Original Research Article

Comparison of intravenous dexmedetomidine and lignocaine infiltration to attenuate the hemodynamic response to skull pin holder during craniotomy

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Abstract

Background: The purpose of the study is to compare the effectiveness of intravenous dexmedetomidine or lignocaine infiltration in attenuating the hemodynamic response to skull pin holder during craniotomy. For the study, 60 patients of the age group 18-70 years belonging to ASA PS I and PS II were selected and divided into two groups. The study design employed was a prospective randomized comparative study. Based on standard dosing, 1mcg/kg of dexmedetomidine diluted to 10 ml with 0.9% saline over 10 minutes was given before induction. Patients randomized to group lignocaine received infiltration of pin sites with 2% lignocaine 3 ml at each site. The timing of dexmedetomidine infusion was such that peak effect of the drug would coincide with the time of application. Heart rate and mean arterial pressure were comparable between the two groups during the study and were recorded at the following intervals pre-induction, pre-infiltration, post-infiltration, pre pin application, post pin application 10 and 15 minutes after pin application. We found that dexmedetomidine is more effective in controlling the hemodynamic response than local lignocaine infiltration during craniotomy. It was concluded that 1 mcg/kg of dexmedetomidine infused slowly over 10 minutes is superior when compared to local infiltration of 2% lignocaine in attenuating the hemodynamic response to skull pin holder during craniotomy. By attenuating the hemodynamic response, brain edema, increased intracranial pressure and intracranial hemorrhage can be prevented.

Keywords- Hemodynamic, Lidocaine, Dexmedetomidine, Craniotomy,skull pin holder

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INTRODUCTION

Application of skull pin holder during craniotomy for neurosurgical procedure is extremely painful and is associated with abrupt increase in heart rate and mean arterial pressure. These adverse effects can lead to brain edema, increased intracranial pressure or hemorrhage. The Mayfield skull pin holder is used to support the head without any direct pressure on the face allowing access to the airway and can holds the head for optimal neurosurgical exposure. Different techniques have been used to blunt these deleterious hemodynamic changes. The hemodynamic response consists of autonomic response to noxious stimuli which increases the sympathetic tone which elevates the blood pressure and heart rate. The

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sudomotor responses consists of sweating whereas the hormonal response consists of release of corticosteroids, glucagon, and catecholamines due to activation of hypothalamic pituitary axis due to surgical stress. Dexmedetomidine, an alpha 2 agonist may blunt the hemodynamic response due to its sympatholytic and analgesic properties. Lignocaine being a local anaesthetic blocks the nerve conduction by decreasing the entry of sodium ions during upstroke of action potential thus decreasing the autonomic response.

MATERIALS AND METHODS

PATIENT SELECTION

Sixty consecutive ASA PS I and PS II aged between 18 to 70 years undergoing elective craniotomy for resection of supratentorial tumors with aid of skull pin holder were selected and randomized into two groups. Group 1 received intravenous dexmedetomidine and group 2 received local lignocaine infiltration.

EXCLUSION CRITERIA

1. Hypertension
2. Ischemic heart disease
3. Heart block
4. Pregnancy or lactation
5. Signs and symptoms of raised intracranial pressure
6. Previous craniotomy
7. Tumors of hypophysis
8. Head injury
9. Patient not willing to participate

MATERIALS

- 18 G venflon
- Drugs -dexmedetomidine, 2% lignocaine
- Drugs for general anaesthesia-glycopyrrolate, propofol, atracurium, fentanyl
- Monitors-ECG,NIBP,Spo2,EtCO2
- This study was done in department of anaesthesia, RGGGH, Chennai

STATISTICAL ANALYSIS

Results for parametric data were reported as means+-SD. Demographic data were analyzed by student t-tests. Hemodynamic data were analyzed by independent t-test for differences between group and paired t-test for differences within groups. For post - hoc comparison, Bonferroni test. A value of <0.05 was considered statistically significant

METHODOLOGY

After ethical committee approval, patients satisfying inclusion criteria after obtaining consent were randomized by closed envelope method. Group 1 received intravenous dexmedetomidine 1 mcg/kg diluted to 10 mg of saline over 10 minutes before induction. These patients received infiltration of 0.9%saline at the pin site to ensure blinding of observer. Patients randomized to group 2 received 10 ml of 0.9% saline intravenously before induction and then received infiltration of pin sites with 2% lignocaine 3mg at each site. The heart rate and the mean arterial pressure were recorded at following time intervals

- Pre induction T1 (before intravenous dexmedetomidine)
- Pre infiltration T2 (before infiltration of 2%lignocaine)
- Post infiltration T3
- Pre pin application T4
- Post pin application T5
- 10 minutes after pin application T 10
- 15 minutes after pin application T 15

Surgery was proceeded with maintenance of general anaesthesia and after extubation, data compilation and statistical analysis was done

OBSERVATION AND ANALYSIS

Results for parametric data were reported as means + - SD. Demographic data were analyzed by Student t-tests. Hemodynamic data were analyzed by independent t-test for differences between group and paired t-test for differences within groups. For post - hoc comparison, Bonferroni test. A value of<0.05 was considered statistically significant While analyzing the age distribution, gender, ASA PS, among the intervention groups using unpaired t-test, the data was found to be statistically insignificant(p>0.05)

RESULTS

Table 1: Heart Rate

HR	GROUP	N	MEAN	STD. DEVIATION	P VALUE BY "t" TEST
Baseline (T1)	DEXOMED	30	80.97	5.25	0.924
	LIGNOCAINE	30	81.10	5.50	
Before administration of dexmed/local infiltration (T2)	DEXOMED	30	81.50	5.01	0.920
	LIGNOCAINE	30	81.63	5.26	
After administration of dexmed/ local infiltration (T3)	DEXOMED	30	72.00	4.58	<0.001
	LIGNOCAINE	30	77.00	5.19	

Prepin application (T4)	DEXOMED	30	71.87	4.11	<0.001
	LIGNOCAINE	30	76.87	4.82	
Postpin application (T5)	DEXOMED	30	72.90	4.04	<0.001
	LIGNOCAINE	30	77.87	4.71	
10 min postpin application (T10)	DEXOMED	30	72.37	3.55	0.001
	LIGNOCAINE	30	76.07	4.51	
15 min postpin application (T15)	DEXOMED	30	72.10	3.62	<0.001
	LIGNOCAINE	30	76.40	3.94	

While analyzing the heart rate distribution among patients undergoing craniotomy using skull pin holder using unpaired t-test, it was observed that attenuation of heart rate in dexmedetomidine group was better than lignocaine and results were found to be statistically significant ($p<0.05$).

Table 2: Systolic BP

SBP	GROUP	N	MEAN	STD. DEVIATION	P VALUE BY "t" TEST
Baseline (T1)	DEXOMED	30	125.60	9.39	0.748
	LIGNOCAINE	30	126.40	9.79	
Before administration of dexmed/local infiltration (T2)	DEXOMED	30	125.40	8.36	0.823
	LIGNOCAINE	30	125.90	8.90	
After administration of dexmed/ local infiltration (T3)	DEXOMED	30	114.80	6.71	0.002
	LIGNOCAINE	30	121.00	7.95	
Prepin application (T4)	DEXOMED	30	115.70	6.92	0.084
	LIGNOCAINE	30	119.03	7.73	
Postpin application (T5)	DEXOMED	30	116.43	6.71	0.034
	LIGNOCAINE	30	120.40	7.38	
10 min postpin application (T10)	DEXOMED	30	113.10	6.02	0.005
	LIGNOCAINE	30	117.80	6.40	
15 min postpin application (T15)	DEXOMED	30	111.47	5.14	<0.001
	LIGNOCAINE	30	117.20	5.90	

While analysing the systolic BP distribution among patients undergoing craniotomy using skull pin holder using unpaired t test,it was observed that attenuation of systolic BP in dexmedetomidine group was better than lignocaine and results were found to be statistically significant($p<0.05$)

Table 3: Diastolic BP

DBP	GROUP	N	MEAN	STD. DEVIATION	P VALUE BY "t" TEST
Baseline (T1)	DEXOMED	30	79.10	6.21	0.157
	LIGNOCAINE	30	81.53	6.91	
Before administration of dexmed/local infiltration (T2)	DEXOMED	30	79.70	4.65	0.288
	LIGNOCAINE	30	81.17	5.87	
After administration of dexmed/ local infiltration (T3)	DEXOMED	30	72.97	4.55	0.001
	LIGNOCAINE	30	77.53	5.48	
Prepin application (T4)	DEXOMED	30	72.80	4.48	0.012
	LIGNOCAINE	30	76.23	5.71	
Postpin application (T5)	DEXOMED	30	74.13	4.74	0.043
	LIGNOCAINE	30	76.23	5.70	
10 min postpin application (T10)	DEXOMED	30	72.20	4.85	0.005
	LIGNOCAINE	30	76.03	5.20	
15 min postpin application (T15)	DEXOMED	30	70.73	4.49	<0.001
	LIGNOCAINE	30	76.07	4.73	

While analysing the diastolic BP distribution among patients undergoing craniotomy using skull pin holder using unpaired t test,it was observed that attenuation of diastolic BP in dexmedetomidine group was better than lignocaine and results were found to be statistically significant ($p<0.05$)

Table 4: Mean arterial pressure

MAP	GROUP	N	MEAN	STD. DEVIATION	P VALUE BY "t" TEST
Baseline (T1)	DEXOMED	30	94.60	6.56	0.309
	LIGNOCAINE	30	96.49	7.64	
Before administration of dexmed/local infiltration (T2)	DEXOMED	30	94.33	5.54	0.273
	LIGNOCAINE	30	96.08	6.63	
After administration of dexmed/ local infiltration (T3)	DEXOMED	30	86.20	4.79	<0.001
	LIGNOCAINE	30	92.02	6.08	
Prepin application (T4)	DEXOMED	30	87.10	4.94	0.022
	LIGNOCAINE	30	90.50	6.16	
Postpin application (T5)	DEXOMED	30	88.23	4.96	0.017
	LIGNOCAINE	30	91.64	5.79	
10 min postpin application (T10)	DEXOMED	30	85.73	4.89	0.002
	LIGNOCAINE	30	89.96	5.29	
15 min postpin application (T15)	DEXOMED	30	84.31	4.11	<0.001
	LIGNOCAINE	30	89.78	4.70	

While analysing the mean arterial pressure distribution among patients undergoing craniotomy using skull pin holder using unpaired t test, it was observed that attenuation of mean arterial pressure in dexmedetomidine group was better than lignocaine and results were found to be statistically significant ($p<0.05$)

DISCUSSION

Different modalities have been experimented with to reduce the hemodynamic response to skull pin application of which the most commonly studied modality has been local lignocaine infiltration at pin sites. However, this was not successful because of improper infiltration, change in pin sites, head movement during fixation and inadequate dosage of local anaesthetics. This resulted in comparison of local lignocaine infiltration with other modalities such as oral clonidine or gabapentin pre-medication, bupivacaine skull block, IV fentanyl. All of them yielded varying results and thus it was identified that further research would be required to identify the ideal modality. Dexmedetomidine, a selective alpha 2 adrenoreceptor agonist has sedative, analgesic, and anaesthetic sparing effect. So we compared dexmedetomidine with the commonly used method of local lignocaine infiltration at pin sites for attenuating the hemodynamic response. Thus it was found that dexmedetomidine is more effective in controlling the hemodynamic response than local lignocaine infiltration. Despite dexmedetomidine having side effects such as hypotension and bradycardia which can be detrimental in neurosurgical patients we did not observe any such side effects when dexmedetomidine was slowly infused over 10 minutes in a dose of 1mcg/kg.

CONCLUSION

It was concluded that 1 mcg/kg of dexmedetomidine infused slowly over 10 minutes is superior when compared to local infiltration of 2% lignocaine in attenuating the hemodynamic response to skull pin holder during craniotomy.

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