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Indian Journal of Clinical Anaesthesia

Journal homepage: www.ijca.in

Original Research Article

Dexmedetomidine versus Lignocaine for extubation in patients undergoing craniotomies

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ARTICLE INFO

Article history:

Received 04-12-2020

Accepted 14-12-2020

Available online 01-06-2021

Keywords:

Dexmedetomidine

Lignocaine

Craniotomy

Space occupying lesions

ABSTRACT

Background: Use of lignocaine and dexmedetomidine in terms of causing hemodynamic variation, sedation and pain management remains a question. Hence this was conducted to compare a bolus dose of dexmedetomidine 0.5mcg/kg/hr to a normal dose of 1.5mg/kg preservative free 2% lignocaine for extubation in patients undergoing craniotomies.

Materials and Methods: This randomized controlled trial was conducted in the department of Anesthesiology at Sri Ramachandra Medical College and Research Institute, Chennai from January 2013 to June 2014. Patients aged between 18-60 years belongs to ASA class I and class II undergoing surgeries were included in the study. A total of fifty cases were included. Statistical analysis was done using SPSS version 17.

Results: Hemodynamic parameters showed significant attenuation of hemodynamic response during extubation when compared to lignocaine group and when the same were analyzed within the groups, the attenuation of extubation response was both clinically and statistically significant in both groups. Extubation and emergence time were similar in both the groups. Sedation and pain scores in dexmedetomidine group were low compared to lignocaine group.

Conclusion: Single dose of dexmedetomidine given 10 minutes before extubation significantly attenuated the hemodynamic and airway response following extubation as compared to lignocaine given before reversal in patients undergoing craniotomy for intracranial space occupying lesions.

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1. Introduction

Endotracheal intubation is an integral part of modern anesthesia techniques for major surgical procedures. Both intubation and extubation are associated with various cardiovascular and airway responses leading to tachycardia, hypertension, arrhythmias, myocardial ischemia, coughing, agitation, bronchospasm, increased bleeding, raised intracranial and intraocular pressure.¹ These transitory changes are of little consequences in healthy patients going for general surgical procedures, but could be of major concern for the anesthesiologist in patients especially with intracerebral space occupying lesions (ICSOL), where a sudden hypertension during or

in immediate post-extubation phase could lead to raised cerebral blood flow (CBF), intracranial pressure (ICP) and decreased cerebral perfusion pressure (CPP) resulting in increased intracranial bleeding, high morbidity and mortality.²

About 76-96% incidence of post-extubation coughing has been reported in the literature.¹ Much attention has been paid to attenuate these changes during intubation when compared with extubation. Intratracheal local anaesthetic instillation,³ intracuff lignocaine,⁴ intravenous 2% lignocaine,⁵ prostaglandin-E1⁶ and verapamil⁷ have been used to attenuate these haemodynamic and respiratory responses during extubation in the past but with certain limitations.

Recently dexmedetomidine, a potent α_2 -adrenoreceptor agonist has been used to facilitate extubation in surgical

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intensive care unit,⁸ but its role in the attenuation of hemodynamic and airway reflexes during extubation in general anesthesia is still scarce. A single dose of dexmedetomidine has been found effective in attenuation of the airway and circulatory reflexes during extubation.⁹ Avoidance of coughing during skull pin removal and during extubation is a desired prerequisite of every neurosurgical anesthetic.

Lignocaine (2%) has long been used to modulate unwanted airway and circulatory reflexes, via intravenous (IV) injection, endotracheal cuff inflation, intratracheal (IT) instillation, tube lubrication and aerosolized form.^{10,11} However, IV 2% lignocaine is short acting.

Hence we decided to compare a bolus dose of dexmedetomidine 0.5mcg/kg/hr to a normal dose of 1.5mg/kg preservative free 2% lignocaine for extubation in patients undergoing craniotomies.

2. Materials and Methods

This randomized controlled trial was conducted in the department of Anesthesiology at Sri Ramachandra Medical College and Research Institute, Chennai from January 2013 to June 2014. Adult patients aged between 18-60 years belongs to ASA class I and class II undergoing surgeries were included in the study. Ischemic, congestive cardiac disease, renal, hepatic and respiratory dysfunction, hypersensitivity to both drugs, heart block, hypertension with beta blockers, patients on clonidine, methyl dopa, beta blocking drugs, anticonvulsants and psychotropic medications were excluded from the study. Sample size of 25 were determined by power analysis with a standard deviation of systolic blood pressure 6.18 and 6.76 with a power of 80% and alpha error of 5% from a previously published study. Thus a total of fifty cases were included in the study. Primary outcomes measured include heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and Mean arterial pressure (MAP). Secondary outcomes measured emergence time, extubation time, sedation score, pain score and hemodynamic and respiratory complications.

Patients were assigned to one of the two groups by lots (sealed envelope technique), either dexmedetomidine 0.50mcg/kg in 20ml normal saline (group D) administered bolus intravenous over 10 minutes during skin closure using an infusion pump or 2% lignocaine 1.5mg/kg in 20ml normal saline (group L) administered bolus intravenous over 60 seconds before reversal. All study drugs were prepared in identical 20 ml syringes in equal volume by an anesthesiologist who was part of the study but not involved in the anesthetic management of the patient. The attending anesthesiologist recording the data was also blinded to the study drug.

At the end of surgery group D received (syringe X) 0.50 mcg/kg dexmedetomidine with saline dilution in 20ml

syringe over 10min during skin closure. Similarly group L received (syringe Y) 1.5mg/kg of preservative free 2% lignocaine over 60 seconds before reversal. Haemodynamic variables were noted before administering study drug (A0), then at one, five, ten and fifteen minutes after the administration of the study drug (A1, A5, A10, A15) and at zero, one, three, five, ten minutes (E0, E1, E3, E5, E10) after extubation respectively. The emergence and extubation time were also noted. Emergence time was defined as time interval between discontinuing of sevoflurane and patient obeying verbal commands post extubation.¹² Extubation time was defined as the time interval between cessation of anaesthetics and tracheal extubation.¹² Grading of cough was noted as a measure of extubation quality and recovery response.¹³

Statistical analysis was done using SPSS version 17. Student's t test and Mann - Whitney U test were used to test the hypothesis, appropriately. Statistical significance was accepted at $P < 0.05$.

3. Results

Mean age in group D and group L was found to be 40.64 ± 15.81 years and 42.64 ± 12.49 years, respectively ($p=0.622$). Also in group D there were 56% males and 44% females whereas in group L there were 48% males and 52% females. Mean weight in group D and group L was found to be 59.72 ± 11.67 kgs and 62.52 ± 5.93 kgs, respectively ($p=0.290$). Comparison of heart rate is shown in Table 1 and Figure 1 (SBP), Figure 2 (DBP) and Figure 3 (MAP).

On comparing the SBP at different times, E- 0 minutes, 1 minute, 3 minutes, 5 minutes and 10 minutes were found to have statistically significant difference between groups whereas in DBP A- 15 minutes, E- 0 minutes, 1 minute and 3 minutes were found to have statistically significant difference between groups.

Comparison of mean grading of cough, sedation score and pain score were significantly low in group D compared to group L. (Table 2)

Comparisons of hemodynamic parameters within the groups were shown in Table 3 and all the parameters showed statistically significant difference.

4. Discussion

Dexmedetomidine is useful in blunting hemodynamic responses in perioperative period. It is successfully used in intravenous doses varying from 0.25 to 1 mcg/kg for attenuating intubation response.¹⁴ Optimal dose for attenuating pressor response seems to be 1 mcg/kg with lesser doses not being effective.¹⁴ Doses in the range of 0.5 mcg/kg not only blunted the extubation response but also reduced the emergence reaction and analgesic requirement post extubation in neurosurgical procedures. There was no delay in recovery or prolonged sedation when boluses were

Table 1: Comparison of Heart rate and MAP between groups

Heart rate (beats/min)	Group D	Group L	P value
A -0 minute	80.56 ± 11.90	88.16 ± 12.31	0.002*
A- 1 minute	79.80 ± 11.75	87.60 ± 13.35	0.033*
A-5 minutes	76.76 ± 12.80	86.28 ± 12.39	0.010*
A-10 minutes	72.65 ± 13.47	85.84 ± 12.26	0.001*
A-15 minutes	75.88 ± 23.92	86.50 ± 14.59	0.231
E-0 minute	94.36 ± 12.19	110.48 ± 14.91	0.001*
E-1 minute	94.93 ± 10.31	105.08 ± 11.39	0.002*
E-3 minutes	91.80 ± 11.26	98.88 ± 12.94	0.045*
E-5 minutes	88.88 ± 11.19	91.6 ± 11.99	0.411
E-10 minutes	87.04 ± 9.72	91.28 ± 11.80	0.171

*Significant

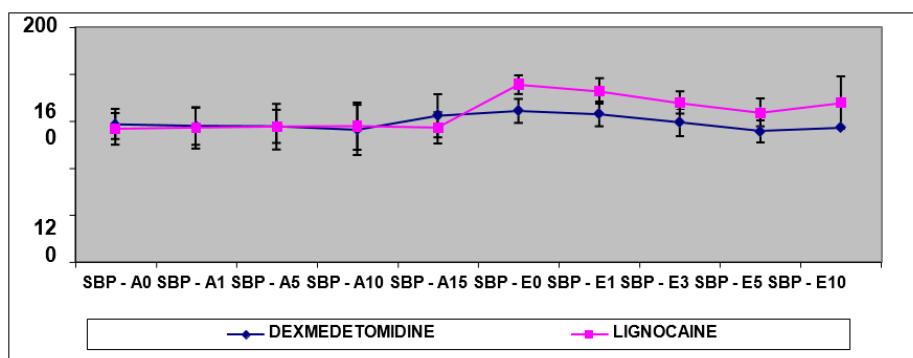
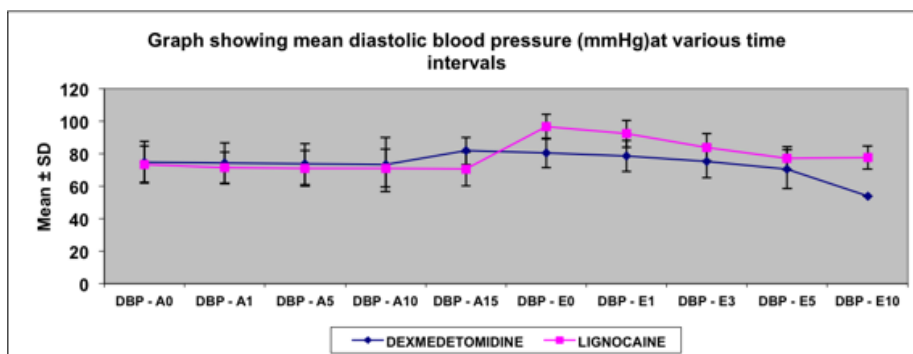
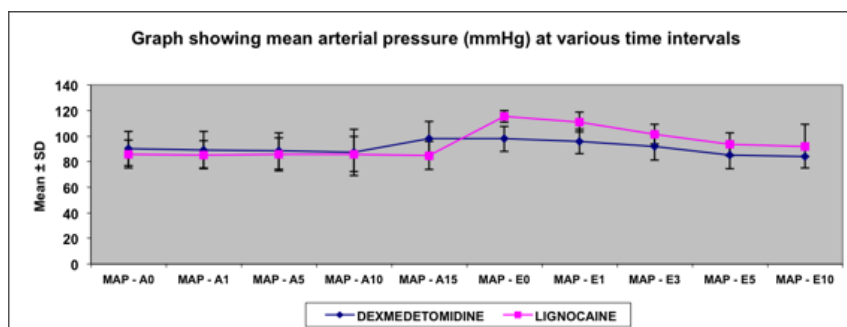
**Fig. 1:** Mean SBP at different time intervals in group G and group L**Fig. 2:** Mean DBP at different time intervals in group G and group L**Fig. 3:** Mean MAP at different time intervals in group G and group L

Table 2: Comparison of mean grading of cough, emergence and extubation time

Variables	Group D	Group L	P value
Grade of Cough	1.88 ± 0.66	2.60 ± 0.577	0.001*
Emergence time (mins)	19.52 ± 5.29	20.72 ± 4.62	0.397
Extubation time (mins)	14.84 ± 5.44	14.60 ± 4.97	0.871
Sedation score	3.08 ± 0.86	4.72 ± 0.79	0.001*
Pain score	0.84 ± 1.10	2.48 ± 0.82	0.001*

*Significant

Table 3: Comparison of hemodynamic parameters-intra group

Variables	Group D	P value	Group L	P value
HR-A 0 minute	80.56 ± 11.90	0.001*	88.16 ± 12.31	0.001*
HR-E 0 minute	94.36 ± 12.19		110.46 ± 14.91	
SBP-A 0 minute	117.08 ± 12.73	0.001*	113.36 ± 13.48	0.001*
SBP-E 0 minute	128.68 ± 10.23		151.12 ± 8.01	
DBP-A 0 minute	75.00 ± 11.31	0.033*	73.24 ± 11.31	0.001*
DBP-E 0 minute	80.44 ± 7.62		96.68 ± 7.62	
MAP-A 0 minute	90.24 ± 11.01	0.004*	85.92 ± 11.01	0.001*
MAP-E 0 minute	97.88 ± 4.634		115.32 ± 4.63	

*Significant

administered before induction or before extubation. Similar was the observation when duration of infusion was within 2 hours.¹⁵ Bradycardia and hypotensions are the major side effects observed following dexmedetomidine infusion.¹⁶

Dexmedetomidine and preservative free 2% lignocaine have been found to be quite effective in attenuating the hemodynamic response to extubation as shown by previous studies.^{12,13} In patients undergoing vascular surgery, dexmedetomidine (plasma concentrations in the range of 0.18 to 0.35 ng/ml) attenuated the increase in HR and plasma norepinephrine concentrations during emergence from anaesthesia.¹⁷ An infusion of dexmedetomidine started 20 minutes before anesthesia and continued until the start of skin closure in patients undergoing supratentorial brain tumor surgery was found to blunt tachycardic response to intubation and the hypertensive response to extubation.¹⁸ Dexmedetomidine 0.5 mcg/kg administered 10 minutes before the end of surgery has been shown to stabilize hemodynamic, allow easy extubation, provide a more comfortable recovery and allow early neurological examination following intracranial operations.¹⁹

There are many studies showing the attenuation of hemodynamic in neurosurgical patients.^{16–19} Although both drugs – dexmedetomidine and preservative free 2% lignocaine prove themselves superior to other treatment modalities / placebo, data on the comparison between these two techniques is less as yet compared. Hence we designed this study with the aim to compare the attenuating effects of single dose dexmedetomidine and 2% lignocaine on hemodynamic and the airway responses during extubation in patients undergoing craniotomy for ICSOL.^{20,21}

The variation in heart rate noted in this study was comparable with the previous study by Dilip Kothari et

al.¹⁶ which also showed a significant attenuation of HR in group D when compared to group L, suggesting that dexmedetomidine was superior to lignocaine in obtundation of HR.

In the present study, the increase in SBP and DBP as response to extubation seems to be significantly higher in group L as compared to group D, but in both the groups the increase in SBP did not exceed the 20% of baseline value and it did not last for more than 5 minutes. These results of SBP and DBP when analyzed with previous study, significant difference were seen upto 15min post extubation. The probable reason for the prolongation of attenuation was due to late administration of study drugs along with reversal drug.¹⁶

The maximum MAP variations during extubation between the groups were comparable with the results of previous study conducted by Vivek et al.,¹⁵ which stated that MAP initially increased during the first 2 minutes followed by decrease from 3rd minute, suggesting that slow infusions are better than rapid bolus doses of dexmedetomidine.

The baseline Mean arterial blood pressure (MAP) is comparable between the two groups. However, after drug administration MAP tends to decrease to about 20% below the baseline in both groups producing comparable values before extubation. The MAP at 1, 3 and 5 minutes after extubation is significantly higher in group L as compared to group D (p<0.05).

None of the patients in both the groups had haemodynamic perturbation as per defined criteria. This is consistent with the hemodynamic profile of dexmedetomidine as demonstrated by Uyar et al.²² and Bekker et al.²³ No patients had breath holding /

laryngospasm / bronchospasm / respiratory depression during or after extubation in both the study groups which shows dexmedetomidine is safer to use with lesser adverse outcomes.

5. Conclusion

We conclude that a single dose of 0.5 mcg/kg dexmedetomidine given 10 minutes before extubation significantly attenuated the hemodynamic and airway response following extubation as compared to 1.5 mg/kg intravenous preservative free 2% lignocaine given before reversal in patients undergoing craniotomy for intracranial space occupying lesions.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare that there is no conflict of interest.

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Cite this article: Safneedha, Vishwanath S. Dexmedetomidine versus Lignocaine for extubation in patients undergoing craniotomies. *Indian J Clin Anaesth* 2021;8(2):326–330.