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Clinical Study

Retrospective Analysis of Pediatric Tracheostomy

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Purpose. This paper reviews analyses for tracheostomy within our patient population over the last 6 years. *Methods.* We conducted a retrospective chart review of consecutive patients undergoing tracheostomy at the tertiary Dicle University Medical hospital, Turkey, from January 2006 to December 2012. Patient age, sex, emergency, planned tracheostomy, indications, complications, and decannulation time were all assessed. *Results.* Fifty-six (34 male, 22 female) adult Pediatric patients undergoing tracheostomy between 2006 and 2013 were investigated. The most common indication for tracheostomy was upper airway obstruction (66.7%), followed by prolonged intubation (33.3%). Mean decannulation times after tracheostomy ranged between 1 and 131 days, the difference being statistically significant ($P = 0.040$). There was no significant difference in terms of mean age (9.8 ± 6.0; $P = 0.26$). There was also no statistical difference between emergency and planned tracheotomies ($P = 0.606$). *Conclusion.* In our patient population, there was a significant decline in the number of tracheotomies performed for prolonged intubation and an increasing number of patient tracheostomy for upper airway obstruction. According to the literature, permanent decannulation rates were slightly higher with an increase in genetic diseases such as neuromuscular disease.

1. Introduction

Tracheotomy is one of the most frequent planned therapeutic or emergency surgical procedures in critically ill patients. Pediatric tracheotomy was first performed in 1620 [1]. Approximately 200 tracheotomies were performed by Trousseau due to diphtheria with airway obstruction in 1833 [2].

Upper airway obstruction, prolonged ventilator dependence, and hypotonia secondary to neurological impairment are some of the most common indications for tracheotomy in pediatric patients. Tracheotomy is performed by making a cut in the trachea. The small diameter of the infant larynx and trachea means that minor changes due to mucosal edema can quickly lead to severe and even life threatening narrowing of the airway. The infant larynx is hidden by the hyoid bone, since it occupies a higher position in the neck than in adults. The thyroid cartilage has a broad leading edge. Cricoid cartilage is often prominent, and palpation to establish the level of the airway can sometimes be difficult. These anatomical characteristics that differ from those in adults may also make management more problematic.

Although indications concerning timing and complications of tracheotomy in adults have been well described and established, these are still controversial in the pediatric population. Most of these indications and complications, and also decannulation, may exhibit different regional approaches and demographic features.

The purpose of this study was to present our clinical experience with the indications, complications, demographic characteristics, decannulation, and other factors involved in tracheotomy in children and to discuss this experience in the light of the relevant literature.

2. Materials and Methods

We reviewed the records of patients undergoing tracheotomy at Dicle University Hospital, Turkey, between 2006 and 2013. The study was approved by the ethics committee of the university medical faculty (17.12.2012/34). Consent was also obtained from patients' parents. Hospital records of 56 (34 male, 22 female) patients were available for analysis. All patient records were analyzed in terms of indications for tracheotomy, early and late complications, demographic characteristics, and time of decannulation. We perform planned tracheotomy after 10 days, while the patient is still intubated. Early complications were defined as those occurring within the first week of tracheotomy and late complications as those occurring more than one week after. Most of our patients underwent flexible endoscopic (1 mm Karl Storz Hopkins AG, Tuttlingen, Germany) examination before tracheotomy and decannulation.

All tracheotomies were carried out by ear, nose, and throat (ENT) surgeons under general anesthesia. The patient was placed in a shoulder roll to expose the laryngeal and tracheal cartilages. Standard tracheotomy performed at our institution consists of a horizontal midline skin incision, converted to a vertical one in lower skin layers to protect the large vessels of the thyroid plexus and thyroid gland. Following exposure of the trachea, the surgical technique performed then differs between adults and children. Tracheotomy in children involves a vertical incision only, with no removal of any tracheal cartilage. The tracheotomy tube is inserted once anterolateral traction has been fixed with sutures. Postoperative care frequently involves endotracheal aspiration, monitoring of tracheal tube cuff volume, and daily examination to prevent occlusion due to clot, debris, or thick mucus. The first cannula changes are performed seven days after the surgical procedure.

3. Results

Fifty-six children (65% boys, 35% girls) underwent tracheotomy during the six-year study period. Median age of patients at time of tracheotomy was 120 months (range: 28 days–216 months). Mean age of patients was 9.8 ± 6.0 years (Figure 1). The most common tracheotomy clinics, in order, were pediatric intensive care, anesthesia intensive care, and others (Figure 2). We determined no significant differences between emergency and planned tracheotomies ($P > 0.05$). Our other results appear under the following headings.

3.1. Indications. Upper airway obstruction was the most common indication ($n = 37$, 66.7%). Primary causes of airway obstruction were general body trauma ($n = 14$, 25.2%), craniofacial anomaly ($n = 4$, 7.1%), head and neck malignancy ($n = 4$, 7.1%), attempted suicide and hanging ($n = 2$, 3.6%), electric shock ($n = 2$, 3.6%), laryngeal web and stenosis ($n = 2$, 3.6%), laryngeal paralysis ($n = 2$, 3.6%), and foreign body presence ($n = 1$, 1.8%).

The primary causes of prolonged intubation were respiratory failure ($n = 19$, 33.9%), neuromuscular diseases

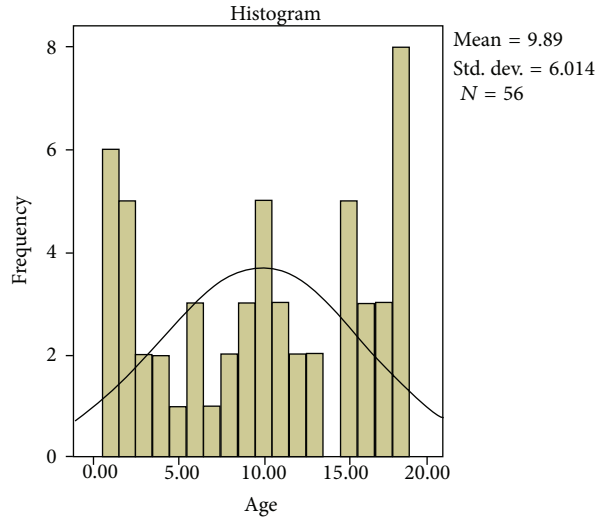

Figure 1: Ages of patients undergoing tracheotomy in our series. The histogram shows the mean and standard deviation values of 56 patients included in the study were found as $\overline{x} \pm \mathrm{SD} = 9.89 \pm 6.01$. According to outcome of the figure, the ages of patients with tracheostomies distributed the all age ranges not collected at a specific group.

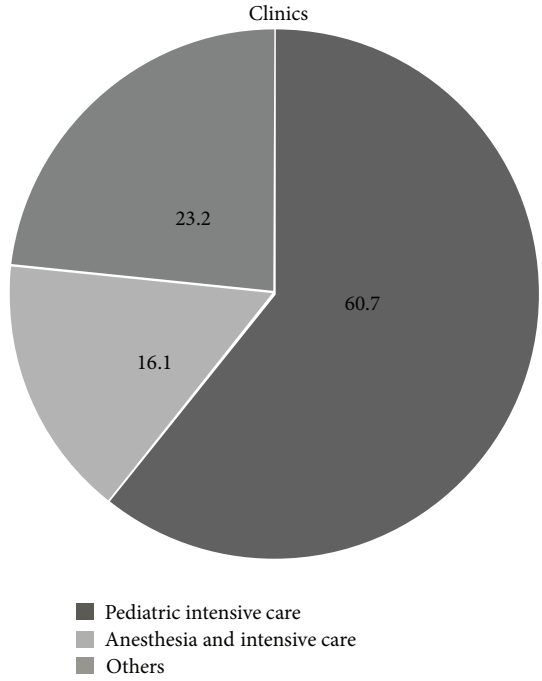

Figure 2: Percent distribution of the most performed tracheotomy clinics. The most performed tracheotomy was found as follows: the pediatric intensive care (60.7%), anesthesia intensive care (23.2%), and other clinics (16.1%), respectively.

($n = 7$, 12.5%), metabolic disease ($n = 6$, 10.8%), postoperative period following major surgery ($n = 5$, 9%), and infection/sepsis-related diseases ($n = 7$, 12.5%). Table 1 shows the indications for tracheotomy.

Table 1: Indications for tracheotomy in our patients.

Indications	*n*	%
General body trauma	14	25.0
Neuromuscular disease	7	12.5
Metabolic disease	6	10.7
Postoperative period following major surgery	5	8.9
Infection/sepsis-related disease	7	12.5
Craniofacial anomaly	4	7.2
Head and neck malignancy	4	7.2
Suicide and hanging	2	3.6
Electricity shock	2	3.6
Laryngeal web and stenosis	2	3.6
Laryngeal paralysis	2	3.6
Foreign body	1	1.8
Total	**56**	**100**

Table 2: Tracheotomy complications in our patients.

Complication	*n*	%
Early		
Accidental decannulation	3	4.7
Pneumothorax	2	3.8
Tube/ventilation problem	2	3.8
Hemorrhage	1	1.9
Late		
Tracheocutaneous fistula	2	3.8
Tracheoesophageal fistula	1	1.9
Suprastomal granulation	2	3.8
Subglottic stenosis	1	1.9

3.2. Complications. Early and late complication rates in our patients were 14.2% and 11.2%, respectively. The most common early complication was accidental decannulation (4.2%), followed by hemorrhage, pneumothorax, and tube/ventilation problems. Late complications were tracheocutaneous fistulae, tracheoesophageal fistula, suprastomal granulation, and subglottic stenosis. Tracheocutaneous fistula and suprastomal granulation are commonly seen late complications. Table 2 shows the specific types and prevalence of these postoperative complications.

3.3. Decannulation. Successful decannulation was observed ($n = 13$, 27.2%) in our patients. Mean decannulation times after tracheotomy ranged from 1 to 131 days.

3.3.1. Statistical Analysis. Mean and standard deviation ($\overline{x} \pm$ SD) values were calculated for continuous variables. All categoric variables were expressed as number of patients and percentages. The chi-square test was used to determine the differences between emergency and planed tracheotomies.

Two-sided P values were considered statistically significant at $P \leq 0.05$. Statistical analyses were carried using SPSS 15.0 for Windows (SPSS Inc., Chicago, IL, USA).

4. Discussion

Indications, techniques, and complications of pediatric tracheotomy have changed over time and due to demographic features. For example, there was an increased incidence of tracheotomy due to genetic diseases, such as neuromuscular or metabolic conditions, in our patients. We attribute this to the frequency of consanguineous marriages in our region. Car accidents and suicide attempts are also noteworthy as indications. There was also no significant difference between emergency and planned tracheotomies in terms of indications, decannulation, and complications ($P > 0.05$). These results indicate an increased indication for intubation in pediatric patients.

Age is an important determinant for disease etiology and complications. According to our results, however, the ages of patients with tracheotomies were distributed through all age ranges and not clustered as a specific group (Figure 1). This suggests that tracheotomy can be performed in all age groups as a matter of course.

Between 1968 and 2005 numerous institutions across the world reported changing indications for tracheotomy, from prolonged intubation to upper airway obstruction [3–6]. Our study suggests a trend toward more tracheotomies being performed for upper airway obstruction. Our results are compatible with those of previous studies. For example, in the 1970s, tracheotomy was commonly performed for acute upper airway involvement due to infectious diseases. Wide use of antibiotics and improvements in intubation and *Haemophilus influenzae* type B vaccine in the treatment of acute epiglottitis or diphtheria have resulted in a major decrease in the indications of tracheotomy for acute infectious diseases [2]. Levels of various indications may therefore rise or fall over time.

As seen from the table, and in contrast to the literature, attempted suicide at an early age, injury from electric shock and traffic-accident-related general physical trauma were particularly remarkable indications for tracheotomy in our study.

Upper airway obstruction is a common indication for tracheotomy in children. Head and neck malignancy, such as respiratory papillomatosis and subglottic hemangiomas, attempted suicide and hanging, electric shock, laryngeal web and stenosis, and presence of foreign bodies were the main etiologies for upper airway obstruction in our patients. Some children with craniofacial syndromes may require tracheotomy secondary to severe glossoptosis or macroglossia and microretrognathia. Congenital laryngeal anomaly, such as web or stenosis, is important for early diagnosis. Flexible endoscopic examination is therefore crucial. Most of our patients underwent flexible endoscopic examination before tracheotomy. Misdiagnosis or a failure to perform tracheotomy promptly may have fatal consequences.

Although tracheotomy is not performed very often, severe complications may result if the surgical rules are not applied. Complications occur in 5% to 40% of tracheotomies, depending on the study design, patient follow-up, and the nature of complications [7]. The early complication rate in the literature varies between 5.6% and 15%, while late

postoperative rates vary considerably (7%–63%) [4, 8]. The rates in this study differed significantly from those in other studies. This may be due to the different patient numbers involved and to different indications and neonatal care clinic capacities. The tracheotomies were also performed in different clinics, as shown in Figure 2. The most common departments where tracheotomy was performed were the pediatric and anesthesia intensive care units. Goldenberg et al. [7] reported in their study of 1130 patients that tracheostomy is most frequently required in patients hospitalized in intensive care. That report is compatible with our results. If the appropriate indications, surgical rules, and strict postoperative follow-up are not adhered to, early (hemorrhage, accidental decannulation, pneumothorax, and tube/ventilation problems) or late (tracheocutaneous fistulae, suprastomal granulation tracheoesophageal fistula, and subglottic stenosis) complications may develop. In order to avoid early complications, optimal anatomic orientation and access to the trachea are essential. Causes of late complication differ. For example, subglottic stenosis may develop due to laryngeal injuries after traffic accidents. Blunt trauma to the larynx with tracheotomy may lead to stenosis. Suprastomal granulation was present in one of our patients. This complication may result from a foreign body reaction to the tracheotomy tube or from infection. Tracheoesophageal fistula is an uncommon finding. Most tracheoesophageal fistulas are iatrogenic due to erosion by the tracheotomy cuff with high pressure. We think that monitored to performed tracheotomy is important for preventing complications like this. We performed primary esophageal closure, and no secondary surgery was required. Two cases of tracheocutaneous fistula were observed. This may occur when the tracheotomy tube has been left in the same position for a prolonged period, permitting epithelialization between the skin and the tracheal mucosa. This complication was successfully overcome with surgical closure.

We usually perform decannulation in a surgical environment under appropriate conditions. Before decannulation, we examine the patient using a flexible endoscopic instrument. Accidental decannulation, due to insufficient strict postoperative follow-up and lack of experienced personnel (e.g., nurses), is a serious but preventable complication, which can be overcome by improving intensive care arrangements. Decannulation was carried out successfully in 27.2% of our pediatric patients. Carr et al. [9] reported a decannulation rate of 34% in 142 children, and Dursun and Özel [10] reported successful decannulation in 5 out of 30 (17%) children undergoing tracheotomy. The decannulation success rate in our institution is therefore slightly lower than those in the literature. In our opinion, the difference may be due to respiratory failure associated with chronic diseases, younger patients, car accidents, or genetic disease, such as neuromuscular conditions.

No deaths due to tracheotomy were observed in this study. Eleven patients died from primary disease, a level of 21%. The level of general body trauma in our patients was higher than in other studies [2, 8, 11]. Carron et al. [12] reported overall mortality of 19%, with a 3.6% tracheotomy-related death rate. Nevertheless, our result was close to that reported by Carron et al.

5. Conclusion

In conclusion, based on our experience, pediatric tracheotomies vary in terms of indication, complications, and decannulation time. The most common indication for pediatric tracheotomy in our study was upper airway obstruction. Complications following tracheotomy were similar to those previously reported in the literature. Accidental decannulation was the most common postoperative complication in our patients. This can be prevented by increasing the number of intensive care unit beds and experienced personnel numbers and by properly instructing family members. Pediatric age groups will also need early and long-term follow-up.

Conflict of Interests

The authors declare that they have no conflict of interests.

References

[1] J. C. Fraga, J. C. K. de Souza, and J. Kruel, "Pediatric tracheostomy," *Jornal de Pediatria*, vol. 85, no. 2, pp. 97–103, 2009.

[2] O. Rajesh and R. Meher, "Historical review of tracheostomy," *The Internet Journal of Otorhinolaryngology*, vol. 4, no. 2, 2005.

[3] A. Lawrason and K. Kavanagh, "Pediatric tracheotomy: are the indications changing?" *International Journal of Pediatric Otorhinolaryngology*, vol. 77, no. 6, pp. 922–925, 2013.

[4] S. Özmen, Ö. A. Özmen, and Ö. F. Ünal, "Pediatric tracheotomies: a 37-year experience in 282 children," *International Journal of Pediatric Otorhinolaryngology*, vol. 73, no. 7, pp. 959–961, 2009.

[5] C. S. Butnaru, M. P. Colreavy, S. Ayari, and P. Froehlich, "Tracheotomy in children: evolution in indications," *International Journal of Pediatric Otorhinolaryngology*, vol. 70, no. 1, pp. 115–119, 2006.

[6] A. H. C. Ang, D. Y. K. Chua, K. P. Pang, and H. K. K. Tan, "Pediatric tracheotomies in an Asian population: the Singapore experience," *Otolaryngology—Head and Neck Surgery*, vol. 133, no. 2, pp. 246–250, 2005.

[7] D. Goldenberg, E. G. Ari, A. Golz, J. Danino, A. Netzer, and H. Z. Joachims, "Tracheotomy complications: a retrospective study of 1130 cases," *Otolaryngology—Head and Neck Surgery*, vol. 123, no. 4, pp. 495–500, 2000.

[8] B. Kremer, A. I. Botos-Kremer, H. E. Eckel, and G. Schlöndorff, "Indications, complications, and surgical techniques for pediatric tracheostomies—an update," *Journal of Pediatric Surgery*, vol. 37, no. 11, pp. 1556–1562, 2002.

[9] M. M. Carr, C. P. Poje, I. Kingston, D. Kielma, and C. Heard, "Complications in pediatric tracheostomies," *The Laryngoscope*, vol. 111, no. 11, part 1, pp. 1925–1928, 2001.

[10] O. Dursun and D. Özel, "Early and long-term outcome after tracheostomy in children," *Pediatrics International*, vol. 53, no. 2, pp. 202–206, 2011.

[11] K. I. Midwinter, S. Carrie, and P. D. Bull, "Paediatric tracheostomy: sheffield experience 1979–1999," *Journal of Laryngology and Otology*, vol. 116, no. 7, pp. 532–535, 2002.

[12] J. D. Carron, C. S. Derkay, G. L. Strope, J. E. Nosonchuk, and D. H. Darrow, "Pediatric tracheotomies: changing indications and outcomes," *The Laryngoscope*, vol. 110, no. 7, pp. 1099–1104, 2000.