

**TRACHEOSTOMY IN CHILDREN: A CLINICAL STUDY**T. Shankar<sup>1</sup>, K. Nagaraj<sup>2</sup><sup>1</sup>Professor, Department of ENT, Osmania Medical College/Govt. ENT Hospital, Koti, Hyderabad.<sup>2</sup>Assistant Professor, Department of ENT, Osmania Medical College/Govt. ENT Hospital, Koti, Hyderabad.

**ABSTRACT:** A tracheostomy is a small, surgical opening from the skin to the anterior wall of the trachea, pediatric patients for whom tracheostomy is more hazardous than adults, consideration have different anatomy, medical conditions, and prognoses than adults, even the tracheostomy tubes are different in size, the indications for tracheostomy in children include, bypassing airway obstruction (Laryngo- tracheobronchitis, epiglottitis), providing access for prolong ventilation, and facilitating tracheo-bronchial toilet, to day prime indication for pediatrics tracheostomy is subglottic stenosis. We have reviewed experience with 84 tracheostomies under 13 years of age in our hospital. We are here discussing the common indications and complications, difficulty in decannulation in pediatric patients, in our study the common indication is the foreign body bronchus followed by other conditions.

**KEYWORDS:** Children, Epiglottitis, Mechanical Ventilation, Subglottic Stenosis, Trachea.

**HOW TO CITE THIS ARTICLE:** T. Shankar, K. Nagaraj. "Tracheostomy in Children: A Clinical Study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 91, November 12; Page: 15665-15668, DOI: 10.14260/jemds/2015/2253.

**INTRODUCTION:** It is a lifesaving surgical procedure in which an opening is made in the anterior wall of the trachea along with the underlying soft tissues, so as to make a communication is maintained with the help of a specially designed tube. The tracheostomy either temporary or permanent accordingly with situation. Tracheotomy is the procedure where only the tracheal wall is incised without making an permanent ostium in the anterior tracheal wall, usually performed in children.

**ANATOMY OF TRACHEA:** The upper end of the trachea is attached to the lower border of the cricoid cartilage at the level of 6<sup>th</sup> cervical vertebra to its bifurcation at the level of the upper border of 5<sup>th</sup> thoracic vertebra.

It is about 10-12cm in length in adults, and its lumen is kept patent by about 20 horse shoe-shaped membrano-cartilaginous rings. The upper 6 rings in the neck and lower 10-14 rings are in the thorax. Mucosa is pseudo-stratified ciliated columnar epithelium. The trachea divides at the carina at the level of upper border of the 5<sup>th</sup> thoracic vertebra in to the right and left main bronchus.

**PRINCIPALS OF TRACHEOSTOMY:**

1. Acts as respiratory bypass in acute laryngeal or upper airway obstruction and relieves respiratory distress.
2. Tracheo-bronchial suction in cases of comatose patient.
3. Reduces dead space air (30-50%) thereby improves respiratory insufficiency.
4. Positive pressure ventilation in respiratory failure cases.
5. Relieves alveolar hypoventilation in pulmonary and chest wall diseases.

6. Relieves alveolar hypoventilation in pulmonary and chest wall diseases.
7. Reduces airway resistance and helps pulmonary ventilation.
8. Pathway to deliver medication or humidification.
9. Enables swallowing and speech without reflex apnoea.

Normal function of the larynx includes protecting the lower airway, regulating airflow, and contributing to Phonation.<sup>(1)</sup> in children, the larynx is located more cephalad than in adults, so mandible also provides some protection.<sup>(2)</sup> as children develop the proportion of the larynx supporting phonation increases, accompanying increasingly sophisticated vocalization skills. Most of the authors consider the subglottis to be the narrowest part of an infants larynx but some authors consider the vocal cords, to be the narrowest part.<sup>(3)</sup> the morbidity and mortality associated with tracheostomy in children is greater than in adults.<sup>(3,4)</sup> and the younger the child the greater the risks.<sup>(5)</sup>

**INDICATIONS FOR TRACHEOSTOMY:** Indications for pediatric tracheostomy includes bypassing upper airway obstruction, providing access for prolonged mechanical ventilation, and facilitating tracheobronchial toilet.<sup>(6,7)</sup> Generally a greater proportion of pediatric tracheostomies are performed to bypass upper airway obstruction. Whereas in adults a large proportion of tracheostomies are performed to support long term mechanical ventilation.<sup>(8)</sup> the upper airway obstruction of infectious origin was the main reason for which the children were submitted for most of the time in an emergency basis.<sup>(9)</sup>

**Today the main indications are:**

- Prolonged oro-tracheal intubation (OTI).
- Laryngotracheal stenosis.
- Upper airway obstruction caused by cranio-facial malformations.
- Hypoventilation associated with neurologic disorders such as brain palsy.<sup>(10)</sup> since the survival of children with these congenital and neurological disorders is on the rise a greater number of tracheostomy are being done in such patients.

Financial or Other, Competing Interest: None.

Submission 22-10-2015, Peer Review 23-10-2015,

Acceptance 31-10-2015, Published 11-11-2015.

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DOI:10.14260/jemds/2015/2253.

In pediatric patients the tracheostomy is more challenging and it is associated to a high mortality and morbidity when compared to the adult patients.

**MATERIALS AND METHODS:** This prospective study conducted in the department of ENT, Govt. ENT Hospital/Osmania medical college, Hyderabad from 2006 to 2014. Total 84 children have been operated for emergency as well as elective Tracheostomy. All the patients under 13 years with both sexes are included in this study. All the patients were admitted and evaluated and operated, among 84 cases 72 cases were done emergency tracheostomy and 12 patients subjected for elective tracheostomy the intra operative and post-operative complications were analysed in relation to the age of the patient and type of surgery (Either emergency or elective) The aim of this study is to analyse the indications and complications associated with tracheostomies carried in pediatric patients in our institute.

**RESULTS:** In our study the total no of 84 cases were operated, among this 32(38%) were girls and 52(62%) were boys. The youngest was 03 months old and the oldest was 13 years, the commonest indications (Table-I) was airway obstruction in 72 patients (93.2%) followed by prolonged OTI in 07 patients (4.1%), severe SOAS in 03 patients (1.9%) and pulmonary.

Among the pediatric patients subjected for tracheostomy the most common indication in our study was foreign body bronchus like custard apple seed, tamarind seed, aspiration of small plastic objects, aspiration of food particles, then followed by recurrent laryngeal papilloma, one patient with mucoepidermoid carcinoma in trachea was operated by us after elective tracheostomy.

In our study the overall complication rate was 21% among this 11% were early, 8% were intermediate, and 2% were late complications, in our series there were four deaths occurred because of the patients reported us in a late stage (03 cases of foreign body bronchus of long duration, 01 patient with recurrent respiratory papilloma with severe stridor).

**DISCUSSION:** Tracheostomy is one of the oldest surgical procedure known.<sup>(11)</sup> it has been routinely used since the middle of the 19<sup>th</sup> century, when Armand Tronseau improved the technique in order to treat diphtheria patients with dyspnea.<sup>(12)</sup> in late 1970 tracheostomy as a primary treatment in the management of LTB and epiglottitis was abandoned in favour of naso-tracheal intubation.<sup>(13,14)</sup> The main indication for tracheostomy in the pediatric patient from our hospital where the study was conducted was airway obstruction (93.2%), prolonged orotracheal intubation and other causes (6.8%) among the airway obstruction in our study was foreign body bronchus, despite the variability in indication seen in the present study, we have noticed changes in the indications for tracheostomy in children along the years.<sup>(15,16)</sup>

The foreign body bronchus was most popular indication for patient in our institute, among this the common foreign body was custard apple seed and aspiration of food particles in to the trachea, the next followed in our study was respiratory papillomatosis, treatment based on papilloma excision in order to keep the airway patent, however in some cases the disease is highly recurrent resulting in air way obstruction, and then tracheostomy is necessary.

In cases of laryngotracheal stenosis it is indicated to observe and follow the patient up when the obstruction causes respiratory distress to the child, in most of the cases, tracheostomy is needed to relieve the respiratory distress in order to secure the airway in the postoperative period, or when it is necessary to wait for the child to grow in order to carry out the surgery.

In laryngeal diphtheria with stridor in our study we have operated 06 cases to relieve the respiratory distress, and since it was a infectious disease the patient was sent back to institute of communicable diseases for further management. Laryngomalacia treatment is based on observation and follow up in majority cases since the symptoms tend to spontaneously regress before second year of life, in some cases, the disease has a severe laryngomalacia and tracheotomy becomes necessary.

We have operated (Endoscopically) one case of mucoepidermoid carcinoma in trachea, after doing tracheostomy since the patient presented us with stridor, HPE was shown mucoepidermoid carcinoma, still patient is under follow up for last 18 months, no recurrence is seen, the diagnostic bronchoscopy was done there was no recurrence the patient was decannulated after one year.

Line et al reported that 50% of children who did not have airway established before tracheostomy, developed severe life threatening complications.<sup>(17)</sup> always advised to have anaesthetist to secure airway than only do tracheostomy in children post operatively all the children managed in pediatric intensive care unit, until the first tube change, we feel these measures are most important in keeping early complication to a minimum. The technical aspects of the procedure remain controversial, particularly the type of tracheal incision, in children excision of the anterior wall of the trachea will results in tracheal stenosis.

We have used a vertical incision in all patients in the trachea without any difficulties at the first tube change or stenosis at the time of decannulation. Hotaling et al used the Bjork flap, stating that it is less dependent on the cannula to maintain airflow patency, however 3.5% of their patients developed tracheal stenosis.<sup>(18)</sup> another important point is the siting of the tracheostomy at the appropriate level, the larynx in the infants and children is higher in the neck than in the adults, if dissection is done too low in the neck the complications are more.

Seven of our 84 children had serious complications – 04 tube displacements and 03 tube obstruction. Tube displacement is commonly reported both early and late after surgery when it occurs before the trachea-cutaneous fistula is well established, reinsertion of tracheostomy tube is difficult and creation of a false passage can make matters worse, preventive measures are to use the correct size of tracheostomy tube.<sup>(19)</sup> Tracheostomy tube obstruction continuous to be the commonest cause of tracheostomy related death.<sup>(20,21)</sup>

The importance of regular suction, the use of humidification and tube changes cannot be over emphasized to nursing staff and parents.

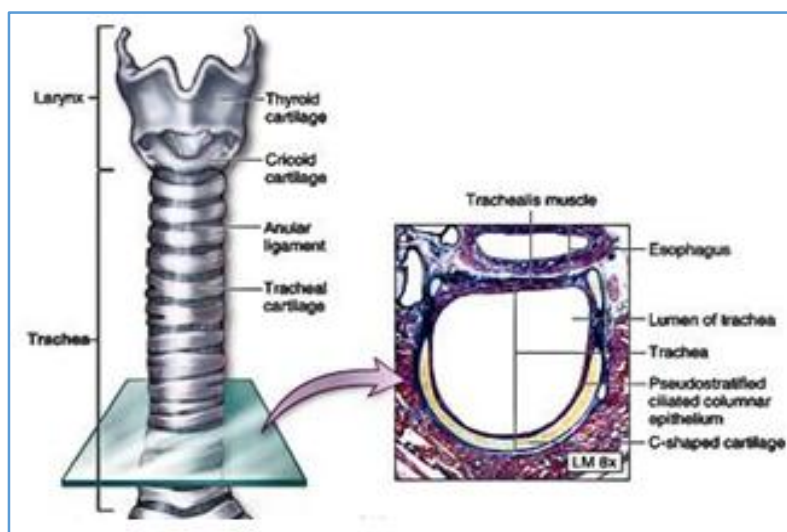
With improvements in the surgical technique along with the years available sophisticated instruments, the development of care programs, and improvement in the postoperative follow up, a decrease in tracheostomy related complications is expected. The integration of a multidisciplinary team has helped much to enhance the quality of life and also the survival of these tracheostomised

children. In our study the pediatric population, tracheostomies have proven to be a safe procedure, which main function is to maintain the airway properly for ventilation.

**CONCLUSION:** Tracheostomies in pediatric patients are most frequently performed to manage airway obstruction and pulmonary disease. Infants tolerate prolonged intubation better than adults, but complications like sub glottis stenosis, can occur most of the complications can be avoidable by meticulous surgical procedure and postoperative tracheostomy care by skilled staff. The most frequent postoperative complication were tracheostomy tube displacement and accidental decannulation.

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**Fig. 1: Anatomy of Trachea.**



**Fig. 2: Intra Op Photo**



**Fig. 3: Patients with Tracheostomy tube in site**

Indication	Patient (%)
1. Airway obstruction	72 (93.2)
2. Prolonged OTI	07 (04.1)
3. Severe SOAS	03 (01.9)
4. Pulmonary clearance	02 (0.8)
<b>TOTAL</b>	<b>84 (100)</b>

**Table I: Indication for Pediatrics Tracheostomy**

In our study the common cause for airway obstruction for pediatric tracheostomy is foreign body bronchus (70.6%), remaining other indications falls in 29.4%, diseases like laryngeal diphtheria, recurrent laryngeal papilloma, bilateral vocal cord palsy, sever laryngomalacia and tracheal tumor. (Table – II)

Indication	Patient (%)
1. Foreign body bronchus	46 (70.6)
2. Recurrent Laryngeal Papilloma	10 (15)
3. Bilateral Vocal cord palsy	08 (6.4)
4. Laryngeal Diphtheria	06 (05)
5. Severe Laryngomalacia	03 (2.3)
6. Tracheal tumor	01 (0.7)

**Table II: Diagnosis of the patients submitted to tracheostomy because of airway obstruction**