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Intraoperative Infusion of Dexmedetomidine and Recovery Quality after ENT, Oral and Maxillofacial Surgeries

[1]Dr. Dhanshree Kale, [2]Dr. P.B. Jamale
[1]Anaesthesiology Department, Krishna Institute of Medical Sciences, Karad-415110, Maharashtra
[2]Professor, Anaesthesiology Department, Krishna Institute of Medical Sciences, Karad-415110, Maharashtra
Corresponding Author: Dr. Dhanshree Kale
E-mail: dhansree_kims@rediffmail.com

ABSTRACT

Agitation is a state of uneasiness, anxiety, mental distress and irritability. We explored the impact of intraoperative infusion of dexmedetomidine on anxiety in young patients. The study conducted with 130 patients, belonging to ASA physical status I or II, between the age of 18 to 58 years, undergoing elective ENT and oral and maxillofacial surgeries were randomly selected. Dexmedetomidine a novel anaesthetic agent which is suitable for pre anaesthetic anxiolysis and sedation as well as intra and post-operative analgesia. The maintenance of intraoperative infusion dexmedetomidine (0.4mcg/kg/hour) till extubation, produced oleaginous and haemodynamically stable parameters in the intraoperative period and at the time of extubation. Dexmedetomidine infusion also diminished the emergence agitation without any complications after ENT and OMFS surgeries in the immediate post-operative period.

Keywords: Dexmedetomidine, intraoperative, maxillofacial, patients, agitation

Correspondence:
Dhanshree Kale
Anaesthesiology Department, Krishna Institute of Medical Sciences
Karad, Maharashtra
E-mail Address:
dhansree_kims@rediffmail.com

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INTRODUCTION

Agitation is a state of uneasiness, anxiety, mental distress and irritability. It can arise from numerous sources including pain, physiological compromise or anxiety. Emergence agitation post general anaesthesia may result in catheters removal and self-extubation which can lead to very serious complications such as hypoxia, airway trauma, aspiration pneumonia, bleeding or re-operation. Oral surgery, Ear, nose and throat surgeries are associated with a higher incidence of emergence agitation due to sense of suffocation. After ENT and OMFS surgeries awake extubation is a common requirement because airway is contaminated by blood which can lead to aspiration in a sedated patient and the nasal airway is blocked by surgical packs that leads to a sense of suffocation and may intensify emergence agitation.[1] Infusion of dexmedetomidine diminishes agitation from general anaesthesia in pediatric patients. It also reduces anxiety and agitation while weaning a patient from ventilator in ICU. However, data regarding the outcome of dexmedetomidine on decreasing emergence agitation post general anaesthesia in adult subjects is limited.

AIM OF THE STUDY

The aim of our study was to evaluate the efficacy of intraoperative dexmedetomidine infusion on emergence agitation and quality of recovery after ENT, Oral and Maxillofacial surgeries.

OBJECTIVES OF THE STUDY

To assess the quality of recovery using Modified Aldrete score. To study the efficacy of intraoperative dexmedetomidine infusion on emergence agitation using Riker Sedation-Agitation Scale. To study perioperative haemodynamic changes. To compare post extubation haemodynamic changes. To compare Time to verbal response (minutes). To compare the adverse effects.

REVIEW OF LITERATURE

Bryson et al., in 2013 reported a case of severe agitation after electroconvulsive therapy that was refractory to usual treatment but was controlled with dexmedetomidine. Hence they concluded that resistant post- ictal agitation after electroconvulsive therapy could be controlled with dexmedetomidine.[2]

Sun et al in., 2014 led a meta-analysis of randomised control trial (RCT) to evaluate the effectiveness of dexmedetomidine on the incidence of sevoflurane related emergence agitation. A total of 15 RCT were included (518 pateints received dexemedetomidine and 413 received placebo). This metaanalysis demonstrated the decrease in incidence of emergence agitation to sevoflurane.[3]

METABOLISM AND PHARMACOKINETICS

Administration

Although the most widely recognized route of dex-medetomidine administration is intravenous, multiple routes of administration are possible and include transnasal, buccal, peroral, transdermal, and intramuscular administration. The mean absolute availability after perioral delivery is only 16%, most likely due to extensive first pass metabolism. The level of bioavailability is highest for the buccal route (82%) a feature that could be beneficial when using dexmedetomidine in uncooperative children and geriatric patients, followed by intramuscular and transdermal routes (73 % and 51%) respectively. [4-6]

Distribution

Dexmedetomidine is rapidly distributed and is mainly hepatically metabolized into inactive metabolites. The steady state volume of distribution of dexmedetomidine is relatively 97±29 liters. It binds to serum albumin and alpha glycoprotein, with average protein binding of 94%. There is no gender specific difference in terms of protein binding ability. There are no reported significant drug-drug interaction due to changes in protein - binding ability, and dexmedetomidine has been explored in vitro in combination with different common highly protein bound

medications including fentanyl, ketorolac, theophylline, lidocaine and warfarin. [7-8]

Metabolism

In a study, patients with severe hepatic failure demonstrated a significantly higher steady state volume of distribution, and decreased terminal half-life and clearance values of dexmedetomidine contrasted with age matched controls; therefore, the pharmacokinetics of dexmedetomidine were markedly affected by hepatic insufficiency. Dexmedetomidine has demonstrated to have a mild inhibitory effect on" CYP2D6 - dependent dextromethorphan O-demethylase activity. Subsequently, no clinically significant drug interaction was demonstrated with the other medications that are metabolised by CYP 450 enzymes. [8]

PHARMACODYNAMICS

CENTRAL NERVOUS SYSTEM

Sedation, anxiolysis, hypnosis and amnesia. Dose dependent anxiolysis and sedation are provided by Dexmedetomidine. The patients are easy to arouse with good correlation between the level of sedation and the bispectral EEG (BIS). Patients have a lower probability to be disoriented or uncooperative. The sleep induced by Dexmedetomidine resembles natural sleep. The alpha 2 agonists act through endogenous sleep promoting pathways to deploy their sedative effect. [9]

Dexmedetomidine produces a diminished venture of the projections of the locus ceruleus to the ventrolateral preoptic nucleus. This increases GABA and galanin release in the tuberomammilary nucleus, producing a reduction in histamine release in the cortical and subcortical projections. The alpha 2 agonists appear to inhibit ionic conductance through voltage gated calcium - activated potassium channels. The similitude between natural sleep (non - rapid eye movement) and dexmedetomidine - induced hypnosis has been speculated to maintain cognitive and immunologic functions in the sleep deprived and restless state.

The sedative quality of dexmedetomidine seems to be different when compared with that produced by other sedatives acting through the GABA systems despite sound levels of sedation with dexmedetomidine, there is limited respiratory depression, giving wide safety margins.

RESPIRATORY EFFECTS

The literature has demonstrated that dexmedetomidine accomplishes its effects without causing much respiratory depression unlike opioids. The respiratory change in ventilation appears as normal as natural sleep.[10]

In a double blind, randomised, placebo controlled, multicenter trial evaluating dexmedetomidine for sedation of 401 postsurgical patients in an ICU, dexmedetomidine appeared to have no effect on respiratory rate, oxygen desaturation, duration of weaning, or time for extubation. The outcomes are similar for pediatric patients.

Several prospective studies have discovered insignificant or no change in respiratory function during the administration of dexmedetomidine when it is given as a single bolus or continuous infusion.

MATERIALS AND METHODS

This study entitled "Efficacy of intraoperative dexmedetomidine infusion on emergence agitation and quality of recovery after ENT, Oral and Maxillofacial surgeries." was undertaken in KIMS, Hospital and Research Centre, Karad, during the period December 2016 to July 2018. After establishing the eligibility of participant, written informed consent was otained from all participants. The study conducted with 130 patients, belonging to ASA physical status I or II, between the age of 18 to 58 years, undergoing elective ENT and oral and maxillofacial surgeries were randomly selected.

SAMPLE SIZE

According to the available literature to detect clinically important differences in the incidence of post operative emergence agitation of 25% between the two groups for the alpha value of 0.05 and power of 80% the sample size was calculated as total of 130 patients or 65 in each group. 18 months (after approval of institutional ethical committee) between December 2016 to July 2018. Prospective randomized Comparative Study.

SAMPLING TECHNIQUE

Randomization was done with the help of Microsoft excel. All the proformas were labeled either group D and group C according to randomization and were kept in the concealed envelopes. At the time of performing the study, the envelope was taken serially.

PROCEDURE

Potential participants underwent pre anaesthetic evaluation one day prior to surgery. Basic laboratory investigations like Hb%, FBS or RBS, blood urea, serum creatinine and ECG were carried out routinely in all the patients. The entire procedure was explained in detail to every patient in their own local language.

OBSERVATION AND RESULTS

Gender wise distribution in dexmedetomidine and saline group.

There were 55 males (42.30%) and 75 females (57.70%) in the study. [Table1]

Table 1: Gender wise distribution in dexmedetomidine and saline group

Demographic characteristics	Type of drug used Dexmedetomidine (n=65)	Saline (n=65)	P Value
Male	30	25	
Female	35	40	0.37

Comparison of grading of cough in dexmedetomidine and saline group

In Dexmedetomidine group out of total 65 subjects 3.08%, 27.69%, 61.54% and 7.69% subjects were having grading of cough 0, 1, 2 & 3 respectively. Similarly in saline group out of total 65 subjects 9.23%, 27.69%, 847.69% and 15.38%

subjects were having pain score 0, 1, 2 & 3 respectively. Between the two groups in the observation ratio (p>0.05) was no statistically significant difference. [Table 2]

Table 2: Comparison of grading of cough in dexmedetomidine and saline group.

Grading of cough	Type of drug used Dexmedetomidine (n=65)	Saline (n=65)	Total
0	2	6	8
1	18	18	36
2	40	31	71
3	5	10	15
Total	65	65	130

Distribution according to Riker sedation agitation scale between dexmedetomidine and saline group

In Dexmedetomidine group out of total 65 participants 12.31%, 61.54%, 20% and 6.15% participants were having Riker sedation agitation scale 3, 4, 5 & 6 respectively. Similarly in saline group out of total 65 participants 0%, 50.77%, 36.92% and 12.31% participants were having Riker sedation agitation scale 3, 4, 5 & 6 respectively. Study participants with scale 3 and 4 were more in Dexmedetomidine group and study participants with scale 5 & 6 were more in saline group. This difference in proportion was statistically significant. (p<0.05) [Table 3]

Table 3: Distribution according to Riker sedation agitation scale between dexmedetomidine and saline group.

Ricker's sedation agitation scale	Type of drug used Dexmedetomidine (n=65)	Saline (n=65)	Total
3	8	0	8
4	40	33	73
5	13	24	37
6	4	8	12
Total	65	65	130

DISCUSSION

The sensory supply of the nasal mucosa is derived from the first and second divisions of the trigeminal nerve. Anterior portion of both the septum and the lateral wall is filled by the anterior ethmoidal branch of the nasociliary nerve (first division). The posterior two thirds by nasopalatine nerves via the sphenopalatine ganglion (second division.) [11]

In animals a notable reflex from this area known as "Krastschmer" reflex occurs in which stimulation of the anterior part of the nasal septum leads to constriction of the bronchioles. When the patient's nose is plugged with gaze after a nasal operation, intense restlessness often occurs during the recovery period even though the oral airway is adequate and there is no pain. It is usually noticed in adolescents who have fractured nasal septum remodeled. It suggests a reflex from the nasal mucous membrane.[11]

The study conducted by Talke et al.,[12] study in 1995 assessing the effects of perioperative dexmedetomidine concluded that the drug was beneficial in managing the haemodynamic parameters intraoperatively in patients undergoing vascular surgeries. In a study in which dexmedetomidine infusion of 0.2 mcg / kg / hour was used and sustained before extubation, mean arterial pressure (MAP) and heart rate were barely different between dexmedetomidine and control groups. The disparity in outcomes is expected to indicate a potential variation in the age range of patients (adults vs. child age category) or differing infusion concentrations.[13]

CONCLUSION

Dexmedetomidine a novel anaesthetic agent which is suitable for pre anaesthetic anxiolysis and sedation as well as intra and post operative analgesia. From our study, we have come to the conclusion that the preservation of intraoperative infosion of dexmedetomidine (0.4mcg/kg/hour) till extubation, produced smooth and haemodynamically stable parameters in the intraoperative period and at the time of extubation. Dexmedetomidine infusion also diminished the emergence agitation without any complications after ENT and OMFS surgeries in the immediate post-operative period.

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