Nasal fibreoptic intubation in children with TMJ ankylosis using sevoflurane. A report of ten cases

Pramod Gupta, Parul Aggarwal

Dept. of Anaesthesia, V.M.M.C. & Safdarjung Hospital New Delhi-110029

email: guptapdnb@yahoo.co.in

Introduction

The temporo-mandibular joints (TMJ) are highly specialized bilateral joints comprising an articulation between the cranium and the mandible. Among various causes of TMJ ankylosis, the commonest are inflammation and trauma. The relatively difficult problem becomes even graver in the pediatric age group because of their small mouth opening, near total trismus and uncooperativeness while securing the airway in the awake state. T-M Joint Ankylosis presents as a serious problem for airway management. Combination of various inhalational agents have been used to induce children under spontaneous ventilation and to intubate the trachea, to avoid tracheostomy, fibreoptic bronchoscopy have been safely performed. Many relevant studies have been carried out in fiberoptic intubation field but only few studies have been done in children presenting with TMJ ankylosis under sevoflurane anaesthesia. The present study was designed to investigate the circulating responses to nasal FOI in children who were induced and then trachea was intubated with the adminostration of sevoflurane under spontaneous anaesthesia. 10 children of either sex, ASA status I and II, age between 5 to 15 years, weight between 15-40 kg and height between 97-133 cm, scheduled for elective TMJ ankylosis correction under general anaesthesia, were included in this study. The circulating responses, i.e. non-invasive B.P., H.R., $EtCO_2$ and SpO_2, to fibreoptic nasotracheal intubation with sevoflurane in spontaneously breathing children were recorded at baseline, post-induction, post translaryngeal block at intubation and every min further for five minutes. Haemodynamic parameters and their significance were compared using Friedman test and Wilcoxon signed ranks test.

All the children were successfully intubated and unilateral ankylosis correction was done to get adequate mouth opening. There were no changes in heart rate or systolic blood pressure. Children were haemodynamically stable. No complications were encountered.

Sevoflurane for fibreoptic intubation in children under general anaesthesia is a very good inhalational agent. As Children cooperate well, induction is smooth and uneventful and also children were found to be haemodynamically stable. Hence from the cases studied, it is found that fiberoptic bronchoscopy with sevoflurane inhalational anaesthesia is a fast and effective method to secure the airway in paediatric patients with a known difficult airway due to TMJ ankylosis.

Many relevant studies have been carried out in fiberoptic intubation field but only small study has been due in children presenting with TMJ ankylosis under sevoflurane anaesthesia.

The present study was designed to investigate the circulating responses to nasal FOI in children who were induced and then trachea was intubated with sevoflurane under spontaneous anaesthesia.

Patents and methods

Following written informed consent, 10 children of either sex, ASA status I and II five to fifteen years weighing (15-40)kg and height (97-133)cm scheduled for elective TMJ ankylosis correction under GA, were included in this study. Exclusion criteria were URI, morbid obesity, CVS disease, child on medication / bronchial asthma and fever.

Before surgery, all the patients fasted overnight and were restricted from fluid 6 hrs preoperatively. Patients were premedicated with syrup phenargan 10 mg/kg body weight, 2 hrs before induction. A 20 gauze intravenous cannula was inserted into the vein of dorsum of the hand and crystalloid infusion was started at the rate of 4.5ml/kg/hr. I/V inj. Ranitidine and Ondansetron were given ½ hr before operation according to weight of the patient. I/M glycopyronium 0.1-0.2 mg was given preoperatively. Also 15 minutes before induction of anaesthesia, 0.05% xylometazoline and 2% lidocaine (0.5ml) was applied using nasal cotton pledges in each nostil.

After patients entered the operating room, non-invasive B.P. and HR were measured, after a stabilization period of 10 min as baseline readings. ECG lead II and SpO_2 were monitored. Before induction, fibreoptic bronchus was checked, focused and flexometallic tube of adequate size was lubricated with 2% lidocaine gel and threaded over a paediatric fibreoptic bronchoscope (2.8mm size).

Along with 5 min of preoxygenation, injection fentanyl 1.5µg/kg was given to coincide with intubating time of approx 5 minutes. Anaesthesia was induced with inhalation induction using face-mask ventilation with sevoflurane in 100% O_2 at 6-8 litres/min minute volume using Ayre's piece circuit / Mapelson D circuit according to age and weight of the patient. Children were

induced slowly at normal tidal volume with sevoflurane at 4-6 MAC with 100% oxygen. On line $EtCO_2$, SpO_2, H.R., non-invasive BP and ECG were monitored every 2 min.

When response to verbal command and eye lash reflex were lost and finger tapping was stopped, nasal airway non-cuffed 4-4.5 size was inserted after lubrication with lidocaine jelly in one of the nostril and fixed. The circuit tubing was attached to nasal airway and spontaneous respiration was maintained with sevoflurane 1-2 MAC at 6 liter/min flow with O_2 : N_2O (50% : 50%).

Post induction translaryngeal block were given with 0.5-1ml of 2% lidocaine. After 1 min, fiberoptic intubation was introduced into right nostril and time was recorded from the start of intubation to tracheal cuff inflation and reading of $EtCO_2$ graph noted. While performing fiberoptic intubation, online $EtCO_2$ was continuously monitored; after the glottis was exposed, the bronchoscope was pared between the vocal cords and downward till carina was seen. A flexometallic nasal tube was gently advanced over the bronchoscope into the trachea. Intubating scoring was done, after visualizing the vocal cords and reaction to intubation, cuff inflation and body movement was noted. After checking the position of tube, fiberoptic bronchoscope was removed. Haemodynamic responses to intubation were recorded at intubation and every minute thereafter for 5 min. All the fibreoptic intubations were performed by single experienced anaesthetist.

After successful intubation, the tracheal tube was attached to the circuit which was already attached to naospharyngeal airway and assisted ventilation was done to keep $EtCO_2$ at 35±3. After 5 min, intravenous neuromuscular blocking agent vecuronium 0.04mgkg^{-1} was given and closed circuit tubing was connected and patient was put on ventilator. Anaesthesia was maintained on O_2: N_2O (33-67%) with Isoflurane 0.8% and top up doses of vecuronium (0.01mgkg^{-1}). $EtCO_2$ was maintained at 35±3 with fresh gas flow of 1.5 lit/min.

Duration of surgery was approximately 1 to 1½ hours. Throughout the operation, the patients were monitored every 5 minutes. Half an hour before the end of operation intramuscular pethidine 1 mg/kg was given for postoperative analgesia. Neuromuscular blocking agent was reversed with glycopyronium 0.02mg/kg and neostigmine 0.04mg/kg. The patients were extubated and oxygenated by face mask.

All data were stored on a disk and analysed with SPSS version. H.R. and blood pressure data was compared with different events using Friedman's test. Where the calculated P value showed significance, Wilcoxon signed Ranks test was used within the events to determine which

differences were significant. The quantitative data were expressed as mean (SD). P value of less than 0.05 was considered as significant.

Results

All ten patients were included in the analysis of haemodynamic parameters (Table 1, 2 and Fig 1, 2). Heart rate and systolic blood pressure did not change significantly throughout the procedure. Diastolic pressure showed significant change at 2 minutes post intubation as post induction value. Value at post intubation 2 minutes showed significant difference of change in MAP as compared to 1 min value.

Time taken for intubation was within 90-sec. There was no reaction to intubation or cuff inflation. Post intubation values at 1, 2, 3 min were not significant statistically, but value at post intubation 2 minutes showed significant fall in B.P. as compared to post intubation 1 minute. None of the value of MAP was low statistically as compared to baseline (P values were >0.05). The study demonstrated the children were haemodynamically stable throughout the procedure. There was no postoperative shivering, vomiting or sore throat, however one child had shivering on O.T. table after extubation. Rest no complications were encountered.

TABLE 1

HAEMODYNAMIC PARAMETER CHANGES TO FIBEROPTIC NASOTRACHEAL INTUBATION

Variables	**Baseline**	**Post-induction**	**Post-translaryngeal block**	**At intubation**	**Post intubation**		
	Mean (SD)	***Mean (SD)***	***Mean (SD)***	***Mean (SD)***	**1 min** ***Mean (SD)***	**2 min** ***Mean (SD)***	**3 min** ***Mean (SD)***
Heart rate (hpm)	89.80 (17.20)	85.20 (17.91)	86.4 (18.45)	96.30 (20.10)	95.10 (19.10)	93.70 (15.72)	90.50 (12.98)
Systolic blood pressure (mmHg)	116.60 (12.02)	110.50 (19.64)	104.70 (18.89)	111.30 (18.48)	109.80 (19.07)	107.80 (18.99)	107.60 (18.88)
Diastolic blood pressure (mmHg)	64.90 (13.16)	68 (10.92)	58.40 (10.51)	63.90 (9.98)	61.40 (12.70)	58.10 (12.52)	60.70 (15.33)
Mean arterial pressure (mmHg)	83.80 (12.24)	81.40 (12.50)	77.70 (13.05)	86.60 (9.48)	85.90 (10.77)	80.30 (11.09)	80.90 (12.41)

All the values are Mean±SD

TABLE 2

MINIMUM AND MAXIMUM VALUES OF HAEMODYNAMIC PARAMETER

Variables	Baseline		Post-induction		Post-translaryngeal block		At intubation		Post intubation					
									1 min		2 min		3 min	
	Mean (SD)		*Mean (SD)*		*Mean (SD)*		*Mean (SD)*		*Mean (SD)*		*Mean (SD)*		*Mean (SD)*	
	Min	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
HR (min)	75	132	67	124	68	132	68	121	73	120	78	120	78	120
Systolic B.P. (mmHg)	102	145	72	145	70	145	86	155	84	155	90	155	91	155
Diastolic B.P. (mmHg)	53	88	59	88	48	84	55	84	46	84	43	85	42	85
MAP (mmHg)	72	107	63	107	64	107	71	107	73	107	70	107	65	107

TABLE 3

SIGNIFICANT - P VALUES OF DIASTOLIC AND MEAN BLOOD PRESSURE

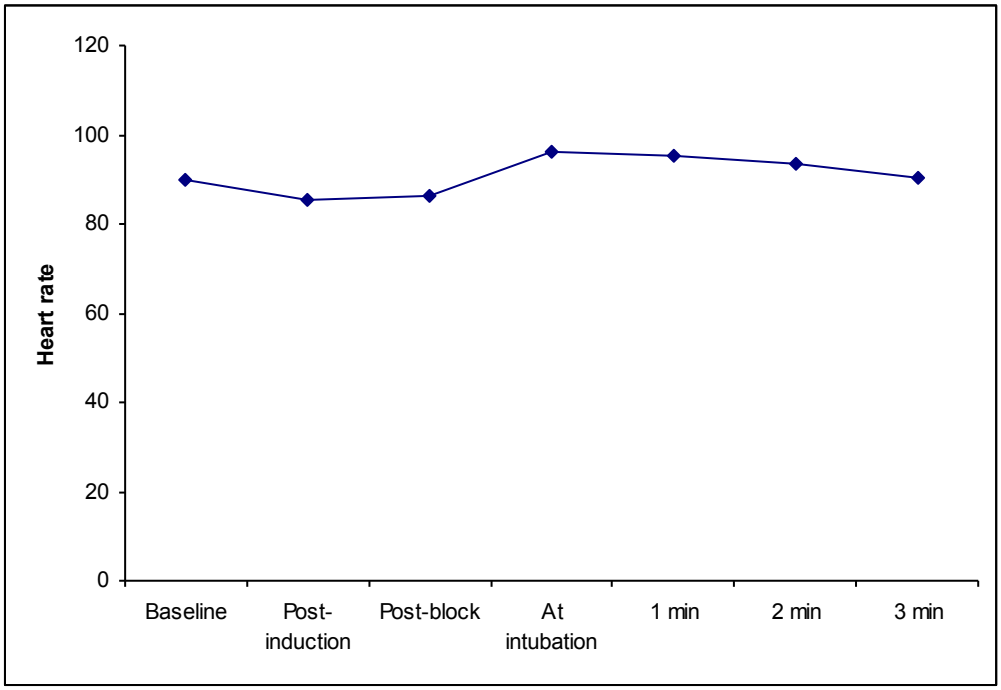
VARIABLES	INTER EVENTS	P VALUES
Diastolic Blood Pressure (mmHg)	1. Post induction as compared to post block	0.008
	2. Post induction as compared to post intubation at 2 minutes	0.007
	3. At intubation as compared to post intubation at 2 minutes.	0.007
Mean Arterial Pressure (mmHg)	1. Post induction as compared to at intubation	0.048
	2. Post block as compared to at intubation	0.018
	3. Post intubation at one minute as compared to post intubation at 2 minutes.	0.017

Wilcoxon signed Ranks test showing significant P values <0.05 on comparing different events.

GRAPHIC 1

HEART RATE CHANGES WITH ALL EVENTS

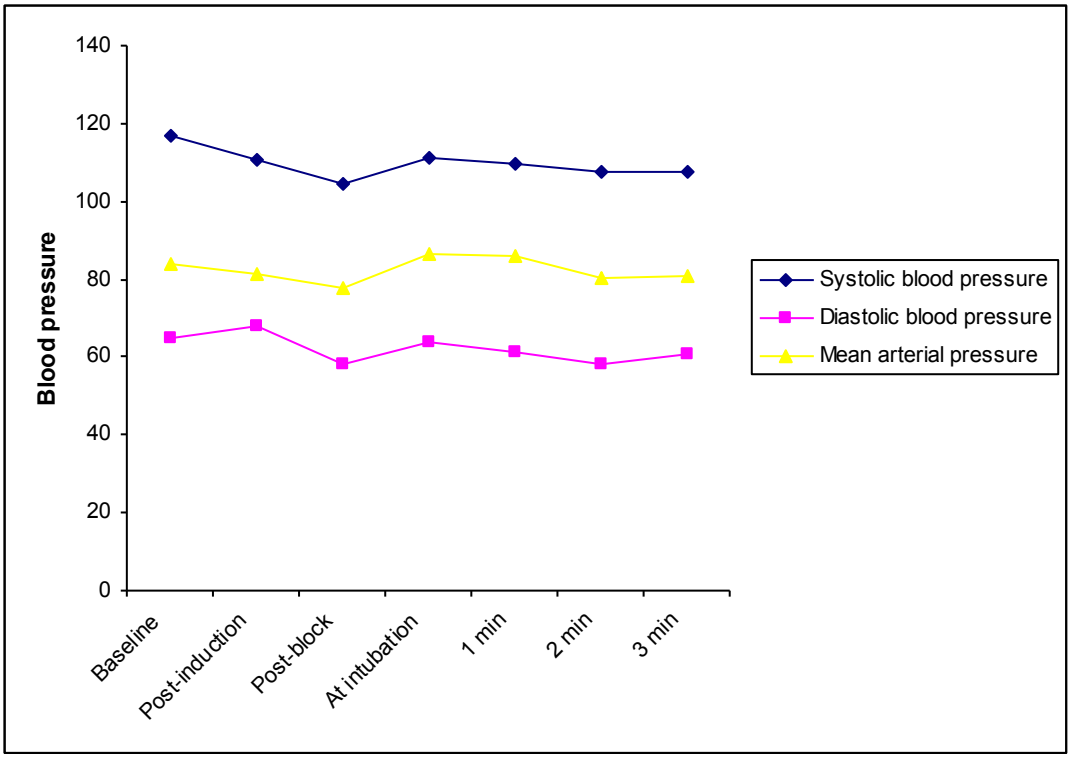
(Rate/min)



GRAPHIC 2

BLOOD PRESSURE CHANGES WITH ALL EVENTS

(mmHg)



Discussion

All the children with T.M. ankylosis had minimal or no mouth opening, the mandible was pulled upward due to trauma. Most of the children had history of fall from tree or height and presented for surgery usually after 3-6 months when trismus slowly lead to closure of mouth opening. Thyromental and stemomental distances were within normal limits.

This study has showed that under general anaesthesia with sevoflurane, children's trachea could be easily intubated by nasal route while they are breathing spontaneously with sevoflurane (O_2 / N_2O 50%) throughout the procedure via nasopharyngeal airway.

The pressor response following the insertion of nasopharyngeal airway in anaesthetized patient is significantly greater than oropharyngeal airway. However the mean rise in arterial pressure does not exceed to that of nasotracheal intubation. [1,2]

Holm-Knudsen R et al has reported that the combination of nasopharyngeal airway under sevoflurane induction and fiberoptic guided nasotracheal intubation is safe and reliable for managing the difficult airways. [3]

Tsubaki et al found that following inhalational induction with 2% Influrane and 50% N_2O/O_2 resulted in less tachycardia response in fiberoptic nasal intubation.[20]

Latorre et al demonstrated fiber optic nasotracheal intubation did not provoke major haemodynamic or endocrine stress responses. Moreover diastolic B.P. changes are lesser than systolic B.P. [21]

B.P. and H.R. both returns to post induction values at 1-3 min after intubation in both nasotracheal and orotracheal intubation this has been reported by the F.S. et al [4].

In post induction period there is fall in blood pressure but heart rate does not change much. After nasotracheal intubation both blood pressure and heart rate are increased for 2 minutes and heart

rate is found to be increased above baseline level for longer time.[5]

Speed of induction with sevoflurane may not be desirable because of increased risk of respiratory depression. Also consensus appears to favour stepwise approach either by increasing inspired concentration by 1-2% quickly or by preoxygenation followed by starting at higher concentration.[7]

Small dose of fentanyl given 5 minutes before intubation blunts the circulating responses to tracheal intubation at its best.[8]

Sevoflurane induction has been used for difficult tracheal intubation including direct laryngoscopy and fiberoptic intubation. Teaching of fiber optic intubation in anaesthesia spontaneously breathing children has also been done. Sevoflurane and local anaesthesia has been used safely by Erb T et al for bronchoscopy procedure and difficult airway cases. [6,9-11]

Sevoflurane induction is a commonly used technique for children. It lacks pungency and airway irritation as compared to other vaporized agents. Sevoflurane induction with different techniques is safe, reliable and well accepted by the patients.[12].

Lambert P et al studied inter patient variability with sevoflurane induction, different time was taken by patients to reach at particular depth of anaesthesia.[13]

T-M Joint Ankylosis presents with a serious problem for airway management. Problem becomes more difficult to manage in children because of smaller or no mouth opening. Vas L et al used combination of ether and halothane to induce children under spontaneous ventilation and the position of larynx was assessed by air bubbles coming out of larynx and then the trachea was intubated. In other studies, fiber optic intubation was safely performed to avoid tracheostomy.[14-17]

A silicone based wire inforced tracheal tube due to hemispherical level reduced nasal bleeding and

is easy to railroad over the bronchoscope as in this study the same tube was used safely.[18]

Introduction of epidural catheter through injection port of bronchoscope can become the source of lidocaine injection i.e. an alternative to translaryngeal block as used by Long T.E. et al.[19]

Sevoflurane produces dose related depression of MAP without change in heart rate during anaesthesia. Cardiac index is significantly decreased at both 1 and 1.5 MAC. Lidocaine has significant antiarrhythmic and negative ionotropic actions as a result of the block of fast sodium channel.[22]

In conclusion, all the children were successfully intubated and unilateral ankylosis correction was done to get adequate mouth opening.

References

1. Tong JL, Smith JE: Cardiovascular changes following insertion of oropharyngeal and nasopharyngeal airways. British Journal of Anaesthesia 2004;93: 339-42.
2. Singh S, Smith JE: Cardiovascular changes after the three stages of nasotracheal intubation. British Journal of Anaesthesia 2003;91: 667-71.
3. Holm KR, Erikesn K, Rasmussen LS: Using a nasopharyngeal airway during fiberoptic intubation in small children with a difficult airway. Paediatr Anaesth. 2005 Oct; 15(10): 839-45.
4. Xue F.S., Li C.W., Su HT . The circulatory responses to fiberoptic intubation : a comparison of oral and nasal routes. Anaesthesia 2006;61: 639-645.
5. Singh S , SMITH JE. BP and HR changes during intubation: a comparison of direct laryngoscopy and a fiber optic method. Anaesthesia, 2006;61(5): 444-8.
6. Kanda Samey R, Siva Lingam P . Use of sevoflurane in difficult airways. In Acta Anaesthesiol Scand. 2000;44(5): 627-9.
7. Woods AW, Allam S. Tracheal intubation without the use of N-M blocking agents. B.J.A. 2005;94(2): 150-158.
8. Koh SH, Kim DC, Han YJ . Small dose fentanyl optimal time of injection for blunting the circulating responses to tracheal intubation. Anesthesia and Analgesia 1998;86: 658-61.
9. Mostaga S.M., Atherton A.M. Sevoflurane for difficult tracheal intubation fiberoptic /direct laryngoscopy. Br. J. Anaesth 1998;80(3): 408.
10. Erb T, Hampl K.F.Teaching the use of fiberoptic intubation in anaesthesia spontaneous breathing patients. Anaesth Analg 1999;89(5): 1292-5.
11. Batra et al: Halothane Vs sevoflurane for bronchoscopy. Annals of cardiac anaesthesia 2004;7: 137-143.
12. Martin L.R., Gilson F. Conventional stepwise Vs vital capacity rapid inhalation induction at two concentrations of sevoflurane. Eur J Anaesthesiol 2004;21(4): 265-71.

13. Lambert P, Junke E . Inter patient variability upon induction with sevoflurane estimated by time to reach pre defined end points of depth of anaesthesia. Eur J Anaesthesiol 2006;23(4): 311-8.
14. Casal P. Use of fiber optic bronchoscope for intubation in maxillofacial surgery. Rev Esp Anaesthesiol Reanim 1987;34(2): 138-40.
15. Vas L, Sawant P: A review of anaesthesia technique in fifteen patients with T.M. Joint ankylosis. Paediatr Anaesth. 2001;11(2):237 –44.
16. Richter M, Tassossyi E, Chausse M. Difficult intubation in maxillofacial surgery tracheostomy or fiberoscopy. Rev Stomatol Chir Maxillofacial 1989;90(6): 367-70.
17. Kawasaki T, Sate T. Airway management of a child with T.M. joint ankylosis following otitis media. Anaesthesia 2002;57(3): 294-5.
18. Kihara S, Komal ST. A silicone based wire reinforced tracheal tube with hemispherical level reduces nasal morbidity for nasotracheal intubation. Anesth Analg 2003;97(5): 1488-91.
19. Long TE, Wass CT.An alternative to transtracheal injection for FOI in awake patients. Anesthesiology 2004;101(5): 1253.
20. Tsubaki T, Aonok. BP, HR and Catacholamine response during fiberoptic nasotracheal intubation under GA. Journal of Anesthesia 1992; 6: 474-9.
21. Latone F, Hofmann M . Fiberoptic intubation and stress: Anaesthesia 1993;42: 423-6.
22. Robert G. Cardiovascular effects of anaesthesia In: edi. Cedric PR, Burnell R. Brown Jr. International Practice of Anaesthesia 1997 (1); Ch 29: 6-14.