Acta Scientific Otolaryngology (ISSN: 2582-5550)

Volume 5 Issue 4 April 2023

Research Article

Unraveling the Evolving Trends of Pediatric Tracheostomy- An Overview at a Tertiary Care Center

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DOI: 10.31080/ASOL.2023.05.0552

Received: February 17, 2023

Published: March 24, 2023

Abstract

Otolaryngologists have long been concerned with pediatric airway care because of the vast range of problems that can arise in these situations. Tracheostomy was practiced in Greece, according to historical documents, and ever since it has served as the cornerstone of medical administration. Through bypassing any upper airway obstructive pathology, pediatric tracheostomy lessens dead space and, hence, the lung work load. It also gives access to suction and airway clearing. As medical technology has advanced throughout time, the indications and length of tracheostomies done on pediatric patients have changed. Our aim was to study the indications and the timing of performing tracheostomy in paediatric population at a tertiary care set up and to assess the complications and outcome for successful decannulation.

The most frequent cause for prologed tracheostomy was Guillain Barre in children. They had good outcomes, including successful decannulation once their general health stabilized. The most frequent cause of death in our research population was cardiac arrest, with tube displacement and lower respiratory tract infection as the most frequent sequelae. Longer tracheostomy durations with a delay in decannulation were linked to longer PICU stays and longer hospital stays. The decannulation was successful in almost all instances, but the socioeconomic status, carer awareness, and general health of the patient determined the speed of weaning off and post-tracheostomy rehabilitation. Even in a developing nation like ours, improved access to intensive care units and medical progress have changed the way that children tracheostomies are thought of.

Keywords: Pediatric Tracheostomy; Tracheostomy; Airway Management; GB Syndrome; Prolonged Intubation

Introduction

Pediatric airway management has always been a major concern for otolaryngologists due to the wide spectrum of complications associated with such cases. Ancient records have shown it to be performed in Greece and since then it has stood as cornerstone in medical management [1]. Pediatric tracheostomy helps by reducing dead space and thus the lung work load, it also bypasses any upper airway obstructive pathology, and provides access to suction and clear the airway. Tracheostomy performed for pediatric patients has seen a changing trend in indication and duration as medical science has evolved over the years [2]. Decades ago, the primary indications of tracheostomy were infective epiglottitis, laryngomalacia, diphtheria, but with the advent of better antibiotics and vaccination for pertussis, Corynae bacterium diphtheriae, whooping cough, H. Influenza a decline of such conditions has occurred [3,6,17]. Meanwhile as the quality of pediatric ICU and ventilatory support has risen more children are sustaining on ventilators for a longer time and require tracheostomy as indicated for prolonged intubation [4]. Between the 19th and 20th century the studies done in the west have shown upper airway obstruction as a common indication after infections of larynx and trachea [1,2]. Trauma and burns causing airway compromise have increased as a result of fast urbanization and industrialization. Better ventilatory support via tracheostomies has led to syndromic babies having higher survival rates [5]. studies have shown that for indications of craniofacial anomalies and upper airway obstruction and infections the timing of tracheostomy is invariable between birth to 4 years of age, while trauma and neurological indications need tracheostomy at a later age beyond 5 up to 15 years [6].

Not much literature is available regarding the decannulation timing and its success or failure rate which is a prime concern to restore the patient as the general condition improves. We have attempted to identify risk factors for failure of decannulation and the timing as well [7].

Materials and Methods

A retrospective study was performed on all PICU patients who had undergone tracheostomy during the three-year study period. Patient data was reviewed for the following variables: gender, age at the time of tracheostomy, diagnosis, primary indication for tracheostomy, length of stay in intensive care unit before and after tracheostomy decannulation, complications, mortality and cause of death. The final data was analyzed using SPSS software version 21 and Excel. Categorical variables are given in the form of frequency table. Continuous variables are given in Mean ± SD/ Median (Min, Max) form.

Results and Discussion

Data contains measurements on 30 subjects whose age ranges from 3-17 years with mean age 9.4 ± 4.39 years. The following table gives the summary of data. Out of 30 subjects, 13 (43.3%) were female and 17 (56.7%) were male. About 36.6% of the subjects were diagnosed with GB syndrome. While analysing indications, it was observed that 10 patients (33.3%) had Respiratory Muscle Weakness, followed by prolonged intubation in 9 patients (30%) and 8 patients (26.7%) had respiratory distress. The mean of duration of tracheostomized days was found to be 14.83 ± 5.86 days almost 2 weeks being a minimum. Out of all the subjects, 25 (83.3%) subjects had successful decannulation. The mean of ICU/Hospital stay was 12.4 ± 5.41 days. Majority of subjects did not have any complication which was observed in 21 (70%).

The commonest indication was respiratory failure due to muscle weakness, of which GBS accounted for maximum number of cases. Complications such as VAP was found in 20% developed VAP due to prolonged mechanical ventilation, permanent scar with poor healing was found in 11% of children more so in those with poor home care leading to local infection and sloughing. figure 3 shows the distribution of GB Syndrome subjects with kind of indication, Duration of trach- days, decannulation and ICU/Hospital stay. It can be observed that among GB syndrome subjects, majority had respiratory muscle weakness over duration of trach days and ICU/hospital stay. The table 2 shows the distribution of non-GB syndrome subjects with kind of indication, Duration of trach- days, decannulation and ICU/Hospital stay wherein we can see the trend of timing of tracheostomy changes based on indication.

In our study, most of the children who underwent tracheostomy were males and above the age of 5 years with the mean age of 9.4 years. Over a period of time, we have witnessed a shifting trend in the indication for pediatric tracheostomy, from acute infections to prolonged intubation for keeping the patient on ventilatory support, which has been noted world over [2] and we have found the same in our study, done at a tertiary care center in south India. In several other studies such as Al Samari., *et al.* and Mahadevan., *et al.* done in the developing nations we also found head injuries contributing to a great number in the cause for pediatric tracheostomies, in our study 13% cases had traumatic head injuries requiring tracheostomy for prolonged mechanical ventilation [4].

Ahmet et al have concluded in their study found that in 73.2% of patients the indication was prolonged intubation [6]. Jessicca., *et al.* conducted a study to describe the outcomes and indications of pediatric tracheostomies and found results suggestive of findings similar to ours that majority which was 93.6% tracheostomies were elective [7].

GB syndrome

In GBS life threatening respiratory failure can occur and these children require prolonged mechanical ventilation and thus become candidates for tracheostomy. Literature shows that the need for this mechanical ventilation varies widely from weeks, to months and in some cases even years [13]. There are multiple factors to consider in these cases of GBS due to age, risk of permanent scar, and tracheal stenosis also found in our study among 3 patients, making decannulation challenging.

Immunoglobulins and plasma exchange is the prime management of GBS [13].

The predictors of prolonged ventilation are mainly the muscle weakness, as seen in previous studies like Christa Walgaard., *et al*. [13] the limb weakness and that of deltoid. We found in our study that patients with serology positive status responded well to immunotherapy and improved. We also found that by using the deltoid muscle weakness as a prognostic indicator for those on ventilators, as 61.8% of the GBS patients who were able to lift arms against gravity with deltoid power improvement needed shorter duration of tracheostomy as against the 38.9% who were unbale to lift arms against gravity and needed tracheostomy for months together with a maximum of 4 months [15-17]. Few studies have tried to corelate duration of tracheostomy with anti -GQ1b antibodies but at our set up such investigations were unavailable being one of our limitations [13,15].

Decannulation

Decannulation was done in a step wise manner, after patients maintain saturation without oxygen and ventilatory support they were monitored for a minimum of 24 hours, underlying respiratory infection was ruled out using chest radiographs and regular tube suctioning, after which we placed fenestrated tubes and blocked them after deflating the cuffs for short durations initially and then 12 hours and lastly 24 hours to make sure the patients were able respire efficiently after which decannulation was done and strapping of the stoma was done.

Caroline Coab., *et al*. have seen that 91% children were successfully decannulated in the 1st attempt and an overall decannulation success rate being 97.1%, in neonates' prematurity led to poor candidature for short tracheostomy periods and quicker decannulations [8]. A. Alladi., *et al*. The decannulation period varied from 2 days to 4 months and they too have witnessed a similar change in the indications [7]. We, in our study were able to successfully decannulate 98% of our patients, we primarily faced difficulty due to ventilator acquired pneumonia and thick secretions which delayed the decannulation as well as poor general condition, due to respiratory muscle weakness as seen in GB syndromes making the child a candidate for prolonged tracheostomy [9]. Two cases of subglottic stenosis and tracheal stenosis and underwent LASER for the same, after which they were decannulated. There is no single or commonest cause for a failed decannulation as concurred form literature. Large multicentric prospective trials will be needed to conclude such a cause.

Guidelines of tracheostomy are based on indication and the general condition, but when it comes to timing decannulation so it must be tailored to the case. Securing the airway is the most important factor and must not be compromised in an attempt of early or untimely decannulation [10].

Complications

The complications encountered are early and late, early include bleeding, tube displacement, respiratory distress, late includes tracheo-cutaneous fistulas, wound site infection, subglottic stenosis. We encountered that in pediatric cases the tubes are small & delicate tend to get easily pulled to the one side by the tug of ventilator tubing's causing one sided lung collapse, and respiratory distress.

In the late period we found inadequate clearance of secretions leading to a mucous plug blocking the bronchi and causing desaturation, wherein it was difficult to reach these plugs and restore adequate air entry. We also found granulation tissue over skin & stomal site needing intervention followed by wound site infection [18].

Several studies regarding pediatric tracheostomies have been conducted at centres for pediatric surgery or paediatric cardiac surgery, these children already have poor general conditions and hence are invariably candidates for prolonged tracheostomy [19,20] so the data regarding the mortality following tracheostomy cannot be extrapolated to centres elsewhere receiving a more varied variety of cases such as ours [21]. Mortality among the patients in our study was just 3% mainly due to respiratory failure or cardiorespiratory arrest and it too must be considered while planning the course of management in tracheostomized patients [22,23].

Conclusion

Almost all our pediatric tracheostomies were elective. The most common indication for tracheostomy in children was long-term intubation due to need for prolonged ventilation followed by

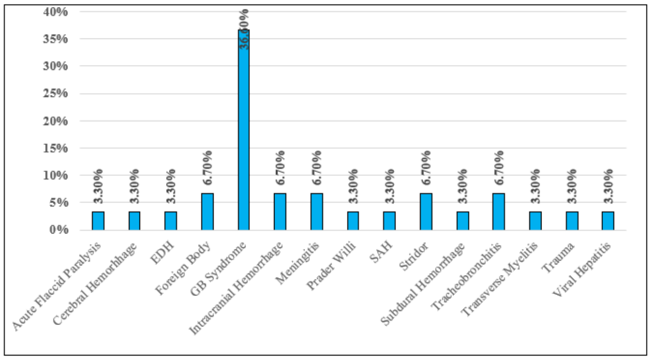

Figure 1: Distribution of subjects according to diagnosis.

Figure 2: Distribution of subjects according to indication

Figure 3: Distribution of GB Syndrome subjects with other variables.

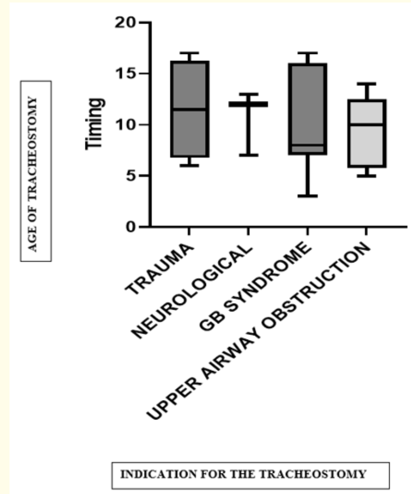

Figure 4: Shows the timings of tracheostomy and age of the patient based on the indications.

Variables	Sub Category	Number of subjects (%)
Age (years)	1 to 10	19 (63.3%)
	11 to 20	11 (36.7%)
	Mean ± SD Median (Min, Max)	9.4 ± 4.39 8.5 (3, 17)
Gender	Female	13 (43.3%)
	Male	17 (56.7%)
Diagnosis	Acute Flaccid Paralysis	1 (3.3%)
	Cerebral Haemorrhage	1 (3.3%)
	EDH	1 (3.3%)
	Foreign Body	2 (6.7%)
	GB Syndrome	11 (36.6%)
	Intracranial Haemorrhage	2 (6.7%)
	Meningitis	2 (6.7%)
	Prader Willi	1 (3.3%)
	SAH	1 (3.3%)
	(DIPTHERIA)	2 (6.7%)
	Subdural Haemorrhage	1 (3.3%)
	Tracheobronchitis	2 (6.7%)
	Transverse Myelitis	1 (3.3%)
	Trauma	1 (3.3%)
	Viral Hepatitis	1 (3.3%)

Indication	Obstructive Apnoea	1 (3.3%)
	Prolonged Intubation	9 (30%)
	Prolonged Ventilation	2 (6.7%)
	Respiratory Muscle Weakness	10 (33.3%)
	Respiratory Distress	8 (26.7%)
Duration Of Trach- Days	Mean ± SD Median (Min, Max)	14.83 ± 5.86 15 (5, 26)
Decannulation Successful	No	5 (16.7%)
	Yes	25 (83.3%)
ICU/Hospital stay	Mean ± SD Median (Min, Max)	12.4 ± 5.41 10 (4, 25)
Complications	None	21 (70%)
	Bleeding	2 (6.7%)
	VAP	6 (20%)
	Vocal Polyp	1 (3.3%)
Mortality	No	22 (73.3%)
	Yes	2 (6.7%)

Table 1: Summary of data showing the distribution of the patients and the diagnosis, duration of tracheostomy, complications and outcomes.

excessive secretions. In syndromic children the commonest cause was SYNDROME followed by craniofacial dystocia their outcome was also good with successful decannulation once general condition improved tube displacement and lower respiratory tract infection was the common complications, and cardiac arrest was the most common cause of mortality in our study population. Longer PICU stay and longer hospital stay was associated with longer durations of tracheostomy with delay in decannulation. The decannulation was successful in almost all cases but the socio-economic strata and awareness of the caretakers and general condition of the patient determined the faster weaning off and quicker rehabilitation post tracheostomy. Better availability of ICU care and advancement of medicine has shifted the paradigm of pediatric tracheostomies even in developing countries such as ours.

Conflict of Interest

The authors declare there is no conflict of interest.

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