



Original Research Article

A comparative study of intramuscular dexmedetomidine alone and intramuscular dexmedetomidine with intravenous fentanyl on hemodynamic response to laryngoscopy and endotracheal intubation for ear surgery under general anesthesia

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ABSTRACT

Introduction: Dexmedetomidine, a potent α_2 -adrenergic agonist with its sedative, anxiolytic, analgesic and sympatholytic property; is an ideal agent for premedication. The intravenous bolus is associated with bradycardia and hypotension; hence we studied the intramuscular route for hemodynamic stability.

Materials and Methods: Sixty adult patients of ASA physical status I and II, aged between 18-60 years, posted for ear surgery received intramuscular dexmedetomidine $2.5\mu\text{g}/\text{kg}$ 60 minutes prior to induction of anesthesia as premedication in recovery room with either injection saline bolus in group D (n=30) or intravenous fentanyl $1.5\mu\text{g}/\text{kg}$ group DF (n=30) 2 minutes before induction in operation theatre. Standard induction technique was used. Sedation score and hemodynamic changes during laryngoscopy were recorded.

Results: During laryngoscopy and intubation, transient rise in Heart Rate and Mean arterial pressure seen in Group D as compared to Group DF; (p < 0.05); Heart Rate and MAP in group D returned to pre-induction values within 3 minutes of laryngoscopy. No patient suffered from profound sedation at any point of observation.

Conclusion: This study provides evidence that intramuscular dexmedetomidine alone acts as effective premedication agent with attenuation of stress response; and combination of Intramuscular dexmedetomidine and intravenous fentanyl not only attenuate but also prevents stress response to laryngoscopy and tracheal intubation.

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1. Introduction

Tracheal intubation induces an increase in central and peripheral sympathetic activity that results in hypertension and increase in heart rate at the beginning of general anesthesia.¹⁻³ Many studies have shown that α_2 -adrenergic agonists have anaesthetic sparing, analgesics, sedative, anxiolytic and sympatholytic effects; there by preventing catecholamine release, hypertension and tachycardia.^{2,4-6}

Dexmedetomidine is potent and selective α_2 -adrenoreceptor agonists. Compared with clonidine, it is about 10-fold more selective towards the α_2 -adrenoreceptor

and acts as a full agonist in most pharmacologic test models.⁷⁻¹⁰ However, the duration of action of a single intravenous dexmedetomidine bolus may be sufficient only for minor general anesthesia procedures and it leads to sudden fall in heart rate and blood pressure. It has, therefore, become necessary to investigate other methods of administration to prolong its effect.

Purpose of this study was to investigate effectiveness of preoperative administration of intramuscular dexmedetomidine $2.5\mu\text{g}/\text{kg}$ in attenuating hemodynamic response to laryngoscopy and endotracheal intubation in patients posted for ear surgery.¹ We also hypothesized that adding intravenous fentanyl to intramuscular dexmedetomidine will

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prevent hemodynamic changes due to laryngoscopy and endotracheal intubation.

2. Material and Methods

After receiving approval from ethical committee; Patients of ASA classification I & II, aged between 18-60 years, posted for ear surgery under general anesthesia were considered for the present study. Duration of this observational study was from June 2018 to Nov 2018 months.

Patients who refused to join, patients with history of allergic reaction to any of the study drug, patients with known case of hypertension and IHD, bronchial asthma, uncontrolled diabetes mellitus, COPD. Patients with hepatic and renal insufficiency, patients on anti-psychotic drugs or sedatives were excluded from the study.

All patients were thoroughly examined and investigated by using a pre prepared Proforma before considering as a study case.

After confirming NBM status and explaining about the study, written informed consent was taken.

Baseline vitals were recorded before giving study drug and inj. DNS 5ml/hr was started.

All patients received Inj. Dexmedetomidine 2.5 µg/kg intramuscularly as premedication, 60 mins before anticipated induction of anesthesia in recovery room. Before transferring to the operating room, Sedation score was noted using Ramsay sedation scale:

1. Anxious or agitated
2. Cooperative and tranquil
3. Drowsy but responsive to command
4. Asleep but responsive to glabellar tap
5. Asleep with a sluggish response to tactile stimulation
6. Asleep and no response.

Patients were randomly divided in two groups:

Group D- (N=30) and Group DF - (N=30) with Total No of cases =60.

Group D: Combination of inj. Dexmedetomidine IM and Inj. Normal Saline intravenously (IV) as placebo.

Group DF: Combination of inj. Dexmedetomidine IM and Inj. fentanyl IV.

In operation theatre, patients were observed for heart rate (HR), Mean blood Pressure (MBP), O₂ saturation and electrocardiogram (ECG) was applied. Pre-oxygenation done with 100% Oxygen for 3 min via face mask, Group D received IV Saline and Group DF received Inj. Fentanyl 1.5 µg/kg IV two min prior to induction. Routine general anesthesia was administered with Inj. sodium Thiopental 4-7 mg/kg and inj. Succinylcholine 2mg/kg IV and IPPV was given with 100% O₂.

After tracheal intubation, patient was put on mechanical ventilation and anesthesia was maintained with N₂O/O₂ and Isoflurane on closed circuit. Muscle relaxation was achieved with inj. vecuronium 0.1 mg/kg loading and 0.03mg/kg as

incremental boluses when the first twitch in a train of four responses was seen.

Heart Rate, Mean arterial Pressure, O₂ saturation were recorded at specific time interval –baseline, pre-induction, at the time of laryngoscopy and tracheal intubation and at 1,3,5,10,15 and 20 mins after intubation and continuously there after till commencement of Operation.

Intra operative monitoring was done at specific time interval as Table 1.

Average category scale (ACS) grading was used to assess Quality of surgical field as: Good (0/1) Fair (2/3) Poor (4/5) by operating surgeon.

At the end of the surgery, reversal was done with inj. Glycopyrrolate (0.01mg/kg) and inj. neostigmine (0.05 mg/kg) intravenously after adequate tidal volume and Resp. Rate. Patient was extubated and shifted to recovery room.

All adverse events including nausea and vomiting dry mouth, hypotension (MBP < 60 mm of Hg sustained for >10 mins), Bradycardia (HR < 45 bpm) and O₂ saturation (<95%) were looked for.

2.1. Statistical analysis

Parameters like demographic profile, hemodynamic response to laryngoscopy & intubation and sedation were mainly evaluated. After considering pilot study with 10 patients (5 in each group), sample size was calculated by using open Epi software, considering the mean pulse rate during laryngoscopy 85.6 +/- 6.8 pulse/min of group D and 77.6 +/- 10.6 pulse/min of group DF, power 80% and level of significance 99%. N=58; n=29, n=29.

All the qualitative data were analyzed using CHI square test and the quantitative data using Students unpaired 't' test. Results were expressed as mean +/- SD. P value < 0.05 was considered statistically significant.

3. Results

Both the groups were comparable with respect to age, weight, gender and duration of surgery.

3.1. Comparison of heart rate

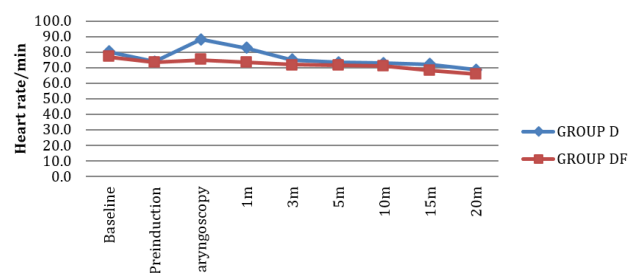


Fig. 1: Comparison of heart rate in two groups

Table 1:

Time interval	Pulse rate	Systolic /diastolic BP	Mean BP	Spo2	Surgical field Good/fair/poor
Baseline					
Pre induction					
Induction					
During laryngoscopy					
1 min after intubation					
3 min					
5 min					
10 min					
15 min					
20 min					

Table 2:

Grade	Bleeding
0	No bleeding
1	Slight bleeding-no suctioning required
2	Slight bleeding-occasional suctioning required. Surgical field not threatened.
3	Slight bleeding-frequent suctioning required. Bleeding threatens surgical field a few seconds after suction is removed.
4	Moderate bleeding-frequent suctioning required. Bleeding threatens surgical field directly after suction is removed.
5	Severe bleeding-constant suction required. Bleeding appears faster that can be removed by suction. Surgical field severely threatened and surgery not possible.

Table 3: Demographic data and operative time

Particulars	Group D	Group DF	P value
Age(years)	32.2	30.33	P > 0.05
Weight(kg)	49.7	51.4	P > 0.05
Duration of surgery (min)	190.3	192.5	P > 0.05

The two groups were comparable at baseline and pre-induction period.

During laryngoscopy and intubation, transient rise in HR seen in Group D as compared to Group DF, the difference was statistically significant ($p < 0.05$).

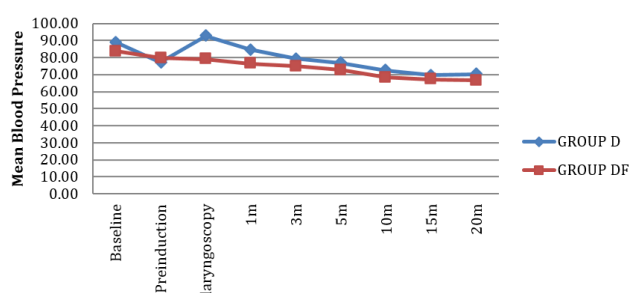
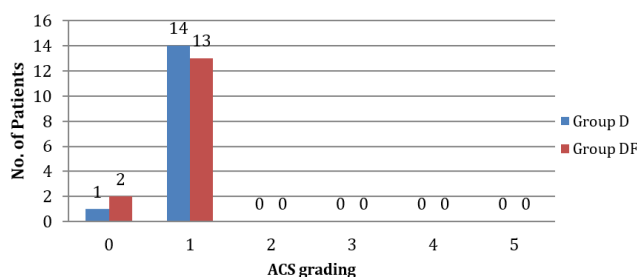
This change in HR returned to pre-induction values within 3 minutes of laryngoscopy and remained stable thereafter.

3.2. Comparison of mean arterial blood pressure (map)

Two groups were comparable in terms of mean blood pressure.

Transient increase in MBP seen in Group D when compared to Group DF during laryngoscopy, the difference between two groups was statistically significant ($p < 0.05$).

This change in MBP returned to pre-induction values within 3 minutes and remained comparable between the two groups thereafter.

**Fig. 2:** Comparison of MBP**Fig. 3:** Comparison of quality of field

3.3. Quality of surgical field

In both the groups quality surgical field was assessed by operating surgeon which was either score 0 or 1.

3.4. Sedation

In recovery room before giving premedication all the patients were fully awake and anxious, hence, the sedation score was 1.

Sedation at pre-induction period in operation theatre in both the groups was 2.67.

Post-extubation sedation score was 2 (fully conscious and oriented)

No patient suffered from profound sedation at any point of observation.

None of the group had any adverse cardiac event and delayed recovery.

4. Discussion

Dexmedetomidine is highly potent and selective α_2 -adrenoreceptor agonist with sympatholytic, sedative, anxiolytic and analgesic properties. It decreases central sympathetic flow in a dose dependant manner without respiratory depression and provides opioid-sparing analgesia.¹¹

The use of intravenous bolus dose of dexmedetomidine is associated with sudden haemodynamic changes including hypotension and bradycardia therefore; we designed this study to investigate the safety and efficacy of dexmedetomidine by intramuscular route as premedication for attenuating the laryngoscopic stress response.

Intravenous Fentanyl is also a well known agent used for attenuation of pressure response due to laryngoscopy, so we combined Intramuscular dexmedetomidine and intravenous Fentanyl to investigate synergistic effect of both the drugs in preventing stress response to laryngoscopy and tracheal intubation. We found that, the combination in the said dosage and route was safe and most effective in attenuating and preventing sympathetic activation due to laryngoscopy and tracheal intubation.¹

Premedication dose of 2.5 $\mu\text{g}/\text{kg}$ was selected on basis of previous references available in which this dose was given 60 minutes prior to induction and they reported desired haemodynamic stability.^{1,2} No adverse response was observed in our study as well as by any of the researchers which makes this dose suitable for clinical use, in our opinion.

H Scheinin et al in 1992 studied the pharmacodynamics and pharmacokinetics of intramuscular dexmedetomidine and proposed preanesthetic use of dexmedetomidine, as per their findings.^{11,12}

The bioavailability of intramuscular route for dexmedetomidine is 104% and time to peak concentration is approximately 1.6-1.7 hours.^{4,13}

Dexmedetomidine provided adequate sedation and anxiolytics as premedication to all our patients. There was moderate rise in HR and MBP in Group D during laryngoscopy and intubation as compared to patients of Group DF. This transient rise in haemodynamics got settled down within 3 minutes of intubation and remained stable. Post-operative no patient suffered from nausea, profound sedation or any other adverse effects.

5. Conclusion

We conclude that intramuscular dexmedetomidine 2.5 $\mu\text{g}/\text{kg}$ as a part of premedication provides adequate sedation and anxiolytics, along with stable haemodynamics. We also found that, the combination of intramuscular dexmedetomidine 2.5 $\mu\text{g}/\text{kg}$ and intravenous fentanyl 1.5 $\mu\text{g}/\text{kg}$ has synergistic effect in attenuating and preventing stress response to laryngoscopy and tracheal intubation in adult patient.

6. Source of funding

None.

7. Conflict of interest

None.

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