A COMPARATIVE STUDY OF THREE DIFFERENT DOSES OF DEXMEDETOMIDINE ON HAEMODYNAMIC RESPONSE TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION- A CLINICAL STUDY

Anaesthesiology

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ABSTRACT

Direct laryngoscopy and endotracheal intubation are associated with increase in sympathoadrenal activity results in hemodynamic instability. Many strategies were used to attenuate this response. Dexmedetomidine is one of the primary drug being used for this purpose. This study was designed to compare the effect of intravenous 0.5 µg/kg, 0.75 µg/kg, 1 µg/kg dexmedetomidine to laryngoscopy and intubation.

This study was conducted on 75 patients allotted into 3 groups 25 patients each. Group A -Inj. Dexmedetomidine 0.5 µg/kg. B - 0.75 µg/kg. C- 1 µg/kg. vitals, sedation score were observed.

After giving Inj. dexmedetomidine in a dose of 0.5, 0.75 and 1 µg/kg change in HR at 10 minutes after laryngoscopy and intubation was 5.47%, 10.80% and 18.38% respectively, change in the SBP was

7.71%, 14.69%, 16.96% respectively, change in the DBP was 6.96%, 13.40%, 18.01%. We have found that effective dose to blunt the hemodynamic response to laryngoscopy & intubation is 0.5 µg/kg.

KEYWORDS

Laryngoscopy, Endotracheal Intubation, Dexmedetomidine

INTRODUCTION:

Direct laryngoscopy establishes a definitive airway, provides maximal protection against the aspiration of gastric contents, and allows for positive pressure ventilation with higher airway pressures than with a facemask or a Supraglottic airway device. Direct Laryngoscopy and Endotracheal Intubation are almost always associated with hemodynamic changes, due to reflex sympathetic discharge, caused by epipharyngeal and laryngopharyngeal stimulation. This increase in sympathoadrenal activity results in hypertension, tachycardia and arrhythmias. This is usually unpredictable and well tolerated by healthy individuals. However, these changes may be detrimental and harmful in patients with hypertension, coronary artery disease or intracranial hypertension. Left ventricular failure, myocardial ischemia, cerebral haemorrhage may occur in those patients. Various pharmacological methods such as lignocaine, opioid analgesics, B blockers, calcium channel blocker, ACE inhibitors, vasodilators and topical anaesthetics have been evaluated but none of them has proven to be ideal, hence the search of an ideal agent is still continuing. The α_2 receptors are located on blood vessels, where they mediate vasoconstriction, and on sympathetic terminals where they inhibit norepinephrine release. The α_2 receptors are also located within the central nervous system and leads to sedation, a reduction of tonic levels of sympathetic outflow and an augmentation of cardiovagal activity. This can result in a decrease in heart rate and cardiac output. The use of α_2 agonists in the perioperative period has been associated with reduced anesthetic requirements and attenuated heart rate and blood pressure responses to stressful events. α_2 receptors within the spinal cord modulate pain pathways, thereby providing some degree of analgesia. Dexmedetomidine offers a unique advantage with sedation, sympatholysis, analgesia, cardiovascular stability and by avoiding respiratory depression in adults. In view of different results of available studies there is need of further studies to compare the different doses of dexmedetomidine for its efficacy and safety to prevent the hemodynamic response to laryngoscopy and endotracheal intubation. This study is carried out using three different doses of dexmedetomidine (0.5, 0.75, 1 g/kg) so as to decide the maximum effective and at the same time safe dose for preventing hemodynamic stress response to laryngoscopy and intubation.

MATERIALS AND METHODS:

Institutional ethical committee approval and written informed consent was obtained before starting the study. This was a prospective

randomized interventional study conducted on 75 patients. All the patients underwent a detailed pre-operative evaluation carried out a day before the surgery and all the routine and specific investigations were noted. The patients were electively kept nil per oral for 6 hours before the surgery and prior to operation patients were explained about the procedure. After the patient was shifted to the theatre, standard monitors like ECG, NIBP, and pulse oximetry were applied and patient's baseline parameters like pulse, blood pressure, respiratory rate, SpO₂ were recorded. Intravenous line was secured in all the patients and intravenous fluid was started.

Patients were randomly divided into 3 groups of 25 each: Group A - Inj. Dexmedetomidine 0.5 µg/kg. Group B -Inj. Dexmedetomidine 0.75 µg/kg. Group C- Inj. Dexmedetomidine 1 µg/kg.

The drug was given according to assign group, drug diluted in 20 mL of 0.9% NS injected slowly over a period of 10 minutes. Monitoring of hemodynamic parameters at 2, 5, 10 min and sedation score were observed and assessed according to Ramsay sedation scale at 2, 5, 10 min.

All patients were pre-medicated with Inj. Glycopyrrolate 0.004 mg/kg IV and Inj. Ondansetron 0.15 mg/kg IV. All the patients were Pre oxygenated with 100% oxygen for 5 min using Bain's circuit. Patients were induced using Inj. Thiopentone (4-6 mg/kg IV) and Endotracheal Intubation was facilitated using Succinylcholine (2 mg/kg IV) and intubation done using an appropriate size Endotracheal tube. Maintenance of anesthesia was done by using 50% oxygen, 50% nitrous oxide, Inhalational agents (Sevoflurane) and Inj. Vecuronium Bromide 0.08 mg/kg IV and intraoperative analgesic Injection diclofenac 1.5 mg/kg given.

Monitoring ECG, Systolic blood pressure (SBP), Diastolic blood pressure (DBP). Oxygen saturation were recorded throughout the procedure. Any change in BP > 20% on either side from baseline taken as significant. Hypotension was treated with increments of Inj. Mephentermine 3 mg IV and hypertension was treated with Inj. NTG intravenously. Any decrease in HR < 60/min was taken as bradycardia and was treated with Inj. Atropine 0.6 mg intravenously. Any decrease in RR < 10/min and decrease in SpO₂ below 95% was taken as respiratory depression and treated with 100% oxygen.

After completion of surgery, All the patients were reversed using Inj. Glycopyrrolate 0.008mg/kg IV and Inj. Neostigmine 0.05mg/kg IV. After thorough oral and endotracheal suction patients were extubated after satisfied the criteria for extubation. Patients were observed for any complication.

Sedation score	Clinical response
0	Awake, Oriented
1	Agitated, Anxious
2	Awake, Cooperative
3	Sleeping but cooperative
4	Deep sedation, Quick response to pain stimuli
5	Deep sedation, Delay response to pain stimuli
6	Deep sedation, no response to pain stimuli

RESULTS:

After studying 75 cases, the observations and results were summarized in tabulated form. Patients was randomly divided into 3 groups of 25 each.

Group A - Inj. Dexmedetomidine 0.5 µg/kg.

Group B - Inj. Dexmedetomidine 0.75 µg/kg.

Group C - Inj. Dexmedetomidine 1 µg/kg.

Figure 1: Heart rate (Mean)

Interpretation:

There was decrease in HR in Group A, B and C at 10 minutes post infusion that was statistically significant. At the laryngoscopy and intubation and thereafter at all intervals there was decrease in HR in all 3 groups but statistically significant in Group C>B.

Figure 2: Systolic blood pressure (Mean)

Interpretation:

There was decrease in SBP in Group A, B and C at 10 minutes post infusion that was statistically significant. At the laryngoscopy and intubation and thereafter at all intervals there was statistically significant decrease in SBP in all 3 groups but highly significant in Group C and B.

Figure 3: Diastolic blood pressure (Mean)

Interpretation:

There was decrease in DBP in Group A, B and C at 10 minutes post infusion that was statistically significant. At the laryngoscopy and intubation and thereafter at all intervals there was statistically significant decrease in DBP in all 3 groups but highly significant in Group C and B.

There was no significant difference in Spo2 and sedation score among three groups.

DISCUSSION:

Dexmedetomidine mediates its action through α_2 A receptors located in locus caeruleus, the predominant noradrenergic nuclei of upper brainstem. The presynaptic activation of α_2 A receptors in the locus caeruleus inhibits the noradrenaline release and brings about sedation and hypnosis. Post-synaptic activation of α_2 receptors in central nervous system brings about decreased sympathetic activity leading to bradycardia and hypotension.

In the present study, laryngoscopy and intubation was accomplished within 15 seconds. It eliminates the preventable increase in hemodynamic stress response due to difficult intubation. If intubation required more than 15 seconds duration, the case was excluded from the study.

Patients in the groups were demographically comparable. There was no statistically significant difference in age, weight and gender distribution among groups.

HEART RATE

The baseline mean pulse rate in Group A was 82.60 ± 8.72 , Group B was 82.92 ± 5.65 and in Group C 82.24 ± 6.21 . The difference between the groups were not statistically significant ($p > 0.05$).

There was decrease in HR in Group A, B and C at 10 minutes post infusion (79.12 ± 8.63 , 76.24 ± 6.13 , 72.12 ± 5.89) that was statistically significant. At the laryngoscopy and intubation and thereafter at all intervals there was decrease in HR in all 3 groups but statistically significant in Group C>B.

Similar to our study, **Kumkum Gupta** [3] observed significant fall in mean HR after infusion of dexmedetomidine at $1 \mu\text{g/kg}$ over 10 minutes. Transient bradycardia was observed by **Kenya et al** [14] also in their study after infusion of dexmedetomidine at $1 \mu\text{g/kg}$ over 10 minutes prior to induction. We found in our study that with dose of $1.00 \mu\text{g/kg}$ (Group C) fall in HR is more statistically significant ($p < 0.05$).

SYSTOLIC BLOOD PRESSURE

The baseline mean SBP in Group A was 118.80 ± 6.96 , Group B was 117.84 ± 6.03 and in Group C 118.16 ± 6.03 . The difference between the groups were not statistically significant ($p > 0.05$).

There was decrease in SBP in Group A, B and C at 10 minutes post infusion (115.08 ± 6.53 , 109.48 ± 6.38 , 106.44 ± 5.75) that was statistically significant. At the laryngoscopy and intubation and thereafter at all intervals there was statistically significant decrease in SBP in all 3 groups but highly significant in Group C>B.

Similar to our study, **Kumkum Gupta** [3] observed significant fall in mean SBP after infusion of dexmedetomidine at $1 \mu\text{g/kg}$ over 10 minutes. After induction, the mean SBP was lower in group 3 as compared with group 1 at all times, with statistically difference among the groups. In their study, dexmedetomidine in dosages of $0.5 \mu\text{g/kg}$ (Group 1), $0.8 \mu\text{g/kg}$ (Group 2) and $1 \mu\text{g/kg}$ (Group 3) was infused over 10 minutes as premedication before propofol induction.

DIASTOLIC BLOOD PRESSURE

The baseline mean DBP in Group A was 75.24 ± 3.64 , Group B was 74.92 ± 6.05 and in Group C 75.48 ± 4.88 . The difference between the groups were not statistically significant ($p > 0.05$).

There was decrease in DBP in Group A, B and C at 10 minutes post infusion (73.60 ± 3.46 , 70.20 ± 5.57 , 70.92 ± 5.36) that was statistically significant. At the laryngoscopy and intubation and thereafter at all intervals there was statistically significant decrease in DBP in all 3 groups but highly significant in Group C and B.

After giving Injection dexmedetomidine in a dose of 0.5, 0.75 and $1 \mu\text{g/kg}$ change in HR at 10 minutes after laryngoscopy and intubation was 5.47%, 10.80% and 18.38% respectively and change in the SBP was 7.71%, 14.69%, 16.96% respectively and change in the DBP was 6.96%, 13.40%, 18.01%. So as per discussion we have found that minimum and safe effective dose to blunt the hemodynamic response to laryngoscopy and intubation is $0.5 \mu\text{g/kg}$.

OXYGEN SATURATION

In our study, we did not find any fall in saturation after giving Dexmedetomidine infusion, intraoperatively and in the perioperative

period.

RAMSAY SEDATION SCALE

The mean sedation score in Group A at 2,5,10 minutes was 1.00 ± 0.00 , 2.00 ± 0.00 , 2.00 ± 0.00 respectively, Group B mean sedation score at 2 minutes was 2.00 ± 0.00 , at 5 and 10 minutes 2.00 ± 0.00 and 3.00 ± 0.00 respectively and in Group C mean sedation score at 2 minutes was 2.00 ± 0.00 , at 5 and 10 minutes was 3.00 ± 0.00 . There was no statistically significant difference among three groups.

From the above discussion, we can infer that Dexmedetomidine did cause some amount of sedation, but the sedation was not statistically significant ($p > 0.05$). The sedation was not that severe so as to warrant any interference from our side.

In our study, no patient had bradycardia (HR < 60 /min), hypertension (BP level $> 20\%$ over baseline levels) or hypotension (BP level $< 20\%$ from baseline levels) and any fall in SpO₂ level, arrhythmias, respiratory depression and nausea or vomiting. Similar to our results **Kumkum Gupta** and **Shirsendu Mondal**^[29] et al who have also not found any instability of vitals either with clonidine or dexmedetomidine. **Singh et al** study also did not show any side effects like bradycardia and sinus pause, which would have warranted the use of atropine. **Scheinin et al** reported that use of α_2 agonist leads to bradycardia.

There were few limitations of the study. Plasma catecholamine level monitoring and measurement of QT interval, more objective means of hemodynamic response^[24] was not performed due to the limited facilities available at our set-up.

CONCLUSION AND SUMMARY:

From the present study it is concluded that

1. All three doses of Dexmedetomidine ($0.5 \mu\text{g/kg}$, $0.75 \mu\text{g/kg}$, $1.0 \mu\text{g/kg}$ -diluted in 20mL NS infused over 10 minutes) ten minutes prior to induction are effective and safe in preventing hemodynamic stress response to laryngoscopy and endotracheal intubation.

2. As $0.5 \mu\text{g/kg}$ is the minimum dose giving the desired results, it is the most appropriate dose to be recommended for preventing Hemodynamic stress response to laryngoscopy and intubation.

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