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Research Article / Araştırma

Retrospective Analysis of Reasons for Early Readmission to the Intensive Care Unit

Yoğun Bakım Ünitesine Erken Dönemde Yeniden Yatış Nedenlerinin Retrospektif Analizi

Ahmet Sari, Esra Karatay Sözüer

Department of Anesthesiology and Reanimation, University of Health Sciences, Haydarpaşa Numune Training and Research Hospital, İstanbul, Türkiye

Sağlık Bilimleri Üniversitesi, Haydarpaşa Numune Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği, İstanbul, Türkiye

ABSTRACT

Objectives: Readmission to intensive care unit (ICU) is associated with longer hospital stays, higher mortality, and increased health-care costs. In addition to the highly subjective nature of ICU discharge decisions, constraints in clinical resources and insufficient beds to admit all ICU patients may result in some patients being discharged from the ICU prematurely and readmitted.

Methods: After obtaining approval from the local ethics committee of our hospital for our study, the files of ICU patients in 2019 and 2020 were retrospectively studied and data collected.

Results: In 2020, the ICU bed rate was 43 (6.9%), 21 (3.4%) higher than in 2019. A total of 57 patients were readmitted per year. The readmission rate in 2019 was 40 (70.2%), 17 (29.8%) statistically significantly higher than in 2020. In 2019, mortality rate in readmitted patients (47.5%) was statistically significantly higher than ICU mortality rate (31.5%). No significant difference was found in 2020. Although mortality rates in readmissions in both years were higher than normal ICU mortality rate, there was no statistical difference between them. The most common reason for readmission in both years was acute respiratory failure and the most frequent readmissions were from general surgery and internal medicine wards.

Conclusion: Overloading ICU capacity to treat critically ill patients can affect physician decision-making, leading to early discharge. Patients discharged from ICU always have the possibility for readmission. ICU readmissions are associated with much higher mortality rates than initial admission. Identifying high-risk patients and better ward care are key to reducing ICU readmission.

Keywords: Critical patient, early readmission, intensive care unit

ÖZ

Amaç: Yoğun bakım ünitesine (YBÜ) yeniden yapılan yatış, daha uzun hastanede kalış süresi, daha yüksek mortalite ve artan sağlık harcamaları gibi olumsuz sonuçlarla ilişkilidir. YBÜ taburcu kararlarının son derece öznel doğasının yanı sıra klinik kaynaklardaki kısıtlamalar ve yoğun bakıma ihtiyaç duyan tüm hastaları kabul etmek için yetersiz yatak sayısı bazı hastaların YBÜ'den erken taburcu edilmesine ve bu hastaların da yeniden yatışlarına neden olabilmektedir.

Yöntem: Çalışma için hastanemiz yerel etik kurulundan onay alındıktan sonra 2019 ve 2020 yıllarında yoğun bakıma yatan hastaların dosyaları retrospektif olarak incelenerek veriler toplandı.

Bulgular: 2020 yılında YBÜ yatak oranı (%6,9 [n=43]), 2019 yılından (%3,4 [n=21]) daha yüksekti. Her iki yıl için toplam 57 hasta yeniden YBÜ'ye yattı. 2019 yılındaki yeniden yatış oranı (%70,2 [n=40]), 2020 yılından (%29,8 [n=17]) istatistiksel olarak anlamlı düzeyde yüksekti. 2019 yılında yeniden yoğun bakıma yatan hastalardaki mortalite oranı (%47,5), yoğun bakım mortalite oranından (%31,5) istatistiksel olarak anlamlı düzeyde yüksekti. 2020 yılında anlamlı bir farklılık tespit edilmedi. Her iki yıl için de yeniden yatışlardaki mortalite oranı normal yoğun bakım mortalite oranından yüksek olmakla beraber aralarında istatistiksel olarak fark yoktu. Her iki yıl için de en sık yeniden yatış nedeni akut solunum yetmezliği olup en sık yatış, genel cerrahi ve dahiliye servislerinden oldu.

Sonuç: YBÜ'nün kritik hastalara bakmak için kapasitesinin aşırı yüklenmesi, hekimin karar vermesini etkileyebilir ve hastaların YBÜ'den erken taburcu edilmesine neden olabilir. YBÜ'den taburcu edilen hastaların, yeniden yatış için her zaman potansiyelleri vardır. YBÜ'ye yeniden yatış ilk kabulden çok daha yüksek mortalite oranları ile ilişkilidir. YBÜ'ye geri kabul oranlarını azaltmadaki önemli nokta, riskli hastaları tanımak ve servis bakım düzeylerini yükseltmektir.

Anahtar sözcükler: Erken dönem yeniden yatış, kritik hasta, yoğun bakım ünitesi

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Address for correspondence: Ahmet Sari, MD. Sağlık Bilimleri Üniversitesi, Haydarpaşa Numune Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği, İstanbul, Türkiye

Phone: +90 505 294 57 59 **E-mail:** ahmet-0221@hotmail.com

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Introduction

Intensive care units (ICUs) are special units where critical patients are followed up and are faced with a high level of patient density. Improvements in organ support systems used in the follow-up and treatment of these patients have contributed to the reduction of mortality. As a result, there is an increase in the number of patients discharged from ICU. However, some of the patients discharged from the ICU are readmitted to the ICU early or late for different reasons. Readmissions to ICU are common[1,2] and range between 5% and 17.5%.[1,3-5] Readmissions to ICU are associated with high morbidity and mortality. One of the quality standards of ICU is the rate of readmission of patients to ICU within the first 48 h after discharge. Our aim in this study was to analyze the reasons for readmission to intensive care in the early period (first 48 h), to determine the effective factors and to take measures to reduce morbidity and mortality in patients discharged from intensive care, and to improve the quality of intensive care.

Methods

Study Design and Inclusion Criteria

After obtaining approval for our study from the ethics committee of Haydarpaşa Numune Training and Research Hospital (HNEAH-KAEK 2021/KK/257) on December 04, 2021, the files of patients hospitalized in ICU in 2019 and 2020 were retrospectively reviewed and data were collected. Patients over the age of 18 who were transferred to the ward after completion of intensive care treatment and who were readmitted to the ICU within the first 48 h after transfer were included in the study. Patients who were under the age of 18 and who were readmitted to intensive care in the late post-transplant period (over 48 h) were excluded from the study.

Data Collection

Demographic data, comorbidities, reasons for ICU admission. Data were collected by recording the duration of ICU stay, transferred ward, reasons for readmission, Sequential Organ Failure Assessment (SOFA) and Glasgow Coma Scale (GCS) values before transfer, and SOFA and GCS values during readmission in an Excel spreadsheet.

Grouping

Readmissions in 2019 and 2020 were compared by creating one group each.

Number of Hospital Beds and Patient Admissions

In 2019, there were 21 intensive care beds in our hospital and this number was increased to 43 in 2020. The total number of hospital beds in both years was 620. In 2019, 974 patients were hospitalized and 667 of them were discharged, while these numbers were 1085 and 682, respectively, in 2020.

Statistical Analysis

IBM SPSS Statistics 22 software was used for statistical analyses while evaluating the findings obtained in the study. The suitability of the parameters for normal distribution was evaluated by Kolmogorov-Smirnov and Shapiro-Wilk tests and it was found that the parameters did not show normal distribution. In addition to descriptive statistical methods (mean, standard deviation, median, and frequency), Mann-Whitney U-test and Wilcoxon sign-rank test were used to compare quantitative data.

Chi-square test, Chi-square test in one-eyed design, and continuity (Yates) correction were used to compare qualitative data. Significance was evaluated at $p<0.05$ level.

Results

In our study, a total of 57 patients who were transferred from intensive care to wards and readmitted to intensive care within the first 48 h were evaluated. Forty (70.2%) of the patients were readmitted to intensive care in 2019 and 17 (29.8%) in 2020. Their ages ranged between 23 and 93 years, with a mean age of 67.53±15.76 years. While 25 (43.9%) were male, 32 (56.1%) were female (Table 1).

The readmission rate in 2019 (70.2%) was statistically significantly higher than in 2020 (29.8%) ($p=0.002$ and $p<0.05$) (Table 1).

In 2020, the ICU bed ratio was 43 (6.9%), 21 (3.4%) higher than in 2019 ($p=0.005$ and $p<0.05$).

The rate of patients who died in intensive care in 2020 (37.1%) was statistically significantly higher than 2019 (31.5%) ($p=0.008$ and $p<0.05$) (Table 2).

The mortality rate in patients readmitted to intensive care in 2019 (47.5%) was statistically significantly higher than the intensive care mortality rate (31.5%) ($p=0.034$ and $p<0.05$) (Table 3).

In 2020, the mortality rate in patients readmitted to intensive care was 41.2% and the intensive care mortality rate was 37.1%, with no statistically significant difference be-

Table 1. Comparison of readmission rates by years

Number of discharges	Readmission			p
	n	%	%	
2019				
667	40	70.2	5.99	0.002*
2020				
682	17	29.8	2.49	
Total				
1349	57	100		

Chi-square analysis in one-eyed design. *p<0.05.

tween them (p>0.05) (Table 3).

Looking at the mortality rates in terms of readmissions, the mortality rate at readmission to intensive care was 47.5% in 2019 and 41.2% in 2020, with no statistically significant difference between them (p>0.05) (Table 3).

There is no statistically significant difference between 2019 and 2020 in terms of admission and discharge SOFA scores (p>0.05) (Table 4).

In 2019 and 2020, the decrease in the discharge according to the arrival SOFA score and the increase in the GCS score were statistically significant (p=0.000 and p<0.05) (Table 4).

There is no statistically significant difference in arrival GCS scores between 2019 and 2020 (p>0.05). In 2020, the discharge GCS score was statistically significantly higher than in 2019 (p=0.005 and p<0.05) (Table 4).

There is no statistically significant difference between 2019 and 2020 in terms of mean age, gender distribution, MV duration, and ICU length of stay (p>0.05) (Table 4).

In 2019, the wards with the highest number of admissions were general surgery with 22.5%, internal medicine with 20%, and neurosurgery with 17.5% (Table 5).

In 2020, the wards with the highest number of admissions were general surgery with 29.4%, internal medicine with 17.6%, and pandemic ward with 17.6% (Table 5).

In 2019, the most common reasons for admission were respiratory failure with a rate of 57.5%, post-operative complications with 20%, and GCS retardation with 10% (Table 6).

Table 2. Comparison of intensive care mortality rates by years

	2019		2020		p
	n	%	n	%	
Ex	307	31.5	402	37.1	0.008*
Alive	667	68.5	682	62.9	
Total number of patients	974		1084		

Chi-square test. *p<0.05.

Table 3. Comparison of intensive care mortality rate and mortality rates in readmissions in 2019

	Total ICU		Readmission ICU		p
	n	%	n	%	
2019					
Ex	307	31.5	19	47.5	0.034*
Alive	667	68.5	21	52.5	
Total number of patients	974		40		
2020					
Ex	402	37.1	7	41.2	0.926
Living	682	62.9	10	58.8	
Total number of patients	1084		17		

Chi-square test. *p<0.05. ICU: Intensive care unit.

Table 4. Comparison of SOFA and GCS scores by years

	2019	2020	Total	[1]p
	Mean±SD (median)	Mean±SD (median)	Mean±SD (median)	
Arrival SOFA	5.3±1.9 (6)	5.9±3.2 (5)	5.5±2.3 (5)	0.923
Discharged SOFA	3.3±1.2 (3)	2.9±1.9 (3)	3.2±1.5 (3)	0.238
[2]p	0.000*	0.000*		
Arrival GCS	11.7±2.3 (12)	10.4±5.2 (13)	11.3±3.4 (12)	0.881
Discharged GCS	13.5±1.8 (14)	14.8±0.4 (15)	13.9±1.6 (15)	0.005*
[2]p	0.000*	0.002*		

[1]: Mann-Whitney U-test; [2]: Wilcoxon sign-rank test; *p<0.05. SOFA: Sequential organ failure assessment; GCS: Glasgow coma scale.

Table 5. Distribution of services by year

Service	2019		2020		Total	
	n	%	n	%	n	%
Neurosurgery	7	17.5	1	5.9	8	14
Internal medicine	8	20	3	17.6	11	19.3
General surgery	9	22.5	5	29.4	14	24.6
Neurology	2	5	1	5.9	3	5.3
Neurology ICU	0	0	2	11.8	2	3.5
Orthopedics	5	12.5	1	5.9	6	10.5
Palliative	4	10	0	0	4	7
Pandemic service	0	0	3	17.6	3	5.3
Plastic surgery	1	2.5	0	0	1	1.8
Urology	4	10	1	5.9	5	8.8

ICU: Intensive care unit.

Table 6: Distribution of reasons for arrival by years

Reason for arrival	2019		2020		Total	
	n	%	n	%	n	%
Aspiration	2	5	1	5.9	3	5.3
General condition disorder	1	2.5	0	0	1	1.8
GCS retardation	4	10	1	5.9	5	8.8
Hypotension, need for HDF	2	5	0	0	1	1.8
Epileptic attack	0	0	2	11.8	1	1.8
Post CPR	0	0	1	5.9	1	1.8
Post-operative complications	8	20.0	1	5.9	9	15.8
Respiratory failure	23	57.5	11	64.7	34	59.6

GCS: Glasgow Coma Scale; HDF: Hemodiyafiltrasyon; CRP: Kardiyopulmoner resüsitasyon.

In 2020, the most common cause of admission is respiratory failure with a rate of 64.7% (Table 6).

Discussion

ICU where critical patients are followed up in hospitals is high specification units. These units should be at a level that can meet the capacity of the hospital in terms of both equipment and number of beds. Especially, the inadequacy in the number of beds can cause significant problems both in admission to the ICU and in terms of discharge. The ideal number of intensive care beds in hospitals should be at least 5-10% of all beds. Readmissions to the ICU within the first 48 h after discharge are an important quality indicator.[6-8] Brown et al.[9] found a rate of 2% for readmission to ICU in the first 48 h. Campbell et al.[5] found this rate to be 3.3%. In our study, this rate was 5.99% for 2019 and 2.49% for 2020. Studies have emphasized that readmissions in the first 48 h after discharge from the ICU indicate early discharge.[4,7] Studies have shown that this rate is around 22-30%.[10] Early discharge may be due to clinical resource constraints or poor discharge planning.[4,11] One of the most important problems in ICU is to make room for patients who need intensive care in a planned or unplanned way. Insufficient number of beds makes this situation more difficult and leads to early discharge of patients who are not fully clinically ready.[4,12-15]

Utzolino et al.[16] reported that the rate of readmission to the ICU increased by 8.3% (139/1675) in elective discharges, and the readmission to ICU increased by 25.1% (110/439) in patients with unplanned discharge, that is, in patients who were transferred due to the lack of ICU beds. In our study, we can say that the number of intensive care beds in 2019 was below the ideal (3.4%), while in 2020, these numbers were slightly better (6.9%). While the readmission rate was 40 (5.9%), in 2019, this rate was 17 (2.49%) in 2020. With our study, we believe that insufficient number of beds due to clinical resource limitations is an important factor in early readmissions. In their study, Çayören et al.[17] found that early discharge rates were higher compared to the literature and stated that the limitation in the number of beds was the reason for this.

Early readmissions to intensive care are certainly a group which deserves special attention. Patients in this group had a disproportionately high hospital mortality.[5,18-21] In our study, the mortality rate in early hospitalizations in 2019 and 2020 was 47.5-41.2%, respectively. We obtained similar results with the literature in that these rates were higher than the normal intensive care mortality rate. One of the points we would like to underline here is that while the mortality rate in readmissions in 2019 (47.5%) is significantly higher than the normal intensive care mortality rate (31.5%), there was no significant difference in 2020 (41.2% vs. 37.1%). The fact that the number of intensive care beds is close to the ideal level in 2020 allowed the patients with indications to be admitted to the ICU more quickly. Since this reduces the waiting times required to make room for new patients, we believe that worsening in this period is prevented and this reduced mortality.

At the time of discharge from the ICU, patients' vital signs being at physiological values and having appropriate GCS and SOFA scores will be useful in preventing readmission to the ICU. Gajic et al.[22] emphasized the importance of low GCS scores on the day of discharge in their study. Fakhry et al.[23] emphasized in their study that a patient's GCS of <9 at the time of discharge from the ICU is one of the strongest predictors for the risk of readmission. In our study, the GCS scores of the patients who were discharged in 2019 with more readmissions compared to 2020 were found to be statistically significantly lower than in 2020. We believe that low GCS scores in patients discharged from intensive care are an important risk factor for readmission.

Early discharge from the ICU and not receiving adequate care in the service to which they were transferred are believed to be among the main reasons for early readmission to the ICU.[10] Studies have reported that readmissions to ICU in the early period are generally due to acute respiratory failure and post-operative complications.[17,24-26]

In the study conducted by Tong et al.,[27] especially in patients who underwent surgery, they found the rate of post-operative respiratory complications to be 44.2% versus 97.7% in patients who were readmitted to the ICU and in patients who were not. Tangonan et al.[28] analyzed the reasons for readmission to the ICU in patients with intracerebral hemorrhage and found that the most common causes were respiratory causes followed by neurological and cardiac complications.

Çakalağaoğlu et al.[29] found the rate of readmission to the ICU as 3.5% in their study in patients who had undergone coronary bypass and stated that ICU readmissions were mostly due to respiratory (29%) and cardiac (23.4%) complications.

The results of our study were consistent with the literature, and the most common causes of early hospitalization were found to be acute respiratory failure and post-operative complications. Therefore, we believe that providing detailed information about these patients to the wards to which patients who have been hospitalized in the ICU for a long time, who have received respiratory support therapies, who have developed weakness in the respiratory muscles, and who are followed up in the post-operative period, pro-

viding complete information about the critical and ongoing treatment of these patients and, if necessary, following up the patient in the wards to which they are transferred, will help early recognition of complications that may occur and prevent a possible early readmission. Again, Jo et al.[30] reported that male gender and diabetes mellitus were effective in ICU readmissions. Our study does not support the same results and we did not find any significant difference in terms of gender and comorbidities.

Readmissions to ICU can occur from any clinic. In the study by Çayören et al.,[17] the most common readmissions were from general surgery and neurosurgery wards. In our study, most of the hospitalizations were in general surgery and internal medicine wards. We believe that the main determining factor here is the lack of adequate treatment, care, and follow-up in the clinic. Therefore, we believe that the clinical follow-up of patients discharged from the ICU can be reduced by close follow-up of the patient in a coordinated manner by the ICU and the ward team to reduce the risk of readmission.

Inadequate bed numbers and increased patient occupancy in an ICU are associated with an increased risk of premature death or ICU readmission after ICU discharge. Overloading the capacity of the ICU to care for critically ill patients can affect physician decision-making and lead to premature discharge of patients from the ICU.

Patients discharged from the ICU always have the potential for readmission. Readmissions to the ICU are associated with much higher mortality rates than initial admission. The important point in reducing ICU readmission rates is to identify high-risk patients and to increase the level of ward care.

Disclosures

Ethics Committee Approval: The study was approved by The Haydarpaşa Numune Training and Research Hospital Clinical Research Ethics Committee (Date: 04/10/2021, No: HNEAH-KAEK 2021/KK/257).

Informed Consent: Patient consent was not deemed necessary because of the retrospective study design.

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