Early First Tracheostomy Change in Pediatric Patients with Fenestrated Tracheostomies

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Abstract

- **Objective**: To evaluate the safety of early tracheostomy tube changes in pediatric patients with fenestrated tracheostomies and understand the effect that design of tracheostomy and timing of the first tube change has on pediatric patients' hospital courses.
- **Materials & Methods**: Retrospective chart review was performed on pediatric patients who underwent standard tracheostomy and fenestrated tracheostomy at two tertiary children's hospitals between April 2013 and August 2022. Rates of morbidity and mortality were compared between the two groups.
- **Results**: Time to first tracheostomy change was significantly shorter in the maturation group (p<.001). Rates of tracheostomy-related mortality did not differ in either group as there were no tracheostomy-related deaths.
- **Conclusion**: Operative maturation of the tracheostomy stoma allows for safe early tracheostomy changes.

Introduction

- The timing of the first tracheostomy tube change has the potential to have a significant effect on patients' hospital courses.
- Opinions on tracheotomy technique and timing of tube change have been varied and controversial. Recent America Academy of Otolaryngology – Head and Neck Surgery (AAO-HNS) guidelines suggest that 5-7 days are necessary for a pediatric tracheostomy tract to mature.
- Current literature suggests that earlier first change regimens are both safe and beneficial.
- At two tertiary, early tracheostomy changes for pediatric patient were implemented, frequently on post-operative day 1. This was made possible through the surgical maturation of stomas with the fenestration or starplasty technique.
- In this study, we aim to determine the safety of early tracheostomy tube changes in patients with fenestrated tracheostomies.

Methods

- Following Institutional Review Board approval from Loma Linda University School of Medicine and Kirk Kerkorian School of Medicine, retrospective review of all patients under the age of 18 that underwent tracheostomy at both institutions between the years of 2017 and 2023 was carried out.
- All information was extracted from electronic medical records.
- Tracheostomy techniques were categorized on the basis or utilization of a stomal maturation. technique and, subsequently, further subcategorized based on the type of maturation technique used.
- Post-operative data was extracted from the existing medical records.
- Data analysis was carried out in R using Welch's two sample t-test, independent sample z-tests, one-way ANOVA, and chi-squared test of independence as appropriate.

Results

- 313 patients underwent tracheostomy during the study timeframe.
- 112 patients underwent tracheostomy with maturation of the stoma (62 via fenestration and 50 via starplasty), 198 had a tracheostomy without maturation of the stoma.
- Time to first tracheotomy change was significantly shorter in the maturation group (Table 1)
- Length of post-operative paralysis was statistically similar between groups.
- Length of post-operative sedation was significantly reduced in children having maturation of the tracheostomy stoma (Table 1).
- Both ICU length of stay and total hospital length of stay were significantly shorter for children in the maturation group (Table 1).
- For children weaned from the vent following tracheostomy, length of ventilator dependence was similar between groups (Table 1).
- There were no tracheostomy-related mortalities in either group.

Results

	Matured Stoma (n=112)	No Maturation (n=198)	p value
Time to first change (days)	1.5 +/- 1.7	6.8 +/- 2.7	<0.001
Length of post-tracheostomy paralysis (days)	0.37 +/- 1.2	0.6 +/- 3.3	0.37
Length of post-tracheostomy sedation (days)	2.4 +/- 4.2	8 +/- 16.6	<0.001
Post-tracheostomy ICU LOS	21.3 +/- 27.8	30.8 +/- 39.7	0.015
Post-tracheostomy Total LOS	35.2 +/- 30.6	43.9 +/- 41.3	0.036
Weaned from ventilator (%)	88.4	46	
Post-tracheostomy ventilator dependence (days)	15.7 +/- 27.7	10.2 +/- 20.5	0.12

Table 1. Time related variables in maturation vs non-maturation group

- Persistent tracheocutaneous fistula (TCF) was reported in 6.2% of children in the maturation group who were ultimately decannulated and 21.8% of decannulated children in the non-maturation group (p=.001) (Table 2).
- Stomal issues were reported in more children in the non-maturation group: predominantly granulomas (82.3%). Similarly, granuloma (77.8%) was the most common stomal issue in the maturation group (Table 2).

	Matured Stoma (n=112)	No Maturation (n=198)	
Decannulated (%)	86.6	67.2	<0.001
Persistent TCF (%)*	6.2	21.8	0.001
Stomal Issues (%)	16.1	31.3	0.003
Granuloma (%)**	77.8	82.3	0.66
Pressure Wound (%)**	16.6	14.5	0.83
Cellulitis (%)**	5.6	1.6	0.59
Keloid (%)**	0	1.6	0.35

*Percentage relative to number decannulated
**Percentage relative to number with stomal issues

Table 2. Rates of decannulation, TCF, and stomal wounds in maturation vs non-maturation group

Discussion

- Surgical maturation of tracheostomy stomas through a fenestrated or starplasty technique allowed for significantly earlier post-operative tracheostomy tube changes.
- AAO-HNS guidelines recommend changes on post-operative days 5 to 7. In this study, patients in the maturation group often underwent tube changes in an average of 1.5 days.
- Tracheostomy-related mortalities did not occur in either group. This study suggests that operative maturation of the tracheostomy stoma allows for safe early tracheostomy changes.
- Interestingly, persistent TCF was more prevalent after decannulation in the non-maturation group.
- Although hospital and ICU length of stay is significantly reduced in the matured stoma group, we understand that this outcome is multifactorial and requires further multivariate analysis.
- In the future, a prospective randomized study with specific protocols are needed to further assess the safety of early tracheostomy tube changes.

References

1. Gergin O., Adil E., Kawai K., Watters K., Moritz E., Rahbar R. Indications of pediatric tracheostomy over the last 30 years: has anything change? Int J. Pediatr Otorhinolaryngol. 2016;87:144-147.
2. Resen M., Gronhoj C., Hjuler T., National changes in pediatric tracheotomy epidemiology during 36 years. Eur Arch. Oto-Rhino-Laryngol. 2018;275(3): 803-808.
3. Doherty C., Neal R., English C., Cooke J., Atkinson D., Bates L., Moore J., Monks S., Bowler M., Bruce L., Bateman N., Wyatt M., Russel J., Perkins R., McGrath B. Paediatric Working Party of the National Tracheostomy Safety P, Multidisciplinary Guidelines for the Management of Paediatric Tracheostomy Emergencies. 2018.
4. Senders C., Muntz H., Schweiss D. Physician survey on the care of children with tracheotomy. Am J Otolaryngol. 1991; 12(1):48-50. 17.
5. Woolley A., Muntz H., Prater D. Physician survey on the care of children with tracheotomies. Am J Otolaryngol. 1996; 17(1):50-53.
6. Mitchell R., Hussey H., Setzen G. Clinical consensus statement: tracheostomy care. Otolaryngol Head Neck Surg. 2013;148(1):6-20.
7. Liu C., Hefferman C., Saluja S. Indications, hospital course, and complexity of patients undergoing tracheostomy at tertiary care pediatric hospital. Otolaryngol Head Neck Surg. 2014;151(2):232-239.
8. Tabaee A., Lando T., Rickert S., Stewart M., Kuhel W., Practice patterns, safety, and rationale for tracheostomy tube changes: a survey of otolaryngology training programs. Laryngoscope. 2007;117(4):573-576.
9. Koltai, P. A New Technique of Pediatric Tracheotomy. Arch Otolaryngol Head Neck Surg. 1998;124(10):1105-1111.
10. Chorney S., Patel R., Boyd A., Stow J., Schmitt M., Lipman D., Dailey J., Nhan C., Giordano T., Sobol S. Timing the first pediatric tracheostomy tube change: A randomized controlled trial. Otolaryngol Head Neck Surg. 2021;164(4):869-876.
11. Woods R., Geyer L., Mehanna R., Russell J. Pediatric tracheostomy first tube change: when is it safe? Int J Pediatr Otorhinolaryngol.2019;120:78-81.