Original Article

DOI: 10.7860/JCDR/2021/47295.14466

Dexmedetomidine vs Fentanyl for Awake Fiberoptic Intubation in Paediatric Patients with Temporomandibular Joint Ankylosis: A Retrospective Analysis

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ABSTRACT

Introduction: For successful management of difficult paediatric airway intubation, proper preparation of airway along with a calm and sedated child with titrated doses of sedative agents is paramount.

Aim: To compare two different classes of sedative agents (Dexmedetomidine vs Fentanyl) regarding intubating conditions and comfort score of paediatric population at the time of awake fiberoptic intubation.

Materials and Methods: This retrospective study was carried out among 40 paediatric patients, aged between 5-14 years those who underwent surgery for Temporo-Mandibular Joint (TMJ) ankylosis. Clinical data relevant for this study was collected from the pre-format sheets of anaesthesia technique, attached with case files of the patients. Inj. dexmetedomidine bolus of 1 mcg/kg for 10 minutes followed by infusion at the rate 0.6 mcg/kg/hr in group A and Inj. fentanyl bolus dose of 2 mcg/kg followed by infusion 1 mcg/kg/hr in group B were compared in terms of intubating conditions and patient co-operation. For data analysis Statistical Package for the Social Sciences (SPSS) version 20 (IBM Inc.) was used. Patient characteristics in the two groups were compared using mean±SD and chi-square test.

Results: All the patients had successful intubation in first attempt in both the groups. In terms of airway preparation, out of total, 14 (35%) patients in group A had no secretions as compare to 4 (10%) patients of group B (p-value was 0.002). In terms of cough score, 13 (32.5%) patients in group A had no cough as compared to 3 (7.5%) patients in group B. Patients in group A were more comfortable at the time of insertion of Flexible Fiberoptic Bronchoscopy (FOB) with no or less resistance to FOB insertion (p-value was 0.043). Vocal cord conditions were favourable in both the groups and there was no difference.

Conclusion: Fiberoptic nasal intubation was found to be easier and safe in terms of patient comfort and preservation of patent airway with the use of dexmedetomidine, in paediatric TMJ ankylosis.

Keywords: Comfort score, Intubating condition, Sedative

INTRODUCTION

The TMJ ankylosis is a serious disabling condition for patients and a daunting experience for anaesthesiologists as they are supposed to intubate in less-than-ideal situations. Blind nasal, retrograde intubation, nasal Fiber-optic intubation and tracheostomy are different techniques of intubation in these cases depending upon operator's preference, and condition of patient.

Among all these techniques, awake fiber-optic guided nasal intubation is the technique of choice. Good preparation of the airway and patient co-operations are keys to successful intubation. These cases become more complicated in paediatric age group where any degree of co-operation cannot be expected from young ones. A number of sedatives [1-5] like midazolam and fentanyl are commonly used as adjuncts for paediatric awake fiber-optic intubation, but most frequent problem faced in these patients are that to make child sleepy and comfortable chances of hypoxemia are there as sedative agents depress the respiration. Certain characteristics of dexmedetomidine makes it ideal agent for such a difficult scenario. It provides a unique type of sedation also known as "conscious sedation" in which patients appear to be sleepy, but are easily arousable, cooperative, and communicative when stimulated. It has a quick onset, a relatively short duration of action and anti-sialagogue action as well [6-10].

The present retrospective study was aimed to examine the efficacy of dexmedetomidine as premedication in paediatric population for fiberoptic intubation, in spontaneously breathing patients of TMJ ankylosis, in terms of patient co-operation and intubating conditions.

MATERIALS AND METHODS

This was a retrospective observational study conducted in the Department of Anaesthesia at SHKM government Medical College Nuh, Mewat from February 2017 to December 2018.

Inclusion criteria: The clinical data of patients between 5-14 years posted for TMJ ankylosis surgery undergoing awake fiberoptic intubation.

Exclusion criteria: Patients who were intubated under either general anaesthesia/combination of anaesthetic agents/blind nasal intubation or those with pre-existing congenital anomalies were excluded from study.

Out of 56 patients operated at the institution for TMJ ankylosis surgery, clinical data relevant for this study were collected from case files of the 40 paediatric patients that were intubated with fentanyl or dexmedetomidine. This included age, gender, relevant clinical data of type of sedative agents, preoperative patient comfort score for shifting child to Operation Theatre (OT) and analysis of Intubating conditions with the help of airway preparation score, cough score, Patient comfort score and Intubation score.

To compare experience with use of dexmedetomidine against fentanyl, which was standard of care at the institution, 20 case files of each were analysed by comparing scores that were filled in specific forms. As per the hospital protocol, the scoring criteria has

been printed in sheets and kept attached to every patient file, which the consulting anaesthesiologist fills [Table/Fig-1].

Parameter	Assessment	Score
Patient comfort score (At the time of FOB)	No reaction	1
	Slight-grimacing	2
	Heavy-grimacing	3
	Verbal objection	4
	Defensive movement of head and neck	5
Airway preparation score (At the time of FOB)	No secretions	1
	Mild secretions	2
	Lot of secretions	3
Cough score	No cough	1
	Slight cough	2
	Moderate cough	3
	Severe cough	4
Intubation score (Vocal cord movement)	Open	1
	Moving	2
	Closing	3
	Closed	4

[Table/Fig-1]: Scoring criteria.
FOB: Flexible fiberoptic bronchoscopy

As per protocol, all the patients were kept Nil Per Oral (NPO) 6 hours before the procedure. One day before surgery, oxymetazoline (0.025-0.050%) nasal drops were given thrice daily. On the day of surgery, injection glycopyrrolate (3-4 mcg/kg) and inj. Midazolam (0.05 mg/kg) intravenous were given 30 minutes before the procedure in both the groups. Nebulization was done for 10-15 minutes with xylocaine 4% (1 mL diluted with 1 mL of normal saline) for topicalisation of airway. Standard American Society of Anesthesiologists (ASA) monitoring was established.

Patients that were intubated with Inj. dexmedetomidine bolus of 1 mcg/kg for 10 minutes followed by infusion at the rate 0.6 mcg/kg/hr were labeled as group A and those patients intubated with Inj. fentanyl bolus dose of 2 mcg/kg followed by infusion 1 mcg/kg/hr in group B. Baseline haemodynamic parameters were documented before and after study drug administration, immediately after intubation. Any episode of desaturation with SpO_2 <95% despite supplemental oxygen were noted.

The primary outcome measures were conditions achieved at bronchoscopy and intubation which were assessed by a single operator by various scores [11] shown in [Table/Fig-1].

STATISTICAL ANALYSIS

For data analysis SPSS version 20 (IBM Inc.) was used. Numerical variables such as age and sex were expressed as mean and standard deviations. The categorical variables such as patient reaction, and scores of intubation and comfort were expressed as frequency and percentages. Patient characteristics in the two groups were compared using mean±SD (with percentage) and chi-square test. The changes in the mean scores over time between the two groups were compared using statistically significance at 0.05 level of significance. Inter-group and intra-group comparisons in terms of difference between means were done. Within each group, change in the mean values of continuous variables with time was compared. Bivariate correlation value calculated as 0.191. A p-value of <0.05 was considered statistically significant.

RESULTS

Data for total 40 patients, of age group 5-14 years, were studied. All the patients underwent successful intubation with awake fiberoptic intubation for gap arthroplasty in TMJ ankylosis. There was no statistically significant difference in demographical profile of patients [Table/Fig-2].

Parameters	Group A (n=20) Mean±SD	Group B (n=20) Mean±SD	p-value
Age	10.2±1.8	9.8±2.3	0.549
Male	17 (85%)	16 (80%)	0.677

[Table/Fig-2]: Age and gender comparison.
unpaired 't' test

Intubating conditions, as assessed with airway preparation score and cough score, were better in dexmedetomidine group (A). In terms of airway preparation as shown in [Table/Fig-3], out of total, 14 (35%) patients in group A had no secretions as compare to 4 (10%) patients of group B. Similarly, no patient in group A had copious secretions as compared to six patients in group B (p-value 0.002).

At the line of FOB	Score	Group A (n=20) n(%)	Group B (n=20) n(%)	p-value
No secretions	1	14 (70)	4 (20)	0.046
Mild secretions	2	6 (30)	10 (50)	0.39
Lot of secretions	3	0 (0)	6 (30)	0.021

[Table/Fig-3]: Airway preparation score.
Chi-square value=5.31. p-value=0.002; FOB: Flexible fiberoptic bronchoscopy; p-value <0.05 statistically significant; unpaired 't' test applied between Group A and Group B

All the patients had successful intubation in first attempt in both the groups. Vocal cord conditions were favourable in both the groups and there was no difference (p-value >0.05) but patient comfort score and intubating conditions were better in Dexmedetomidine group (A) as compared to fentanyl group (B) [Table/Fig-4].

VC movement	Score	Group A (n=20) n (%)	Group B (n=20) n (%)	p-value
Open	1	6 (30)	6 (30)	0.742
Moving	2	13 (65)	12 (60)	0.87
Closing	3	1 (5)	2 (10)	0.57
Closed	4	-	-	

[Table/Fig-4]: Intubation score.
Chi-square value=0.11, p-value=0.829; VC: Vocal cord; p-value <0.05 statistically significant; unpaired 't' test applied between Group A and Group B

In terms of cough score, 13 patients in group A had no cough as compared to three patients in group B [Table/Fig-5]. The difference was statistically significant (p-value was 0.829). In these patients, local anaesthetic and bolus of propofol were given as per need.

Grading	Score	Group A (n=20) n(%)	Group B (n=20) n(%)	p-value
No cough	1	13 (65)	3 (15)	0.03
Slight cough	2	6 (30)	7 (35)	0.809
Moderate cough	3	1 (5)	10 (50)	0.014
Severe cough	4	-	-	

[Table/Fig-5]: Cough score.
Chi-square value=10.42, p-value=0.829; p-value <0.05 statistically significant; unpaired 't' test applied between Group A and Group B

Patients were more comfortable and co-operative at the time of insertion of FOB in Dexmedetomidine group as compare to fentanyl group (p-value was 0.043) as shown in [Table/Fig-6].

At the time of FOB	Score	Group A (n=20) n(%)	Group B (n=20) n(%)	p-value
No reaction	1	4 (20)	0 (0)	0.05
Slight-grimacing	2	6 (30)	2 (10)	0.91
Heavy-grimacing	3	8 (40)	10 (50)	0.69
Verbal Objection	4	1 (5)	4 (20)	0.20
Defensive movement of head and neck	5	1 (5)	4 (20)	0.20

[Table/Fig-6]: Patient comfort score.
Chi-square value =3.61; p-value = 0.043; FOB: Flexible fiberoptic bronchoscopy; p-value <0.05 statistically significant; unpaired 't' test applied between Group A and Group B

DISCUSSION

Awake Fiberoptic intubation in paediatric patients with difficult airway is quite a challenging task [12,13]. It is more difficult to perform this procedure in paediatric patients than in adults.

Use of fentanyl for awake Fiber optic bronchoscopy in paediatric patients is standard of care. There are many studies of fentanyl use either alone or in combination of midazolam/propofol for successful awake intubation. Use of fentanyl as premedication for Fiber optic bronchoscopy for paediatric patients provides favourable operating conditions but it comes at the cost of respiratory depression and other side effects [14]. In this study fentanyl was used, in dose of 2 mcg/kg bolus dose followed by 1 mcg/kg/min infusion till the intubation. Similarly, Dhasmana S et al., conducted a study in adult TM joint ankylosis for conscious sedation comparing optimal doses of fentanyl [15]. They observed that while fentanyl with a bolus dose of 3 mcg/kg leads to more comfortable patient as compared to a bolus dose of 2 µg/kg but it comes at the cost of side-effects like respiratory depression, nausea, vomiting and chest wall rigidity.

Dexmedetomidine is a potent and highly selective α-2 adrenoceptor agonist with sympatholytic, sedative, amnestic, and analgesic properties which have been described as a useful and safe adjunct in many clinical applications. Several reports are now available for dexmedetomidine for both non-invasive and invasive procedural sedation in infants and children [16-18]. Total plasma clearance of dexmedetomidine is age independent; thus, similar rates of infusion can be used in children and adults [19]. Dexmedetomidine has many properties to make it suitable for use during fiberoptic intubation [20,21]. Although there is literature on use of dexmedetomidine for paediatric procedural sedation [22,23] but no study has been done regarding experience of using dexmedetomidine in paediatric population of TMJ ankylosis. Abdelmalak B reported a series of successful awake fiberoptic intubations using dexmedetomidine in similar doses as the index study [24]. Chu KS et al., had used loading dose (1 µg/kg) of intravenous dexmedetomidine for providing conscious sedation without respiratory depression or upper airway obstruction for fiber-optic nasotracheal intubation [25].

Similarly, Mondal S *et al*., had observed that dexmedetomidine was more effective than fentanyl in producing better intubation conditions, sedation along with haemodynamic stability, and less desaturation during Awake Fibreoptic Intubation (AFOI) [26]. Their study population was patients with normal airway while in the present study both the agents were tested in paediatric population in difficult airway. In the present study, supplement oxygen was started through the side port of flexible bronchoscopes, meant for passage of instruments, from the beginning of intubation to prevent the development of desaturation. No patient in either group had episode of desaturation. Hypotension and bradycardia, the two common side effects of dexmedetomidine, were not observed in this study probably because the patients were well hydrated with intravenous fluids before administration of dexmedetomidine and all of them had received glycopyrrolate as well. A recent retrospective study of 747 children [27] evaluated the safety and efficacy of large-dose therapy, with IV loading doses of 2-3 mcg/kg followed by infusions of 1-2 mcg/kg/hr. While the authors achieved adequate sedation in 97% of their patients, there was a 16% incidence of bradycardia. None of the patients with bradycardia required intervention. In this study, intubation score was the only score which was comparable in both the groups. Patient comfort score was much better in dexmetedomidine group as these patients were allowing to insert the fiberoptic bronchoscope more cooperatively. Similarly, dexmetedomidine being anti-sialagogue, airway secretions were less in this group. Cough score were better in dexmetedomidine group than fentanyl group. In fentanyl group, although all the patients had successful intubation, one fourth patients had moderate cough which required subsequent boluses of propofol for intubation.

Limitation(s)

On one hand fentanyl is an established dative agent but dexmedetomidine is still not labeled for paediatric use. Although both agents were compared in terms of intubating conditions but no comparison was done regarding haemodynamic stability in paediatric use. The strength of present study is, there were only two operators who conducted the intubation; the familiarity and experience were almost equal for both. Hence, there were little confounding factors of variability in the skills of the operators.

CONCLUSION(S)

Awake fiberoptic intubation is the gold standard for management of TM joint ankylosis patients, but intubating an awake child is very challenging. Dexmedetomidine not only provided satisfactory intubating conditions in this subset of patients but also by calming the child and maintaining the patency of the airway, provides favourable conditions for anaesthesiologists to handle difficult airway.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Oct 21, 2020
- Manual Googling: Dec 11, 2020
- iThenticate Software: Dec 22, 2020 (12%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? NA
- Was informed consent obtained from the subjects involved in the study? NA
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Oct 21, 2020**
Date of Peer Review: **Nov 25, 2020**
Date of Acceptance: **Dec 11, 2020**
Date of Publishing: **Jan 01, 2021**