade I.

Graph 2 shows ASA grade of patients



Heart rate: There is significant difference in heart rate between two groups at various intervals.

Table 1 shows mean heart rate in both groups at various intervals

Time interval	**Group**	**Mean**	**P value**
Baseline	D	70.6	0.001
	L	76.7	
Heart rate at 15 min	D	74.2	0.001
	L	84.61	
Heart rate at 30 min	D	70.1	0.001
	L	78.4	
Heart rate at 45 min	D	70.2	0.001
	L	79	

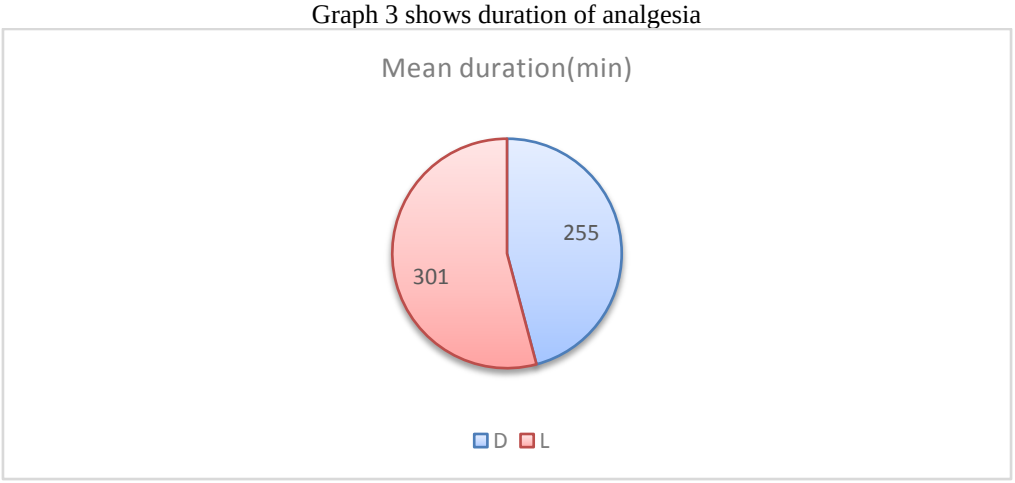
MAP:
There is significant difference in MAP at various intervals. It was less in D group patients

Table 2 shows mean MAP in both groups at various intervals.

MAP in mm of Hg	**Group**	**Mean**	**P value**
Baseline	D	80.23	0.001
	L	89.3	
15 min	D	81.03	0.001
	L	87	
30 min	D	79.6	0.001
	L	85.1	
45 min	D	80.83	0.001
	L	87.6	

Duration of analgesia:
There is significantly difference in duration of analgesia between two groups. It was significantly less in D group patients. (p=0.02).

Graph 3 shows duration of analgesia



Mean VAS score:
Mean VAS score was significantly less in D group patients.

Table 3 shows mean VAS score between two groups

Group	Mean VAS score	p
D	4.2±1.1	0.0001
L	5.1±1.3	

IV. Discussion

In patients undergoing neurosurgeries, the head is stabilized by fixing head frames or skull pin holders. Though they are performed under general anaesthesia, these insertions can cause periosteal stimulation, sudden rise in heart rate, brain edema, intracranial hypertension,tissue damage[11-13] and hemorrhage, especially in patients with Intracranial space-occupying lesions and intracranial aneurysms. So, the appropriate method of maintaining hemodynamic stability is of vital importance.

Sixty patients belonging to American Society of Anaesthesiologists (ASA) grade I or II or III posted for craniotomy under general anaesthesia were allocated randomly into two groups. Group D patients received Dexmedetomidine and group L patients received levobupivacaine. Results showed thatmost of the patients were aged 31 to 40 years. Most of the patients were females, and belonged to ASA grade I in our study. Mean arterial pressure and heart rate were significantly less among D group patients compared to L group patients. Duration of analgesia was significantly less in L group patients. The mean VAS score was significantly less in D group patients in our study.

Muhammad et al.[14]did a study toanalyze the effects of scalp block with ropivacaine among patients scheduled for craniotomy. The study was done on 14 Subjects aged 18-64 years. Results showed that the mean opioid usage in Ropivacaine group was less. Pain was also significantly less in Ropivacaine group after surgery. Scalp block with Ropivacaine 0.5% was found to be more effective in reducing painfor up to 12 hours. In our study, dexmedetomidine found to maintain more hemodynamic stability compared to levobupivacaine.

Deshmukh's study[15] compared the efficacy of 0.5% Ropivacaine with 0.5% Levobupivacaine for scalp block in providing haemodynamic stability. The study was done on 60 patients of either sex, aged 18 to 65 years under General Anaesthesia. Results shown that the response to pin insertion was obtunded by both the drugs. The reaction to incision was blunted better in Ropivacaine group.But, overall Levobupivacaine showed better efficacy.

Vallapu et al.[16]did a study to assess the efficacy of IV Dexmedetomidine on reducing hemodynamic responses to skull pin head holder application. The study was done on ninety ASA I–III patients undergoing craniotomy. Patients in Group D showed a higher and sustained attenuation of MAP, similar to our study.

Yaoxin Yanget al[17]. did a a prospective study to assess the effects of SNB using different doses of ropivacaine on postoperative pain and intraoperative hemodynamic variables among patients undergoing craniotomy under general anaesthesia. 85 patients were randomized to receive scalp block with either 0.2% Ropivacaine or 0.33% Ropivacaine or 0.5% Ropivacaine, or normal saline. The study found that the blockage with 0.2% and 0.33% of ropivacaine provided proper postoperative pain relief up to two hours, while administration of 0.5% ropivacaine provided pain relief for up to four hours after Craniotomy. 0.2% and 0.5% ropivacaine found to reduce heart rate response to incision and drilling. The study reported that scalp block with 0.5% of Ropivacaine to provide good postoperative analgesia.

V. Conclusion

It was proved from our study results that dexmedetomidine for scalp block attenuated hemodynamic responses better to skull pin insertion among patients undergoing craniotomy under general anaesthesia.

The study is self-sponsored and there are no conflicts of interest.

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