

# Tracheostomy in the neonatal intensive care unit: Five-year experience

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## ABSTRACT

**Objective:** It is seen that the majority of tracheostomies in the pediatric age group occur under the age of 1, especially in neonatal intensive care (NICU) or after pediatric intensive care transfers. In this study, we wanted to present our tracheostomy experience and indications in our long-term follow-up.

**Material and Methods:** In this study, the retrospective records of patients who were hospitalized in the NICU of our hospital and underwent tracheostomy between January 2017 and December 2021 were reviewed. Patients were divided into two groups according to tracheostomy indications.

**Results:** A total of 28 patients were included in the study. Eight patients (28%) were tracheostomized due to upper airway disease (Group 1), and 20 patients (72%) due to prolonged mechanical ventilation (Group 2). There was no difference between the median week of birth and birth weights between the two groups (37 weeks [32–39] 2825 g [1500–3400] and 36 weeks [24–41], 2320 g [465–3925], respectively) ( $p>0.05$ ). Although the median number of postnatal days with mechanical ventilator and tracheostomy before tracheostomy was lower in patients with upper airway stenosis, it was not statistically significant (26 days [6–126] -94 days [21–260] and 53 days [30–75]-116 days [48–159], respectively) ( $p=0.08$ ). While the need for mechanical ventilator in the postoperative period of 6 (75%) patients who were tracheostomized due to upper airway stenosis disappeared, only 2 (11.8%) patients in Group 2 did not need it ( $p=0.04$ ). While no mortality was observed in tracheostomy patients due to upper airway stenosis, the mortality rate in Group 2 was quite high (63.3%) ( $p=0.03$ ).

**Conclusion:** Although the indication for tracheostomy in the neonatal period has increased due to medical developments in the last decade, it is not widely used. While indications and durations were based on certain criteria in adult and pediatric intensive care tracheostomy studies, no such literature data on the neonatal period could be reached. In our study, in parallel with the literature, the number of days for tracheostomy was found to be quite high compared to the number of days in ICU and PICU. We think that early tracheostomy would be beneficial for mortality and long-term morbidity, especially in neonatal patients with upper airway stenosis and surgical inconvenience or failure.

**Keywords:** Mechanical ventilation; neonate; tracheostomy.

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# Yenidoğan yoğun bakım ünitesinde 5 yıllık trakeostomi deneyimimiz

## ÖZET

**Amaç:** Çocuk yaş grubu trakeostomilerin çoğunluğu bir yaşın altında ve özellikle yenidoğan yoğun bakım ünitesinde ya da pediyatrik yoğun bakım transferleri sonrası gerçekleştiği görülmektedir. Bu çalışmada, uzun dönem takip ettiğimiz hastalarımızdaki trakeostomi tecrübemizi, endikasyonlarımızı sunmayı amaçladık.

**Gereç ve Yöntemler:** Bu çalışmada Ocak 2017–Ocak 2022 tarihleri arasında hastanemiz yenidoğan yoğun bakım ünitesinde yatarak tedavi gören ve trakeostomi açılan hastaların geriye dönük kayıtları incelendi. Trakeostomi endikasyonlarına göre hastalar iki gruba ayrılarak karşılaştırıldı.

**Bulgular:** Toplam 28 hasta çalışmaya alındı. Sekiz (%28) hasta üst hava yolu darlığı nedeniyle (grup 1), 20 (%72) hasta uzamış mekanik ventilasyon nedeniyle (grup 2) trakeostomize edildi. Her iki grup arasında ortanca doğum haftası ve doğum ağırlıkları arasında fark bulunmadı [36 hafta (24–41), 2320 gram (465–3925) ve 37 hafta (32–39), 2825 gram (1500–3400) sırasıyla] ( $p>0,05$ ). Üst hava yolu darlığı olan hastalarda trakeostomi öncesi ortanca mekanik ventilatör ve trakeostomi açılan postnatal gün sayısı daha düşük olsa da istatistiksel olarak anlamlı değildi [sırasıyla 26 gün (6–126)-94 gün (21–260) ve 53 gün (30–75)-116 gün (48–159)] ( $p=0,08$ ). Üst hava yolu darlığı nedeniyle trakeostomize olan 6 (%75) hastanın postoperatif dönemde mekanik ventilatör ihtiyacı ortadan kalkarken, grup 1’de sadece 2 (%11,8) hastanın ihtiyacı kalmadı ( $p=0,04$ ). Üst hava yolu darlığı nedeniyle trakeostomize hastalarda mortalite görülmezken, grup 1’de mortalite oranı oldukça yüksekti (%63,3) ( $p=0,03$ ).

**Tartışma:** Yenidoğan döneminde trakeostomi endikasyonu son dekatta tıbbi gelişmelere bağlı artış göstermiş olmasına rağmen yaygın kullanılmamaktadır. Erişkin ve çocuk yoğun bakım trakeostomize çalışmalarında endikasyon ve süreler belirli kriterlere dayanırken, yenidoğan dönemine ait böyle bir literatür bilgisine ulaşılamamıştır. Bizim çalışmamızda, literatüre paralel olarak trakeostomi açılan gün sayısı erişkin ve çocuk yoğun bakım gün sayısına göre oldukça yüksek olarak görülmüştür. Özellikle üst hava yolu darlığı olan ve cerrahi uygunsuzluğu veya başarısızlığı olan yenidoğan hastalarda erken dönem trakeostomize olmanın mortalite ve uzun dönem morbiditeye faydalı olacağını düşünmekteyiz.

**Anahtar Kelimeler:** Mekanik ventilasyon; trakeostomi; yenidoğan.

## INTRODUCTION

Advances in neonatal and pediatric intensive care units have improved in the past two decades and medical advances lead to an increasing survival rate of patients in intensive care units (1). Many of these infants require long-term mechanical ventilation as a result of a variety of reasons. It is commonly accepted that long-term mechanical ventilation in neonates is well tolerated without damage in the larynx (2). While the most common indication for tracheostomy was upper respiratory tract infection, it was replaced by prolonged mechanical ventilation over time (3). Pediatric tracheostomies were performed 50% in the 1st year of life mostly in neonatal intensive care units (NICU) (4, 5). In adult population, tracheostomy indications are more clear and morbidity is lower in adult population compared to neonatal and pediatric intensive care units (6). The goal of the present this study to share our experiences and indications of tracheostomy in level IV NICU.

## MATERIAL AND METHODS

This study was conducted in the 4<sup>th</sup> level NICU with a capacity of 61 beds.

The medical records of patients who were hospitalized in our NICU and underwent tracheostomy between January 1, 2017, and December 31, 2021, were collected retrospectively from the computerized data system.

The study was approved by the Local Ethics Committee.

Patients with incomplete clinical information and who underwent tracheostomy after NICU discharge were excluded from the study.

Table 1. Indications for tracheostomy

Indications	Patients	
	n	%
Upper airway disease		
Severe laryngomalacia	4	14
Vocal cord paralysis	2	7
Laryngeal stenosis	2	7
Lower airway disease		
Neurologic	12	42
Craniofacial anomalies	3	10
BPD	3	10
Other	2	7

BPD: Bronchopulmonary dysplasia.

Patients were divided into two groups based on primary indication of tracheostomy, namely, Group 1: upper airway disease (subglottic stenosis, laryngotracheomalacia or combination of these diseases) and Group 2: lower airway diseases (bronchomalacia, chronic lung diseases, prolonged mechanical ventilation cause of neurological disorders, or congenital heart disease). If the upper airway anomaly was not related to any congenital syndromes, it was grouped as upper airway diseases.

Patients demographics data included sex, race, gestational age, birth weight, time to tracheostomization, time to mechanical ventilation, and time to discharge were collected from computerized data system.

**Table 2. Demographic description of patients**

	Upper airway disease (n=8)	Lower airway disease (n=20)	p
Gestational age, wk, median	37 (32–39)	36 (24–41)	>0.05
Birth weight, g, median	2825 (1500–3400)	2320 (465–3915)	>0.05
Age at tracheostomy (d, median)	53.5 (30–175)	116 (48–359)	>0.05
MV days before tracheostomy (d, median)	26 (6–126)	94 (21–260)	>0.05
Discharge (d, mean)	176±119	257±117	>0.05
Mortality (n, %)	0	12 (63.2)	<0.05
Decannulation	2 (33.3%)	0	>0.05

MV: Mechanical ventilation.

### Statistical Analysis

Statistical analysis included general descriptive statistics of patients and comparisons between the two defined groups. Continuous variables were assessed using one-way analysis of variance and comparison of categorical variables using Chi-square or Fisher's exact tests. All statistics were done using the SPSS for Windows software version 17.0 (SPSS Inc. Chicago, IL, USA).

### RESULTS

A total of 30 infants met the criteria and enrolled in the study. Of these patients, 28 met the criteria and two infants were excluded due to inadequate data.

Most tracheostomies were placed as an indication of the lower airway diseases than upper airway disease (72% vs. 28%) (Table 1). Between groups gestational age and birth weights were similar. The median age at tracheostomy was in Group 1 and 2; 53 days (30–75) and 116 days (48–159), respectively ( $p=0.08$ ). The demographic description of infants is shown in Table 2. Although the median mechanical ventilator days before tracheostomy and median age at tracheostomy were lower in patients with upper airway disease, it was not statistically significant (26 days [6–126] – 94 days [21–260] and 53 days [30–75] – 116 [48–359] days, respectively) ( $p=0.08$ ). Six (75%) patients who were tracheostomized due to upper airway disease no longer needed mechanical ventilators in the post-operative period. In Group 2, only 2 (11.8%) patients were weaned from the mechanical ventilator after tracheostomization. While no mortality was observed in tracheostomy patients due to upper airway disease, the mortality rate in Group 2 was higher (63.3%) ( $p=0.03$ ). None of the deaths were secondary to the tracheostomy procedure. In the long time following, two infants were decannulated in the upper airway disease group.

### DISCUSSION

We report that the main indication for tracheostomy in NICU was prolonged mechanical ventilation. Despite the variability in indications in pediatric population before 80's, most common indication for tracheostomy was upper airway stenosis due to infections; nowadays, main indication of tracheostomy is prolonged mechanical ventilation (3).

In adult patients, when mechanical ventilation is required for more than 10 days, tracheostomy is recommended to reduce mortality and morbidity (7). There is no consensus about timing tracheostomy in neonates, because it is commonly accepted that neonates can tolerate long time endotracheal intubation without damage to larynx (8). In pediatric intensive care units, timing of tracheostomy varies between 4.3 and 30.4 days (9). In this report timing of tracheostomy in neonates, much longer than other populations and infants with upper airway disease have tracheostomy much earlier than lower airway disease.

In children, mortality associated with tracheostomy in the literature varies between 0.5% and 3% (10). In our study, 12 infants were dead (42%) in lower airway disease group, but it was not related to the surgery or surgical complications directly. Underlying primary disease was the main cause of all mortality.

Almost 20% infant experience a complication after tracheostomy surgery (11). Because the lack of our data, we could not give our complication rates in the study population.

Decannulation rate is lower in children with tracheostomy due to long-term intubation due to primary disease. In our study, tracheostomy was closed during follow-up after discharge in only two patients (12).

Especially, patients who need long-term intubation can be discharged after tracheostomy with home ventilation and needed family education. For children who will be monitored at home and will have a tracheostomy for a long time, at least, one of the parents should be educated about tracheostomy care and what to do in an emergency (13). This education takes 2 weeks at least in our services (14).

All materials necessary for interventions should be kept around the child. The home environment should be arranged according to the needs of the child. A regular relationship should be established between the family, the child and the health personnel.

### CONCLUSION

We think that early tracheostomy would be beneficial for mortality and long-term morbidity, especially in neonatal patients with upper airway stenosis and surgical inconvenience or failure.

**Ethics Committee Approval:** The Ümraniye Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 23.06.2022, number: 212).

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**Mali Destek:** Yazarlar bu çalışma için mali destek almadıklarını beyan etmişlerdir.

**Yazarlık Katkıları:** Fikir – FYA; Tasarım – İMA; Denetleme – İMA; Kaynaklar – FYA, FA; Malzemeler – DÇ, ÖŞ; Veri Toplanması ve/veya İşlenmesi – ÖG; Analiz ve/veya Yorum – SŞÖ; Literatür Taraması – SŞÖ, ÖG; Yazıyı Yazan – FYA; Eleştirel İnceleme – İMA.

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