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Assessment of Patients Discharged From the Intensive Care Unit with Tracheostomy: A Retrospective Analysis of Single-Center Data

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Trakeostomili Olarak Yoğun Bakım Ünitesinden Taburcu Edilen Hastaların Değerlendirilmesi: Tek Merkez Verilerinin Retrospektif Analizi

ABSTRACT

Objective: *The aim of our study was to evaluate the reasons of mortality and morbidity of the patients who were discharged home from the intensive care unit (ICU) with tracheostomy within a 6-month follow-up period.*
Method: *This retrospective study was completed with 35 patients. The demographic characteristics, indications for hospitalization, comorbidities, Glasgow Coma Scores (GCS) at discharge, history of re-hospitalization after discharge whether there was home mechanical ventilator support (HMVS), problems experienced at home, form of nutrition, and causes of death were assessed.*
Results: *Advanced age, patients requiring care after resuscitation, presence of comorbidity, requirement of HMVS and feeding with PEG were found to be factors related to mortality ($p<0.05$). Sex, tracheostomy opening time, GCS at discharge and re-hospitalization were not correlated with mortality. The 74.3% of the patients were discharged with HMVS. Mortality rates were higher in patients with airway and ventilator problems and comorbidities ($p<0.05$). The six-month mortality rate was 72.2% and it was found that deaths were often caused by respiratory failure.*
Conclusion: *It has been concluded that the mortality rate was higher in patients who were discharged with tracheostomy, those with advanced age, and comorbid diseases, patients hospitalized for post-resuscitation care, required HMVS and fed with PEG. It was concluded that it is among the factors related to mortality in airway-related complications.*

Keywords: *Mechanical ventilation at home, Tracheostomy, Outcome research*

ÖZ

Amaç: *Çalışmamızda, yoğun bakım ünitesi (YBÜ)'nden trakeostomili olarak taburcu edilen olguların 6 aylık süre ile olan takibindeki morbidite ve mortalite nedenlerinin araştırılması amaçlanmıştır.*
Yöntem: *Retrospektif çalışma 35 olguyla tamamlandı. Olguların demografik özellikleri, yatış nedenleri, komorbiditeleri, taburculuktaki Glasgow Koma Skorları (GKS), taburculuk sonrası tekrar hastaneye yatış öyküsünün varlığı, evde mekanik ventilatör desteği (EMVD) olup-olmaması, evde yaşanılan sorunlar, beslenme şekli ve ölüm nedenleri değerlendirildi.*
Bulgular: *İleri yaş, resüsitasyon sonrası bakım gereken hastalar, komorbidite varlığı, EMVD gereksinimi ve PEG ile beslenmenin mortalite ile ilişkili faktörler olduğu belirlendi ($p<0.05$). Cinsiyet, trakeostomi açılma zamanı, taburculuktaki GKS ve yine hastaneye yatışla mortalite arasında ilişki saptanmadı. Olguların %74.3'ü EMVD ile taburcu edildi. Hava yolu ve ventilatör sorunları ve ek hastalıkları olanlar için ölüm oranı yüksekti ($p<0.05$). Altı aylık mortalite oranı %72.2 idi ve sıklıkla solunum yetmezliği nedeniyle ölümler olduğu saptandı.*
Sonuç: *Trakeostomili olarak taburcu edilen olgularda ileri yaş, resüsitasyon sonrası bakım için yatışı olan, ek hastalığı olan, EMVD gereken ve PEG ile beslenen hastalarda mortalitenin yüksek olduğunu; hava yoluna bağlı komplikasyonlarında mortalite ile ilişkili faktörler arasında olduğu sonucuna varıldı.*

Anahtar kelimeler: *Evde mekanik ventilasyon, trakeostomi, sonuç araştırması*

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INTRODUCTION

Intensive care units (ICUs) are special treatment units managed by specially-trained health personnel and designed for the monitoring and treatment of life-threatening organ failures which can be seen during the course of acute and chronic diseases [1]. Acute exacerbation of chronic obstructive pulmonary disease (COPD), cerebrovascular disease (CVD) sequelae and neuromuscular diseases commonly cause chronic respiratory failure with a large proportion of patients requiring long-term mechanical ventilator support (LMVS) in the intensive care unit (ICU) [2-6]. The number of patients with chronic respiratory failure who are hemodynamically stable, and requiring invasive and noninvasive LMVS for all or part of the day, is increasing day by day and these patients frequently have tracheostomies [6-8]. Whether tracheostomy can improve outcomes in patients requiring mechanical ventilator (MV) is controversial. In stable patients, home mechanical ventilator (HMV) is becoming more frequently used as a treatment choice with the aim of reducing complications, decreasing duration of hospital stay (as mortality is associated with prolonged hospitalization in ICU, morbidity, higher health expenditure and infection rates), preserving long-term respiratory functions and increasing and preserving quality of life [5-12]. The most important point for successful organization of HMV is the sufficiency of home health care services. In Turkey, concerns about home health care services and the lack of sufficient experience related to this topic have led doctors and patient relatives to ignore these services. In studies, the importance of home care during rehabilitation of long-term tracheostomy patients is emphasized in terms of low costs, quality social support and increased quality of life [6,7,10,12-14]. However, there is insufficient information about the short and long-term outcomes of the patients discharged with tracheostomy and the effect of problems experienced related to tracheostomy at home or MV on morbidity and mortality.

The aim of our study was to evaluate the mortality and morbidity of the patients who were discharged home from the ICU with tracheostomy within a 6-month period.

MATERIALS and METHODS

Our study was completed after receiving permission from Zonguldak Bülent Ecevit University, Faculty of Medicine Clinical Research Ethics Committee (meeting protocol no: 2018/02, date: 17/01/2018). The records of 41 patients who were discharged with tracheostomy from 10-bed-capacity, tertiary ICU between January 2012 and December 2017 were retrospectively investigated. Patients could not leave MV during the stable period after acute problems had resolved, because they had swallowing difficulties or could not preserve airway reflexes due to central nervous system pathologies and as a result they were sent home with tracheostomy. Information about the last health status of the patients was reached by making phone calls with first degree relatives of the patients. Verbal consent was obtained from all participants. However, as 6 patients could not be reached, the study was completed with 35 patients.

The patients' ages, gender, indications for admission [post-resuscitation care, acute exacerbation of COPD, postoperative care, multiple trauma, CVD, sepsis, larynx cancer, amyotrophic lateral sclerosis (ALS)], timing of tracheostomy, number of diseases (0: no disease, 1: single disease, 2: two diseases, ≥3: three and more diseases), and Glasgow coma scores (GCS) at discharge were recorded. After discharge, recurrent admissions to hospital, whether there was mechanical ventilator support at home (HMVS), and problems experienced at home [0-no problems, 1-airway problem (inability to perform tracheal aspiration, excessive secretions and formation of blockage, aspiration of gastric content, dislocation of tracheostomy cannula), 2-MV problems (insufficient tidal volume formation in the ventilator, frequent alarms, air leak, increased respiratory problems in the patient), 3-infection, 4-compression wound] were defined. Before discharge, tracheostomy patients who could not be fed orally or with impaired swallowing reflexes had percutaneous endoscopic gastrostomy (PEG) probe inserted. The form of nutrition at home (oral/PEG) was noted. Additionally, patient relatives were interviewed by telephone and the survival time at home and cause of death (respiratory failure, myocardial infarction, lower respiratory tract infection, heart failure, and sepsis) were recorded. Patients (n=35) were divided into two gro-

ups as survivors (n:16) and non-survivors (n:19) within the first 6 months after discharge.

Individuals who would take care of the patient were informed about the treatment of the disease and motivated about maintenance of treatment at home. Before discharge, the carer was given theoretical and applied training by the intensive care team about airway control, tracheal aspiration, postural drainage, replacement of the tracheostomy cannula, stoma care and MV for at least one week. The use of assisting tools like aspirator, oxygen condenser, mask and moisturisers was explained. If the carer appeared successful at the end of training, the decision was made about discharging the patient.

The patient was sent home in an ambulance accompanied by a doctor. At home, MV checks were repeated. Families were given a telephone number where they could access aid for 24 hours if they encountered any problem. Follow-up after discharge was completed in partnership with the Ministry of Health, Home Care Services. Patients then were observed for 6 months after hospital discharge.

Statistical Analysis

Statistical analyzes were performed using IBM SPSS v.23.0 software. (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). The normality assumption of the data was evaluated by Shapiro-Wilk test. Data were stated as mean±standard deviation (mean±SD) for continuous variables and frequency (n) for categorical variables. For comparison between the groups the Student's t-test was used. Categorical variables were compared using Pearson's chi-squared test and Fisher's exact test. $p<0.05$ was accepted as the level of statistical significance.

RESULTS

The study population consisted of a total of 35 patients (female, 31.4% and male, 68.6%). ICU admissions were mostly due to post-resuscitation care (34.1%), multiple trauma (25.1%), acute exacerbation of COPD (14.2%), other diseases (14.2%), and postoperative care (11.4%). The demographic characteristics of patients and correlation of admission reasons with mortality is shown in Table I. Eight patients [CVD (n=3), ALS (n=2), acute exacerbation of COPD (n=2) and larynx cancer (n=1)] had tracheostomy on admission to ICU. The correlation of duration of tracheostomy opening, presence and number of additional diseases, GCS at discharge, repeated hospital stay, presence of HMVS, problems experienced at home related to the disease and form of nutrition at home with mortality in patients discharged with tracheostomy is shown in Table II. Based on the results of multivariate logistic regression analysis of the risk factors affecting mortality, all variables were statistically insignificant due to the small sample size ($p>0.05$). Most of the patients (n=26; 4.3%) were discharged with MV support and in 11.4% (n=4) of the patients tracheostomies were closed at a later date. In our study post-discharge, the 30-day and 6-month mortality rates were 36.8% and 72.2%, respectively. We observed that the causes of death were respiratory failure (n=7), myocardial infarction (n=6), lower respiratory tract infection (n=3), heart failure (n=2) and sepsis (n=1).

Table I. Demographic characteristics of patients and correlation of cause for admission with mortality

Values	All patients (n=35)	Survivors (n=16)	Non-survivors (n=19)	p
Age (years)	58.6±21.0	49.75±22.01	66.05±17.38	0.030
Gender (female/male)	11 / 24	3 / 13	8 / 11	0.138**
Reason for admission				
Care after resuscitation	12	3	9	
Acute COPD flare-up	5	1	4	0.036∞
Postoperative care	4	1	3	
Multiple trauma	9	7	2	
Other*	5	4	1	

Data are presented as mean±Standard Deviation or number (n); COPD: chronic obstructive pulmonary disease
**CVD, Sepsis, larynx cancer, ALS*
***Fisher's exact test*
∞ Pearson Chi Square test

Table II. Factors affecting overall mortality among patients discharged with tracheostomy

Values	All patients (n=35)	Survivors (n=16)	Non-survivors (n=19)	p
Time since tracheostomy (days)	20.56±11.7	16.92±13.02	25.18±8.01	0.079
Presence of additional diseases	19	5	14	0.012*
Number of additional diseases				
0	16	11	5	
1	5	-	5	0.043**
2	6	2	4	0.174
≥3	8	3	5	0.557
GCS at discharge	9.31±3.35	9.82±3.71	8.83±2.99	0.031***
Repeated hospital admission +/-	15 /20	6 / 10	9 / 10	
HMVS (+/-)	26 / 9	9 / 7	17 / 2	
Problems at home				
None	15	11	4	0.007**
Airway and MV	13	2	11	
Compression wounds and infection	7	3	4	0.049***
Form of nutrition at home				
PEG / Oral	26 / 9	9 / 7	17 / 2	

Data are presented mean±Standard Deviation or number (n); GCS: Glasgow coma scores, HMVS: Home mechanical ventilator support, MV: Mechanical ventilator, PEG: percutaneous endoscopic gastrostomy; +/-: present/absent
**Continuity Correction*
***Pearson Chi Square*
****Fisher's Exact Test*

DISCUSSION

Our study is one of the limited number of studies about the experience of increasing rates of HMV applications in Turkey. In our study, we identified that patients with advanced age, admission due to post-resuscitation care, additional diseases, those requiring HMV and nutrition with PEG had high mortality rates among tracheostomy patients discharged from ICU. Additionally, airway and MV linked complications were among factors associated with mortality.

New approaches to home care and developments in respiratory devices have made it easier for patients linked to respiratory devices to receive care at home. The incidence of HMV is increasing every day and the annual increase is reported as 0.3/100.000 [7]. A study involving sixteen European countries reported the prevalence of HMV as 6.6/100.000 [6]. It is noteworthy that an ICU providing 3rd stage health services in our region with nearly 100.000 population discharged 2 patients with tracheostomy in 2013 with a significant increase through the years to reach 11 in 2017. Additionally, the increase in HMV applications through the years observed in our study supports the view that this treatment method will become more commonly used in our country in future years.

Patients admitted to the adult ICU are generally elderly with chronic disease or acute attacks of chronic disease requiring supportive treatment. Especially cases with underlying chronic pulmonary disease or neurological disease stay in the ICU for long periods and it appears that HMV applications are chosen more often in this group [5-8,12,13]. Since functional health state of patients sent home from the ICU with HMV is very slowly improving, higher mortality and hospital re-admission rates have been reported [15,16]. When the correlation between the admission and mortality rates was assessed, apart from the groups of multiple trauma and other diseases, we identified mortality rates of ≥75 percent. Single-centered design of the study performed in only one ICU, heterogeneity of patient diagnoses, high number of elderly patients (>65 years, n=14 including 10 exited patients) and the increasing number of comorbidities were the main reasons increasing mortality rates. We thought that the reason for the lack of difference between hospital stay rates may be due to the higher 30-day mortality rate (36.8%).

It is known there are different effects of tracheostomy on survival, with a significant effect of tracheostomy opening times on the clinical outcomes of patients; however, there are varying opinions about its effect on mortality [9,10,17-20]. Any correlation has not been shown between the timing of tracheos-

tomy and duration of MV for patients with good respiratory function in the ICU monitored with MV [21]. In our study, it was observed that the prolongation of tracheostomy opening time and mortality was not significant.

As tracheostomy has theoretical advantages of increasing patient comfort, easing aspiration of secretions, reducing airway resistance, increasing patient mobility, making nutrition possible and shortening the time to "weaning from MV" it is reported the ventilation time may be prolonged after stabilization of the patient [17,22]. Some researchers have proposed that though tracheostomy increases survival in the ICU and speeds up discharge, the majority of these patients die in the ICU which exerts a negative effect on general hospital mortality [18]. In our study, we determined the mean stay in the ICU was similar for survived and non-survived patients.

GCS is one of the markers used both to identify the neurological status of patients in the ICU and to determine mortality but it is stated to be a weaker predictor in mortality estimation models [23]. In our study, we found that lower GCS does not correlate with mortality rates and believe that the small number of patients is an effective factor in the results.

In a study, Doğan et al. [24] reported that 30.9% of the patients discharged for home care with tracheostomy, and 80% (n=24) of these patients were discharged with MVS, while 20% of them died within 1 week of discharge and 23.3% of them were still surviving. A similar study found the rate of patients discharged with tracheostomy was 67.5%. In those; 60.5% discharged with MVS, 22.5% had tracheostomy closed, and 10% died [12]. In our study, we determined that 74.3% of our patients were discharged with MVS, 25.7% of them with spontaneous respiration, while 11.4% (n=4) of them had their tracheostomies closed after discharge and 45.7% of them were still surviving. In our study, we thought that the presence of tracheostomy of 8 patients during ICU admission was a factor in the high number of patients discharged with MVD.

Basic problems encountered during HMV are increased secretions, insufficient aspiration of secretions, not being aware of findings during acute attacks and MV-related adverse effects [25]. In our study with a small number of patients, the most frequently reported problems were similar to those indicated in the literature and related to airway (aspiration of secretions) and MV (frequent alarming, failure to provide enough tidal volume).

Although PEG increases comfort of the patient in terms of nutrition and reduces some complications, Golestanian et al. [26] stated that opening PEG along with MVS for acute CVD was a marker of poor prognosis. In our study, high mortality rates (65.4%) were detected in patients with PEG opened and we believe that PEG is an indicator of poor prognosis. However, we think that similar studies should be conducted with a higher number of participants in order to evaluate the presence of PEG as a prognostic factor.

In a study of tracheostomy patients requiring HMV services, Marchese et al. [27] reported that the mean survival times were 26 months for COPD patients and 49 months for cases with neuromuscular diseases and generally the cause of death at home was underlying diseases. In another study, it was reported that the mean life expectancy of the patients who were discharged with tracheostomy in patients with CVD, COPD acute exacerbation and other diseases were 11, 18, and 15 months, respectively. The same study found the cause of death at home was commonly airway (43%), and MV-related problems (21%) [24]. In our study, the 30-day and 6-month mortality rates after discharge were 36.8% and 72.2%, respectively and causes of death were observed to be linked to respiratory failure and myocardial infarction. The high mortality rates among cases with airway and MV-realted problems (84.6%) have shown that our study supports the results in the literature.

Limitations of the current study could be considered as its retrospective design, and lower number of patients. This study obtained data from patient relatives via verbal reporting, without determinig the degree to which patients benefited from home care services and also lack of documentation concerning home care services which were the greatest limitations. Another limitation is that this study was performed in one single ICU only. Therefore our results may not be comparable with other ICU populations.

In conclusion, HMV application for tracheostomy cases in ICUs in Turkey with limited bed capacity, is a good choice to reduce chronic patient load. However, it is chosen less often due to insufficient health budgets and home care services and lack of experience about this HMV. The most important determinant of mortality at home was related to airway and MV problems which leads to consideration of the importance of care by individuals with sufficient education and medical support to reduce these problems and ensure reliable ventilation at home.

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