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COMPARISON OF EFFECT OF LOCAL DEXMEDETOMIDINE WITH INTRAVENOUS DEXMEDETOMIDINE ON SEDATION AND HEMODYNAMIC CHANGES DURING NASOTRACHEAL INTUBATION

Anaesthesiology

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ABSTRACT

Managing difficult airway is one of the most challenging responsibilities of anesthesiologists. The present study aimed to evaluate and compare the effects of local Dexmedetomidine (Dex) with intravenous Dexmedetomidine (Dex) on sedation rate and hemodynamic changes in candidate patients for nasotracheal intubation. **Material & Methods:** A cross-sectional analytical study was conducted at SAIMS & PG Institute, Indore (M.P.) on 120 adult patients of age group 18-65 years of either sex, ASA Grades I and II posted for elective surgery under general anesthesia and indicated for nasotracheal intubation. They were randomly divided into three groups of 40 patients each including intravenous (IV) Dex group, local Dex group, and control group. After performing the intubation, propofol infusion was used to keep the patients on predetermined cerebral state index (CSI). Hemodynamic parameters, arterial blood O2 saturation (SpO2), and CSI were monitored in all patients before, during, and after the procedure. Coughing score, intubation score, and patient tolerance score during and after nasotracheal intubation were assessed. Propofol consumption was also measured. **Results:** A total of 120 patients with the mean age of 44.6 ± 6.4 years were evaluated (58.3%) of females). Hemodynamic parameters and SpO2 were significantly different between the three groups ($P < 0.001$). The dose of propofol used for reaching proper CSI was significantly higher in the control group compared to IV and local Dex groups ($P < 0.001$). There is no significant statistical difference in propofol consumption between local and IV Dex groups. The number of patients who were cooperative during intubation was higher in local Dex group compared to IV Dex and control groups; however, the difference was not statistically significant. **Conclusion:** The use of local Dex during nasotracheal intubation is probably associated with a reduction in abrupt changes in hemodynamic values, a decrease in coughing, and an improvement in patient tolerance and intubation scores. In order to reduce the dosage of propofol, local Dex may be helpful in an IV version.

KEYWORDS

Dexmedetomidine, Local, IV, Airway blocks, Nasotracheal intubation

INTRODUCTION

Managing difficult airway is one of the most challenging responsibilities of anesthesiologists. When an anesthesiologist encounters a difficult airway, intubation is a reliable technique for airway management. Nasotracheal Intubation is a valuable technique in securing the airway in predicted difficult intubation scenario, compromised airway, lower airway pathology and when neck extension is to be avoided. Use of airway blocks and providing proper sedation during intubation procedure will result in patient comfort, reduction in airway reflexes, and increase in cooperation and hemodynamic stability of the patient, as well as proper amnesia accompanied by airway preservation and spontaneous ventilation in the patient.[1-3]

In awake intubation under intravenous (IV) sedation patient should remain calm, fall asleep if undisturbed and follow verbal commands. Available conventional sedatives such as benzodiazepines, opioids and propofol cause respiratory depression, especially when used in higher doses. An ideal sedation regime should provide patient comfort, cooperation, amnesia, hemodynamic stability, blunt airway reflexes, and maintain a patent airway with spontaneous ventilation. Numerous compounds have been used for the induction of conscious sedation during intubation.[4-7]

Dexmedetomidine (Dex) is an α^2-adrenergic agonist that has been used as a valuable drug during intubation. Proper sedation and analgesia without respiratory depression are among the advantages of prescribing intravenous (IV) Dex during intubation in patients.[8] Use of Dex adjuvant in local or neuraxial blocks for inducing analgesia or elongating the duration of sensorimotor blocks became worldwide in the past few years, yet few studies have evaluated the side effects of local use of this drug.[9-13]

The positive effects of local Dex regarding pain management after surgery and desirable control of hemodynamic signals have been reported in many anecdotal studies.[14-16] On the other hand, some studies have deemed its local use inefficient for some procedures such as epidural block.[17]

However, there is a paucity of research comparing the effectiveness of Dex when used locally and Intravenously (IV). In advent of same, the present study was designed and conducted aiming to evaluate and compare the effects of local Dexmedetomidine (Dex) with intravenous Dexmedetomidine (Dex) on sedation rate and hemodynamic changes in candidate patients for nasotracheal intubation.

MATERIAL & METHODS

After approval from the Institutional Ethics Committee and obtaining written informed consent, this cross-sectional analytical study was conducted from 1st April 2021 to 30th September 2022 at Sri Aurobindo Medical College and Post Graduate Institute, Indore (M.P.) on 120 adult patients of age group 18-65 years of either sex, American Society of Anesthesiologists Grades I and II posted for elective surgery under general anesthesia and indicated for nasotracheal intubation.

Inclusion Criteria:

- Patients for elective and emergency surgeries with indications for nasotracheal intubation.
- Aged between 18 and 65 years from both sexes.
- ASA grade I and II

Exclusion Criteria:

- ASA grade III & IV
- Patients with a history of cardiac diseases, high blood pressure, consumption of blood pressure medication or agonist or antagonists of α-adrenergic receptors
- Patient with liver and kidney diseases or history of addictive of psychotropic drug abuse or any psychiatric disease as well as pregnant women.
- Patients with a baseline heart rate (HR) lower than 60 beats/min or

atrio-ventricular block in electrocardiogram or history of allergy to α-receptor agonists and those with coagulation disorders.

- Patient not giving consent.

METHODOLOGY

After taking written informed consent from the patients, the patients were allocated inro 3 groups by alternate methods depending upon **the route of administration of Dexmedetomidine (Dex).**

Group A (N=40): Control group: Patients whose airway block was done with the aid of lidocaine with a total dose of 5 mg/kg

Group B (N=40): IV Dexmedetomidine group: Patients who received a single dose of 1 µg/kg body weight IV Dex during 10 min in addition to a total dose of 5 mg/kg local lidocaine when undergoing airway block.

Group B\C (N=40): Local Dexmedetomidine group: Patients whose airway block was done using a combination of lidocaine with a total dose of 5 mg/kg and local Dex with a total dose of 1 µg/kg body weight**.**

Patients posted for routine and emergency surgeries were selected for the study. All patient underwent thorough pre anaesthetic evaluation before surgery. Patient were advised to nill orally as per ASA protocol. A pre structured proforma was used to collect the baseline data. Detailed clinical examination and biochemical tests was done on all patients as per the protocol. In the operating theater, routine monitoring devices were placed and baseline ECG, HR, mean blood pressure, mean arterial pressure (MAP) and oxygen saturation (SpO_2) were recorded.

Due to unknown effects of Dex on trachea, glossopharyngeal, superior laryngeal, and recurrent laryngeal nerves were blocked by local anesthetic injection and intranasal anesthesia using lidocaine in all groups. Immediately after blocking and local anesthetic injection, propofol infusion pump was started with the initial dose of 30 mg/kg body weight to adjust the cerebral state index (CSI) to 65–75. The time of reaching 75 CSI was recorded for all patients. Propofol infusion continued up to sedation induction. Nasotracheal intubation was carried out by paying attention to CSI and symptoms of airway block. In all patients, intubation was done by an anesthesiologist with sufficient experience. The anesthesiologist in charge of intubation, patients, anesthesiology resident, and nurse were all blinded to the drug used, and the drug provided to the team was prepared by another anesthesiologist.

Five methods are used for evaluating airway block and intubation in patients:

1. **Ramsay sedation score**[18]

Grade	Response
1	Patient is anxious and agitated or restless, or both
2	Patient is co-operative, oriented, and tranquil
3	Patient responds to commands only
4	Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5	Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6	Patient exhibits no response

2. **Coughing score** ranging from 1 to 4 (1 = no cough, 2 = mild cough, 3 = moderate cough, 4 = severe cough)
3. **Intubation score** based on vocal cord movements on a 1–4 scale. (1 = open, 2 = moving, 3 = closing, 4 = closed)
4. **Patient tolerance score during nasotracheal intubation** based on a 1–5 scale of patient comfort during fiberoptic intubation (1 = no reflex from the patient, 2 = mild grimace, 3 = significant grimace, 4 = verbal complaining, 5 = defensive posture with head or hands)
5. **Patient tolerance score immediately after nasotracheal intubation** on a 1–3 scale (1 = calm and cooperative, 2 = restless, 3 = complete resistance and in need of rapid general anesthesia).

Blood pressure, HR, electrocardiogram, arterial blood O2 saturation (SpO2), and CSI condition were monitored in all patients during and after airway blocking and then for every 2 min until general anesthesia. Specially designed pre structured proforma was used for collecting the data and will be filled in the master chart.

Statistical Analysis

All quantitative variables are reported as mean and standard deviation, and qualitative variables are listed as number (percentage). Descriptive statistics were used to show the feature and characteristics of the collected data. The data was also be entered to master chart. The raw data was entered into the computer database. All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.

Prevalence of an outcome variable along with 95% confidence limits was calculated. Results on continuous measurements are presented using Mean ± Standard Deviation (Min-Max) whereas results on categorical measurements are presented in numbers (%). Student T test will be used to compare quantitative data if data found to be normal. The association between qualitative data was shown by Chi square test. P value <0.05 was considered significant.

RESULTS

A total of 120 patients with the mean age of 44.6 ± 6.4 years were evaluated in the present study. Majority of patients were females i.e., 70 (58.3%) with male: female ratio of 1:1.4. Baseline and demographic data of the studied patients demonstrating that the three groups were not significantly different regarding demographic characteristics such as age, sex, weight, and hemodynamic variables including systolic blood pressure (SBP) and diastolic blood pressure, HR, and SpO2 is shown in Table 1.

Evaluation of SBP showed that, after adjustment for baseline blood pressure, there is a significant difference between the groups during the study ($P < 0.001$). In addition, after multi-purpose analysis (Bonferroni test), SBP was significantly higher in the control group as compared to IV Dex (difference = 12.2, 95% confidence interval [CI]: 8.7–15.7, $P < 0.001$) and local Dex (difference = 8.0, 95% CI: 4.5-11.3, $P < 0.001$) groups. The difference between local and IV Dex groups was also significant (difference = 4.3, 95% CI: 0.9–7.8, $P = 0.016$) [Chart 1a]. Assessing diastolic blood pressure revealed that, after adjustment for baseline blood pressure, diastolic blood pressure is significantly different between groups ($P < 0.001$). In addition, evaluation of DBP after multi-purpose analysis with Bonferroni test, showed a significantly higher DBP in the control group than IV Dex group (difference = 6.1, 95% CI: 4.2–9.2, $P < 0.001$). However, the difference between control and local Dex groups was not statistically significant (difference = 2.2, 95% CI: −0.3–4.8, $P = 0.052$). There was also a significant difference between local and IV Dex groups regarding diastolic blood pressure (difference = 4.2, 95% CI: 2.3–7.3, $P = 0.018$) [Chart 1b].

Mean arterial pressure (MAP) evaluation showed that, after adjustment for baseline blood pressure, MAP is significantly different between groups ($P < 0.001$). In addition, after multi-purpose analysis with Bonferroni test, MAP was significantly higher in the control group compared to IV Dex (difference = 7.2, 95% CI: 4.5–10.1, $P < 0.001$) and local Dex (difference = 4.6, 95% CI: 2.1–7.5, $P = 0.001$) groups. However, local and IV Dex groups were not different in this regard (difference = 2.4, 95% CI: −0.4–5.4, $P = 0.061$) [Chart 1c].

HR assessment revealed a significant difference between groups over the course of the study after adjustment for baseline HR ($P < 0.001$). In addition, after multi-purpose analysis with Bonferroni test, HR in the control group was significantly higher than IV Dex group (difference = 4.1, 95% CI: 2.3–6.3, $P < 0.001$). However, the difference between control and local Dex groups was not significant (difference = 0.8, 95% CI: −1.2–2.9, $P = 0.380$). There was also a significant difference between local and IV Dex groups regarding HR (difference = 3.2, 95% CI: 1.3–5.3, $P = 0.003$), and in IV Dex group, HR was significantly lower than local Dex group [Chart 1d].

Evaluation of SpO2 revealed that, after adjustment for baseline SpO2, SpO2 is significantly different between groups ($P < 0.001$). In addition, after multi-purpose analysis with Bonferroni test, SpO2 in the control group was significantly higher than IV Dex group (difference = 1.5, 95%CI: 0.9–2.1, $P < 0.001$). However, the difference between control and local Dex groups was not significant (difference = −0.2, 95% CI: −0.9–0.27, $P = 0.713$). SpO2 of IV Dex group was significantly lower than local Dex group (difference = 1.5, 95% CI: 0.9–2.1, $P < 0.001$) [Chart 1e].

Comparison between the three groups showed that the a significantly higher dose of propofol was used for reaching a 65–75 CSI before

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sedation induction in the control group compared to IV and local Dex groups (P < 0.001) [Chart 2]. However, a statistically insignificant difference in propofol consumption between local and IV Dex groups was noticed.

The number of patients who did not cough during nasotracheal intubation was significantly higher in local Dex group compared to both IV Dex and control groups (P = 0.015). The number of patients who did not show grimace was significantly higher in local Dex group in comparison with IV Dex and control groups (P = 0.039). The number of patients who were cooperative during intubation was higher in local Dex group compared to IV Dex and control groups; however, the difference was not statistically significant. The number of patients whose vocal cords were open during intubation was also higher in local Dex group compared to IV Dex and control groups, but the difference was not statistically significant [Table 2].

*†Based on ANOVA, ‡Based on Kruskal - Wallis test, *Based on Chi-square test. MAP = Mean arterial pressure,HR = Heart rate, SD = Standard deviation, IV = Intravenous*

Table 1: Baseline characteristics of participants

	CONTROL	DEX IV	DEX L	
Age				
Mean±SD	43.5±14.7	48.9±15	46.3±13.2	0.347†
Median (range)	44.5 (21-64)	53 (19-65)	48 (20-65)	
Sex (%)				
Male	1 9 (59.4)	1 4 (45.2)	1 0 (31.3)	0.078*
Female	1 3 (40.6)	17 (54.8)	22 (68.8)	
Weight				
Mean±SD	77.6±20.9	70.5±12.5	71.8±19	0.261*
Median (range)	75 (45-140)	70 (46-104)	69 (45-132)	
SBP				
Mean±SD	135±17	129±18	126±22	0.149†
Median (range)	133 (104-170)	129 (97-170)	123 (94-167)	
DBP				
Mean±SD	81±11	81±12	79±15	0.902†
Median (range)	81(52-103)	81(59-109)	77 (54-106)	
MAP				
Mean±SD	99±13	96±13	95±19	0.585†
Median (range)	98 (73-124)	98 (65-124)	90 (68-136)	
HR				
Mean±SD	83±15	81±15	82±17	0.904†
Median (range)	84 (56-111)	81(56-113)	81 (52-113)	
Sp02				
Mean±SD	97±2	97±3	97±2	0.697‡
Median (range)	97 (92-100)	98 (90-100)	97 (92-100)	

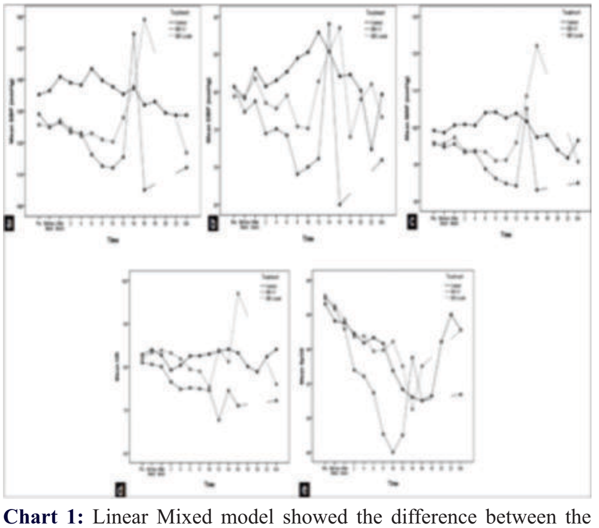

Chart 1: Linear Mixed model showed the difference between the groups regarding the mean systolic blood pressure (a), diastolic blood pressure (b), mean arterial pressure (c), heart rate (d) and SpO2 (e) after adjustment for the baseline values during the study periods

*† Based on ANOVA, ‡ Based on Kruskal-Wallis test, *Based on Chi-square test. IV = Intravenous*

Table 2: Scoring for evaluating airway block and intubation in patients

Variable	CONTROL	DEX IV	DEX L	P value
Cough				
No	22 (55)	28 (70)	35 (87.5)	0.015‡
Slight	10 (25)	12 (30)	4 (10)	
Moderate	6 (15)	0	1 (2.5)	
Severe	2 (5)	0	0	
Grimace				
No	18 (45)	19 (47.5)	30 (75)	0.039‡
Slight	17 (42.5)	19 (47.5)	9 (22.5)	
Heavy	4 (10)	2 (5)	1 (2.5)	
Verbal	1 (2.5)	0	0	
Intubation				
Cooperative	24 (60)	18 (45)	30 (75)	0.156‡
Restless	11 (27.5)	20 (50)	8 (20)	
Severe Resistance	5 (12.5)	2 (5)	2 (5)	
Vocal Cords				
Open	28 (70)	21 (52.5)	29 (72.5)	0.231*
Moving	12 (30)	19 (47.5)	11 (27.5)	
Closing	0	0	0	
Closed	0	0	0	

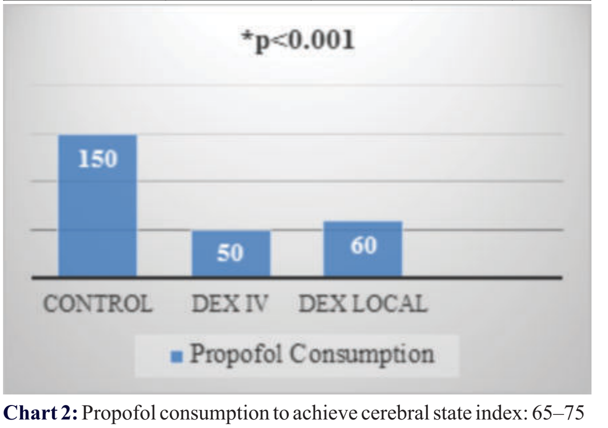

Chart 2: Propofol consumption to achieve cerebral state index: 65–75

DISCUSSION

Findings of the present study showed that during awake intubation under nasotracheal intubation, local Dex is more efficient in controlling hemodynamics and improving the quality of intubation compared to local lidocaine alone (control group). The results of present study showed that Local and IV Dex groups preserve hemodynamic values better as compared to control group. Local Dex like IV Dex could result in propofol dose saving during the procedure. As far as we know, there is no similar clinical trial in literature that assessed the efficacy of local Dex in same situation. However, the findings are compatible with previous studies done by Harsha MS *et al* & Mondal S *et al.* that all just assessed the IV form of Dex.

Mean HR and diastolic blood pressure in IV Dex group were lower than the other two groups, which can be associated to be due to bradycardia caused by systemic Dex effect. As suggested by Piao G *et al.,* although Dex can stabilize hemodynamics, in patients with hypovolemia and heart block, it should be used cautiously.

IV Dex injection for facilitating nasotracheal intubation was studied frequently, and most of researches like Madhere M *et al.* & Hu R *et al.*, stated the ease of patient care and patient satisfaction during and after the procedures.

Moreover, it could be said that due to low systemic uptake, the effect of local Dex is different from that of IV Dex. In fact, local Dex with more powerful local anesthesia and low systemic uptake not only stabilizes hemodynamics better but also improves the quality of intubation. Unlike IV Dex, local Dex does not have a hypnotic effect, does not decrease O2 saturation during fiberoptic intubation, and enables awake intubation with beneficial local effects. (Cheung CW et al.[15])

Local Dex was used and studied in different procedures such as septoplasty, third molar surgery, and peripheral nerve blockade, and usually reported as a proper option with less adverse effects than IV administration of this agent. (Cheung CW et al.[15], Brummett CM et al.[24] & Dogan R et al.[25])

The superiority of local Dex in decreasing the required propofol dose needed for sedating the patients in comparison with control group was another interesting finding of the present study, which had also been noted in some previous studies for IV Dex (Knolle E et al.[4]) This study also revealed that local Dex improves intubation score and decreases coughing compared to control and IV Dex groups. Most of the previous studies have shown a better quality of awake intubation under fiberoptic intubation after IV Dex administration, but this study is the first one to evaluate local Dex in this procedure. (Madhere M *et al.*[22], Hu R *et al.*[23], Avitsian R *et al.*[26] & Liu H *et al.*[27])

CONCLUSION

It can be concluded that the use of local Dex during nasotracheal intubation is probably associated with a reduction in abrupt changes in hemodynamic values, a reduction in coughing, and an improvement in patient tolerance and intubation scores. In order to reduce the dosage of propofol, local Dex can be just as helpful as IV version. These local Dex effects happen without resulting in bradycardia or a lowering of SpO2.

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Conflicts Of Interest: None.

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