

Research Article**Anaesthetic Management of Temporomandibular Joint Ankylosis in Paediatrics:
A 5 Year Audit in a University Hospital****Sumalatha R Shetty^{1*}, Avanish Bhandary², Anirban Roy³, Vikram Shetty⁴**¹Professor, Department of Anaesthesiology, K. S. Hegde Medical Academy, Nitte University, Mangalore, Karnataka-575018, India²Associate Professor, Department of Anaesthesiology, K. S. Hegde Medical Academy, Nitte University, Mangalore, Karnataka-575018, India³Senior Resident, Department of Anaesthesiology, K. S. Hegde Medical Academy, Nitte University, Mangalore, Karnataka-575018, India⁴Director, Nitte Meenakshi Institute of Craniofacial Surgery, Nitte University, Mangalore, Karnataka-575018, India***Corresponding author**

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Abstract: Temporomandibular joint (TMJ) ankylosis presents significant challenges for airway management, more so in children due to the inherent differences in their physiology and airway anatomy. Techniques used to secure airway in adults may not be ideal for children and sometimes dedicated equipment may not be available. We conducted a 5 year audit to analyse different techniques used to manage these patients in our hospital. Although TMJ ankylosis is well known to be associated with difficult airway management, the techniques used are dependent on the expertise of the concerned anaesthesiologists and available resources most of the time. The aim of our audit was to determine the incidence of difficulty in airway management during TMJ ankylosis repair in paediatric age groups well as look for the incidence of comorbidities and complications. We retrospectively audited cases of TMJ ankylosis amongst paediatric population over a 5-year period in our institution, recording demographics, comorbidities, postoperative complications, anaesthetic techniques including difficulty in ventilation and airway management strategies. We report a total of 32 patients, 16 belonging to the paediatric age in comparison with 16 adult patients operated for ankylosis release. Different techniques used and outcomes have been studied in this audit. A range of anaesthetic techniques were employed for induction, maintenance and extubation. There was intubation difficulties recorded at induction of one patient. Our audit revealed that even though different techniques were employed by different anaesthesiologists, awake fiberoptic intubation or with mild sedation still remained the first choice for intubation in TMJ ankylosis with.**Keywords:** TMJ ankylosis, Fiberoptic intubation, Difficult airway.

INTRODUCTION

The word ankylosis is derived from a Greek terminology meaning 'stiff joint'. Ankylosis of the TMJ may either be true (intra-articular) or false (extra-articular), bony or fibrous. The commonest causes of TMJ ankylosis are trauma and infection in or around the joint region. Other causes that have been cited include tumors and inflammation. The factors that predispose to TMJ ankylosis include meniscal tear, age (10 years and below) and prolonged immobilization in patients with intra capsular injuries (2). When it occurs in a child, not only does it have serious effects on the future growth of the jaws and teeth, but also profound influence on the psychosocial development of the patient because of the obvious facial deformity which worsens with growth. It is crucial that early diagnosis and management are undertaken if the worst sequelae of this condition are to be avoided.

The relatively difficult problem becomes even graver in the paediatric age group because of their small mouth opening, near total trismus and their inability to cooperate for awake intubation. TMJ Ankylosis in this age group presents a serious problem for airway management. Various anaesthetic techniques have been used to induce and intubate children under spontaneous ventilation using fiberoptic bronchoscopy, in a quest to avoid tracheostomy.

TMJ ankylosis presents significant challenges for airway management, more so in children, due to the inherent differences in their physiology and airway anatomy. Techniques used to secure airway in adults may not be ideal for children and sometimes dedicated equipment may not be available. We conducted a 5 year audit to analyse different techniques used to manage these patients in our hospital. Although TMJ ankylosis is well known to be associated with difficult airway

management, the incidence and the techniques to manage the same are unclear. Most of the time, the techniques used are dependent on the expertise of the concerned anaesthesiologists and is based on ASA difficult airway algorithm.

Anaesthetic management depends on patient comorbidities, anaesthesiologists' preference and local hospital protocols. This results in a wide range of practices and it is unclear which techniques are the most optimal. The exact incidence of difficulty in airway management with modern anaesthetic techniques is not known.

The aim of this audit was to determine the incidence of intubation and ventilation difficulties during anaesthesia for TMJ Ankylosis release. We also recorded the current practices of anaesthesia and analgesia in these children and the incidence of perioperative complications.

MATERIALS AND METHODS

The study was conducted in K S Hegde Hospital. Were prospectively identified cases of TMJ Ankylosis repair for a 5-year period from January 2008 to January 2012. Institutional ethical committee approval was obtained and patient names and hospital numbers were de-identified prior to analysis. An access database was created for entering data. This constituted demographic data (age& sex), associated abnormalities and anaesthetic data (induction agents, ventilation prior to intubation, method of intubation, intubation difficulties or failures, muscle relaxants used and time to extubation). Airway difficulty was defined by either specific anaesthesiologist's comments in the record, severe gastric distension or the presence of significant hypoxemia (pulse oximeter saturation (SpO₂) <90% or drop >10% below baseline) Intubation difficulty was defined by either anaesthesiologist's comments or any incidence of failure to secure the airway in more than two attempts or cancellation of the case due to failure to secure airway by multiple attempts by more than one anaesthesiologist.

RESULTS AND DISCUSSION

A total of 32 cases of TMJ Ankylosis repair were identified over a period of 5 years, of which 16 patients belonged to paediatric age group whose notes were retrieved and retrospectively looked at for demographics.

Table 1 indicates the patient characteristics. Of the 16 paediatric patients, 5 were male and 11 were female. The incidence of male patients with TMJ Ankylosis in paediatric age group in our institution was 31.25 % and that of female patients was 68.75 %.

Table 1: Demographic characteristics

Gender	Ratio
Male : Female	5 : 11

Of the 16 paediatric patients, 2 were less than

5 years of age, 8 patients were between 5- 10 years of age and 6 patients above 10 years of age.

7 patients had left sided, 7bilateral and 2 patients had right sided TMJ ankylosis. The commonest maxillo-facial findings were hemifacialmicrosomia, retrognathia, mandibular hypoplasia, facial asymmetry, rounding of molar prominence, prominent antegonial notch and reduced mouth opening.

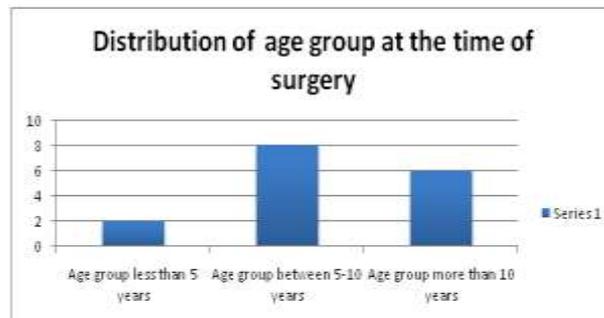


Fig. 1: Distribution of age group at the time of surgery

Pre-operative airway assessment was done by the anaesthesiologist allotted for the case. All the 16 patients presented with Mallampati class IV. Mouth opening was restricted in all the patients. Neck movement was normal. The inter-incisor distance, thyro-mental distance and sterno-mental distance were noted from the surgeon's recordings. The mean inter-incisor distance was found to be 6mm. Thyro-mental distance was also found to be reduced in all the patients, with a mean of 4cm. Sterno-mental distance was also reduced to a mean of 9cm. Written informed consent was obtained from the caregivers after the explanation of anaesthesia procedures.

Standard NPO guidelines were followed for all the patients: NPO for solid foods 8 hours, breast milk 4 hours and for clear liquids 2 hours before surgery. 9 patients were pre-medicated with tab ranitidine, 2-4 mg/kg body weight along with inj. glycopyrrolate 0.2 mg IM an hour before surgery. 7 patients were given oral atropine 0.6mg 45minutes before surgery. No sedative pre-medications were used for any of the patients.

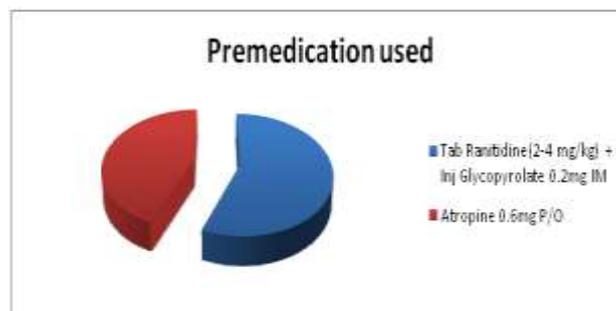


Fig. 2: Premedication used

A range of techniques were found to be used for induction, maintenance, extubation and pain control

from the notes reviewed. All 16 patients were induced and intubated in the theatre. Of the 16 patients, 4 (33.33%) patients had inhalational induction and the rest 12 (75%) patients had intravenous induction. Fiberoptic guided nasal intubation was attempted in all patients. In one of the cases, where awake fiberoptic intubation failed on first attempt and visualization was obstructed due to bleeding and secretions, blind nasal intubation was tried and was successful. One case was postponed due to failed intubation both with fiberoptic bronchoscopy and blind nasal techniques. Patient was rescheduled after 1 week and was successfully intubated through fiberoptic bronchoscopy.

All patients were monitored with non-invasive blood pressure, heart rate, ECG, pulse oximeter and precordial stethoscope during perioperative period. Before induction, the paediatric fiberoptic bronchoscope (2.8mm) was checked, prepared and a flexometallic tube of appropriate size for age threaded over it. After 5min of preoxygenation, inj. fentanyl 1.5µg/kg was given to coincide with intubating time of approximately 5 minutes in all the patients.

Inhalational induction using incremental concentration of sevoflurane in 100% O₂ delivered through Jackson Rees breathing system was done in 4 (25%) patients, who also received intravenous ketamine 2mg/kg and midazolam 0.02 mg/kg as an aid to awake fiberoptic intubation. Following successful tracheal intubation, position of the endotracheal tube was confirmed by capnography. Non depolarizing muscle relaxant atracurium was used in all the four cases. Maintenance of anaesthesia was achieved with isoflurane in O₂ and N₂O.

In the other 12 (75%) patients, intravenous induction using propofol 1mg/kg was employed. 3 out of 12 patients had regional analgesia techniques supplementation (superior laryngeal nerve block and

trans tracheal block given with 2% lignocaine). Non depolarizing muscle relaxant vecuronium was used in 4 cases and atracurium was used in 8 cases following successful tracheal intubation. Anaesthesia was maintained intraoperatively with isoflurane in O₂ and N₂O.

Residual neuromuscular blockade was reversed using neostigmine 0.04 mg/kg and glycopyrrolate 0.02mg/kg. All patients were shifted to post-operative ward with endotracheal tube in situ with cuff deflated. Six patients (37.5%) self-extubated within 6 hours of shifting, while the other 10 (62.5%) patients were extubated 24 hours post operatively over Cook's airway exchange catheter.

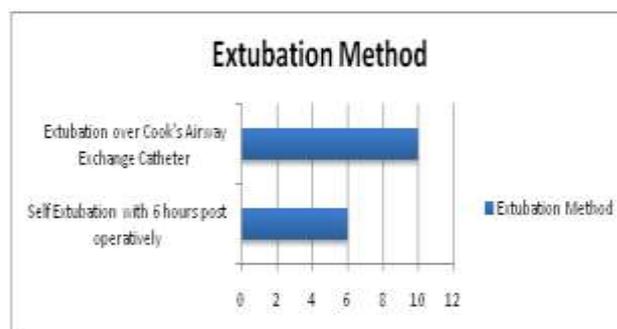


Fig. 3: Extubation method

Intraoperative analgesia was provided with inj. fentanyl in all the patients. Postoperative analgesia was provided primarily with paracetamol suppositories.

After the results of the audit were analysed, we prepared a questionnaire to evaluate the knowledge & practices of airway management amongst our colleagues in the department. This helped us to constitute a protocol for anaesthetic management of TMJ ankylosis, particularly so, in paediatric age group.

Institutional Protocol for management of Paediatric Difficult Airway

1. Pre-anaesthetic evaluation to be done by concerned consultant anaesthesiologist posted for the case. Yes/No
2. Would you like to give sedative premedication for a child with DA? Yes/No
3. If Yes, what is your choice?
 - a) Trichlorophos 70-100mg/kg for <10kg; Oral midazolam (0.5mg/kg) / nasal midazolam (0.2mg/kg) for 10-20kg; Tab Diazepam 2.5mg for >20 kg
 - b) Oral/nasal midazolam
4. Tick whichever you would like to use as anti-sialogogue
 - a) Oral atropine: 0.3mg P/O for <10kg; 0.6mg P/O for 10-20kg.
 - b) Inj. glycopyrrolate 0.2mg IM for >20kg
5. How long do you pre-oxygenate?
 - a) 1 min
 - b) 2 min
 - c) 3 min
 - d) 4 min
 - e) 5 min
6. Tick intra-operative monitors used:
 - a) ECG (lead II)
 - b) SpO₂
 - c) NIBP

- d) Precordial stethoscope
 - e) Temperature
- Any other monitors: Please mention.....
7. When would you like to give inj. fentanyl (2µg/kg): Before induction / At induction / After intubation
 8. When would you like to place intravenous cannulation : Pre induction / Post induction
 9. What is your choice of induction? Inhalational / Intravenous
 10. Choice of inhalational agent: Halothane / Isoflurane / Sevoflurane
 11. Method of induction:
 - a) O₂ : N₂O : Sevoflurane
 - b) O₂: Sevoflurane
 - c) O₂: Propofol
 - d) O₂: Sevoflurane: Ketamine
 12. Choice of intubation technique (Please arrange according to your preference)
 - a) FOB
 - b) Blind nasal
 - c) Retrograde intubation
 - d) Tracheostomy
 - e) Bonfill's Retro-Molar scope
 - f) I-LMA
 13. If FOB is first choice
 - a) FOB with sevoflurane
 - b) FOB with ketamine sedation
 - c) FOB with propofol sedation
 14. Choice of muscle relaxant: Vecuronium / Atracurium
 15. Does succinylcholine have a role to play in TMJ ankylosis?
.....
 16. Plan of extubation
 - a) On table
 - b) Post-op after.....hours
 - c) Patient self extubates
 17. Age at which airway blocks are to be attempted:
 18. Cuff to be deflated before shifting to post op? Yes/ No
 19. Method of extubation: Over tube exchanger Yes/ No

DISCUSSION

In this audit, ventilation and intubation difficulties occurred in one patient (6.25%) at induction, where intubation was not feasible with either fiberoptic or blind nasal intubation. There were no intra-operative cardiac arrests observed.

Our review confirms that there is indeed a wide range of anaesthetic practices employed and that no standard techniques are observed in the airway management of paediatric patients presenting for TMJ Ankylosis repair. Anaesthetic management generally depends on patient comorbidities, anaesthesiologists' preferences and hospital practices.

Children with TMJ ankylosis are anticipated to have difficult intubation because of reduced mouth opening and limited protrusion of lower jaw. Mandibular hypoplasia and unequal growth of two halves of mandible makes mask ventilation difficult as well [1]. In developing countries, children having TMJ ankylosis present at later stages with severely reduced mouth opening when, conventional method of intubation with direct laryngoscopy is usually not possible. Different methods for airway management like tracheostomy, blind nasal intubation and fiberoptic

intubation are mentioned in literature. Tracheostomy is usually considered as last option in paediatric age group because of high incidence of complications associated [2].

Awake fiberoptic intubation with topical anaesthesia in anticipated difficult airway is regarded as the safest approach [3]. Our audit revealed that awake fiberoptic intubation was attempted in 15 (93.75%) out of 16 patients. The anaesthesiologists were successful in securing the airway via fiberoptic guided nasal intubation in 14 (87.5%) out of 16 cases either awake or sedated. Topical anaesthesia of airway improves child's acceptance of an airway device and blocks airway reflexes. It can be used as a sole technique or in conjunction with either inhalational or intravenous induction. Our review has shown that 3 (18.75%) out of 16 patients received airway blocks as an aid to awake fiberoptic guided intubation, all of whom were above 12 years of age. No data regarding the use of topical anaesthesia during or after induction in the other patients were documented. Introduction of epidural catheter through injection port of bronchoscope can be used for lignocaine injection as an alternative to trans-laryngeal block as used by Long TE *et al.* [4].

The incidence of failure to intubate and ventilation difficulty was found to occur in 1 (6.25%) out of 16 patients, where the anaesthesiologist failed to secure the airway by fiberoptic guided intubation technique on first attempt. Successive attempts via fiberoptic guided method didn't yield any success as the visualization was blurred due to excessive secretions and blood, following which a single dose of succinylcholine was used after confirming bag and mask ventilation. Blind nasal technique was then attempted to secure the airway. When even this failed, after two attempts, the patient was ventilated with 100% O₂ till the return of consciousness and surgery cancelled. The surgery was rescheduled after 1 week when intubation was achieved via awake fiberoptic technique.

In anticipated difficult airway situations, induction of anaesthesia can be either intravenous or inhalational. Intravenous anesthetics can precipitate sudden loss of airway control and apnea, which may result in cannot intubate or ventilate situation [5].

Inhalational induction is preferred as spontaneous breathing can be preserved in this technique. Small dose of fentanyl given 5 minutes before intubation blunts the haemodynamic responses to tracheal intubation [6]. Our study revealed that inhalational induction using sevoflurane was used in 4 (25%) out of 16 patients who also received concomitant dose of intravenous ketamine and midazolam as an aid to awake fiberoptic intubation. Sevoflurane has been shown to be a useful agent for inhalational induction, as it has a blood gas solubility of 0.69 and is least irritating to the airway. It has been used for the management of difficult paediatric and adult airway and has an important role because the depth of anaesthesia can be rapidly altered and the patient can be awakened if airway cannot be secured [7]. Although the speed of induction with high concentration of sevoflurane may not be desirable because of an increased risk of respiratory depression, consensus appears to favour either stepwise approach of increasing the inspired concentration by 1-2% quickly or by pre-oxygenation followed by starting at higher concentrations [8]. Intravenous induction using propofol was used in 12 (75%) out of 16 patients. A silicone based wire reinforced tracheal tube with hemispherical bevel reduces nasal bleeding and is easy to railroad over the bronchoscope [9]. Intravenous fentanyl was used in all the cases prior to attempted intubation.

CONCLUSION

As our hospital is equipped with craniofacial department and we have a wide range of patients presenting for corrective surgeries, we could conduct this audit and observe the different techniques of airway management. The questionnaire developed to study the airway management by different anaesthesiologists also helped us to develop a department protocol for the management of TMJ ankylosis. Presently, all these

cases are managed under awake or sedated nasal fiberoptic intubation followed by muscle relaxation with 2 experienced consultants in the theatre and the surgeon ready for tracheostomy in case of any airway loss; if any difficulty is encountered while intubating, the patient is awakened and rescheduled on a later date. We also recognized that the fiberoptic bronchoscope is very important equipment and is always the first choice for intubation in difficult airway. But using it requires training and practice on normal airways before venturing into a difficult airway scenario. This has increased our understanding that the anaesthesia trainees require to be exposed to and educated about the same during the training years.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the contributions of the Department of Anaesthesiology, K.S.Hegde Medical Academy, Nitte University in helping us to conduct this audit successfully.

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