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Discharge of dependent patients directly from the intensive care units after a critical illness: a single-center retrospective cohort study

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Abstract. – OBJECTIVE: This study aimed to determine the mortality and predictive factors affecting mortality of patients discharged directly from the intensive care unit (ICU) at the third- and sixth-month post-discharge. Additionally, it assessed the rate of hospital readmissions within 30 days post-discharge and the satisfaction level of family members with post-ICU care.

PATIENTS AND METHODS: In this single-center, retrospective, observational cohort study, dependent patients discharged directly from the ICU between July 1, 2019, and July 1, 2022, were included. Data on patients' demographics, reasons for admission, pre-existing diseases, length of ICU stay, advanced clinical interventions, discharge destination, physiological status on discharge, readmission within 30 days, and clinical outcomes and mortality at the third- and sixth-months post-discharge were collected.

RESULTS: The study included 240 patients, representing 45.8% of all patients discharged directly from the ICU. Of these, 122 were discharged to their homes, and 118 to intermediate care units intermediate care units (IMCUs). The mean age was 71 years [interquartile range (IQR): 22.8]. Among the patients, 113 (47.1%) were readmitted within 30 days post-discharge, and 23 (20.35%) were re-hospitalized. The overall mortality rate in the third and sixth months was 25.4% and 32.5%, respectively. Logistic regression identified age, readmission within 30 days, and Glasgow Outcome Scale-Extended (GOS-E) at discharge as predictive factors for short-term and long-term mortality. Patients discharged to IMCUs had significantly higher long-term mortality. Family members of patients discharged to their homes had significantly higher satisfaction with post-ICU care (p=0.002).

CONCLUSIONS: Discharging patients directly from the ICU to their homes may yield better outcomes in selected patients compared to discharging to IMCUs. This approach may also enable more efficient use of hospital resources and reduce ICU occupancy and associated costs.

Key Words:
Dependent patients, Intensive care unit, Discharge planning, Home care, Long-term care.

Introduction

The survival rate of critical patients has improved because of the advances in intensive care unit (ICU) management over the last few decades. Discharge from the ICU involves a complex decision-making process, primarily due to the difficulty of optimizing post-ICU care, especially when it comes to dependent patients. Traditionally, patients have been transferred from the ICUs to regular hospital wards once they no longer require intensive treatment or monitoring. However, hospitals have operated at nearly full capacity in recent years, and the wards mainly accept patients from emergency services and polyclinics. Thus, it takes time to free up beds in the wards for patients to be transferred from the intensive care unit, resulting in more extended lengths of stay, an increased risk of nosocomial infections, and higher patient costs.

Recently, there has been an increased interest in clinical studies on the direct discharge of patients from ICUs to their homes without first being transferred to wards[1-4]. A recent meta-analysis revealed that discharging patients from the ICUs directly to their homes yielded somewhat better outcomes than discharging them to hospital wards[5]. However, the evidence on the superiority of discharging patients from the ICUs directly to their homes to discharging them to hospital wards is inconclusive.

In this context, this study assessed critically ill patients discharged directly to their homes or intermediate care units (IMCUs) without being transferred to hospital wards in terms of demographics and clinical characteristics. In parallel, this study's objective is primarily to determine the mortality of patients discharged directly from the ICU in the third and sixth months after discharge and the predictive factors affecting mortality, and secondarily to assess the rate of readmissions to the hospital within 30 days after discharge and the satisfaction level of family members with the post-ICU care.

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Patients and Methods

Population and Sample

The population of this single-center, retrospective, observational cohort study consisted of 326 dependent patients discharged directly from a level 3 adult ICU with 134 mixed (medical and surgical) beds to their homes or IMCUs between July 1, 2019, and July 1, 2022. Patients who have been discharged directly from the ICUs but did not need continuous care at home or in medical intensive care units (MICU), whose family members could not be reached or refused to be interviewed, or were unable to provide coherent responses, as well as patients who had recurrent hospitalizations in the same intensive care unit and were transferred from other hospitals were excluded from the study. In the end, the study group consisted of 240 patients.

Data Collection

The patients discharged directly from the ICU were determined by screening the admission registry of 6,625 patients admitted to ICUs. The medical records of patients determined to have been discharged directly from the ICU were obtained from the hospital's electronic database. In addition, patients' caregivers were called to inquire about their medical progress within 30 days, three months, and six months after discharge.

Patients' demographic characteristics, including age, gender, reasons for admission, pre-existing diseases, disease severity based on Acute Physiology and Chronic Health Evaluation II (APACHE II)- and Sequential Organ Failure Assessment (SOFA)- scores assessed during the first 24 hours in the ICU, length of stay, advanced clinical interventions received in the ICU, including vasoactive medications, mechanical ventilation, and continuous renal replacement therapy, discharge destination, i.e., home or IMCU, physiological status on discharge based on the need for tracheostomy, home-care ventilator, and/or percutaneous endoscopic gastrostomy (PEG), etc., readmission to hospital within 30 days of discharge, and outcomes on the third and sixth months after discharge were recorded. The Extended Glasgow Outcome Scale (GOS-E) was used to evaluate patients' neurological status upon discharge and three and six months after discharge. Additionally, family members were asked to rate their satisfaction level with post-ICU care using a numeric rating scale ranging from 1 (extremely dissatisfied) to 10 (extremely satisfied).

Discharge Criteria

MICUs are institutional centers where patients receive routine nursing care accompanied by their caregivers under the supervision of a physician who visits them periodically. Patients with a tracheostomy, patients requiring a home ventilator or needing oxygen supplementation, and patients who need brief periods of non-invasive mechanical ventilation are allowed to stay in MICUs. Patients who require vasopressors, continuous drug infusions, or intermittent venous hemodialysis are not accepted. Patients whose general status is impaired while in the MICU are transferred to the nearest hospital's emergency department. MICUs provide care for the patients, training on caregiving, and facilitate the adaptation of the family members to their patients' new physical status.

According to the discharge policy of the ICU subject to this study, a home ventilator, a portable airway suction device, an airbed, and enteral nutritional products are provided to the patients depending on their needs. If the patients are to be discharged directly to their homes, their family members receive training in the ICU on caregiving. The patients whose family members prefer their patients to be discharged to an IMCU and receive professional support there rather than being discharged to their homes are transferred to an IMCU. Family members are provided with the necessary medical supplies and receive training on caregiving as their patients are discharged from MICU. At discharge, patients are given medical advice and explained potential problems after discharge, and their family members are advised on what to do in case said problems occur and when to reapply to a hospital. All patients included in this study were discharged from the ICU *via* the same procedure.

Statistical Analysis

Statistical analyses were carried out using the SPSS 23.0 (Statistical Package for the Social Sciences for Windows, Version 23.0, IBM Corp., Armonk, NY, USA) software package. Continuous variables were expressed as mean±standard deviation (SD) or median [interquartile range, (IQR)] values, whereas categorical variables were expressed as numbers (n) and percentages (%). The Kolmogorov-Smirnov test was used to assess the normality assumption for the continuous variables. Continuous data were compared using the student's *t*-test and Mann-Whitney U test for parametric and nonparametric variables, respectively. Categorical data were compared using Pearson's Chi-square test and Fisher's exact test in cases where the sam-

ple size was less than 5. Kaplan-Meier curves were used to demonstrate survival data. The independent risk factors for mortality were identified using multivariable logistic regression analysis. The odds ratios (OR) with 95% confidence intervals (CI) were estimated. Probability (p) statistics ≤0.05 were deemed to indicate statistical significance for all comparisons.

Results

Baseline Demographic and Clinical Characteristics of the Study Group

The patients discharged directly from the ICU were determined by screening the admission registry of 6,625 patients admitted to ICUs between July 1, 2019, and July 1, 2022. The overall direct discharge rate was 16.5% for all survivors. The study cohort consisted of 326 patients discharged from ICUs in need of care, constituting 45.8% of all directly discharged patients. Of these 326 patients, 240 who met the inclusion criteria were included in the study (Figure 1). The mean age of the study group, of which 52.9% was male, was 71 (IQR: 22.8) years. Of the 240 patients, 223 (92.9%) had at least one pre-existing disease on admission. The rate of patients discharged directly to their homes or IMCUs was 50.8% and 49.2%, respectively. The demographics and clinical characteristics of the study group are shown in Table I.

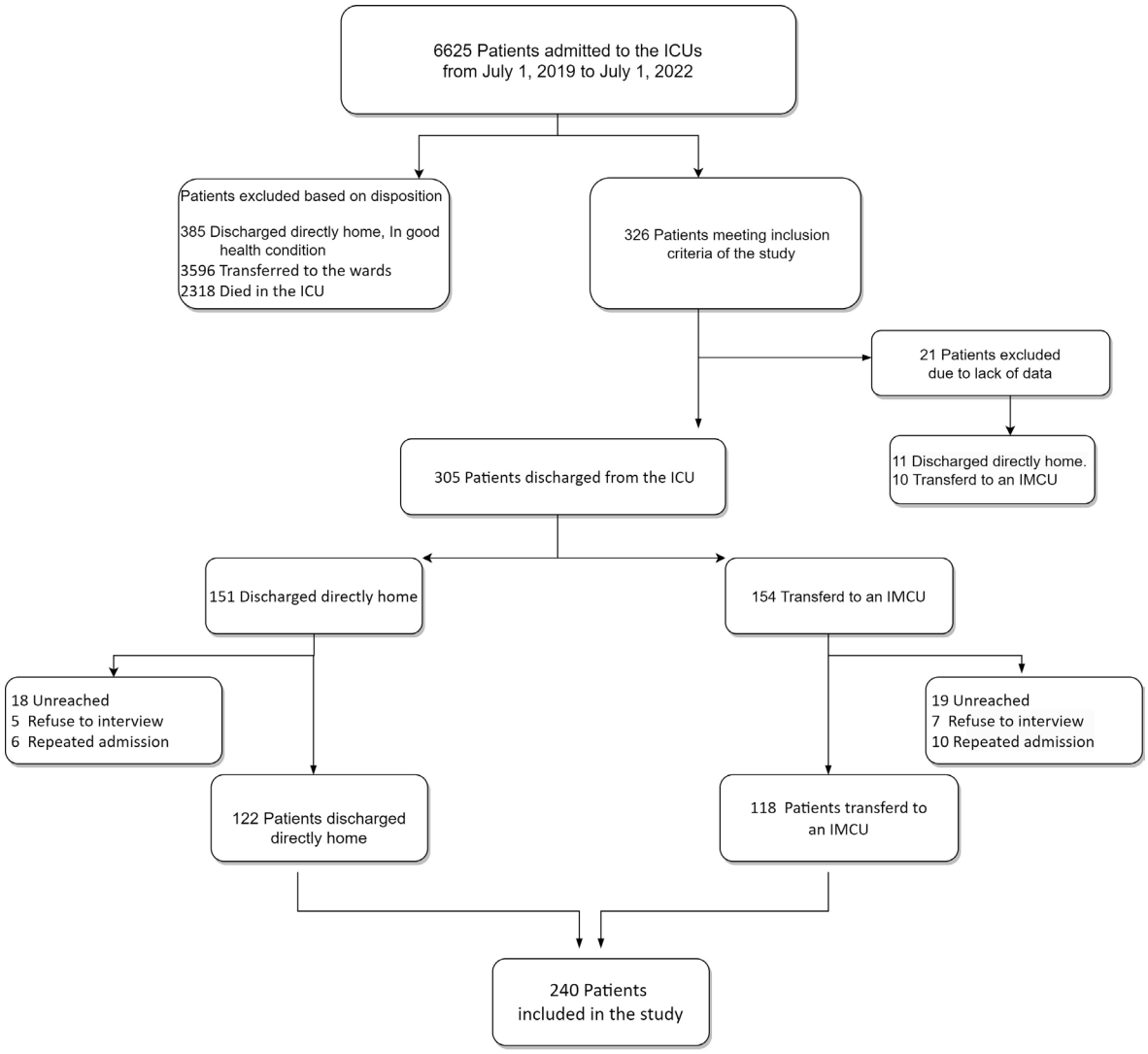

Figure 1. Flowchart showing patient selection for analyses.

Table I. Demographic and clinical characteristics of patients (n=240).

Variables	Results
Age (yrs)[a]	71 (22.8)
Gender[b]	
Female	113/47.1
Male	127/52.9
Route of admission	
Emergency department	176/73.3
Ward	64/26.7
Length of stay in ICU (days)[a]	28 (55.8)
Total hospital stay (days)[a]	30 (56.5)
Number of pre-existing diseases	
0	17/7.1
1	95/39.6
2	82/34.2
≥3	46/19.2
GCS on admission	8 (5)
APACHE IIa Score	17 (7.8)
SOFA Scorea	4 (1)
Requirement of ALS[b]	
MV	172/71.7
Vasoactive agent infusion	80/33.3
CRRT	32/13.3
Physiological status on discharge[b]	
Tracheostomy (T)	101/42.1
Home-care ventilator (H)	49/20.4
PEG (P)	119/49.6
T+P	80/33.3
T+H+P	43/17.9
Discharge destination[b]	
Home	122/50.8
IMCU	118/49.2
GCS on dischargea	11 (5)
GOSEa	
Discharge	5 (3)
3 months	4 (4)
6 months	4 (3)
Previous ICU admission[b]	93/38.8
Readmission within 30 days[b]	113/47.1
Mortality[b]	
≤3 months	61/25.4
≤6 months	78/32.5

[a]median (IQR); [b]n/%; yrs: years; n: number; %: percentage; ICU: intensive care unit; IQR: Interquartile Range; GCS: Glasgow Coma Scale; APACHE II: Acute Physiology and Chronic Health Evaluation; SOFA: Sequential Organ Failure Assessment Score; ALS: Advanced Life Support; MV: Mechanical ventilation; PEG: Percutaneous endoscopic gastrostomy; GOSE: Extended Glasgow Outcome Score; IMCU: Intermediate long-care unit.

Clinical Outcomes

Pulmonary causes were the most common reason for ICU admissions, accounting for 25% of ICU admissions and 37% of readmissions within 30 days of discharge (Figure 2).

Of 240 patients, 113 (47.1%) were readmitted to the hospital within 30 days of discharge from ICU. The number of patients with pre-existing comorbidities (p=0.010) who received adjuvant concurrent chemoradiation therapy (CCRT) while in ICU (p=0.008), who were discharged with a home-care ventilator (p=0.001), and who were discharged with a home-care ventilator along with a tracheostomy and PEG (p=0.003) was significantly higher in patients who were readmitted to the hospital within 30 days of discharge from ICU than in other patients. Additionally, patients readmitted to the hospital within 30 days of discharge from ICU had significantly lower Glasgow Outcome Scale-Extended (GOS-E) scores on discharge (p=0.020) and a significantly higher number of previous ICU admissions (p<0.001). The three- and 6-month mortality rates were also significantly higher in readmitted patients than in others (p<0.001) (Table II). There was no significant difference between patients discharged directly to their homes or IMCUs in terms of readmission to the hospital within 30 days of discharge from the ICU (p=0.528).

The overall mortality of the study cohort in the third and sixth months was 25.4% and 32.5%, respectively. The six-month mortality rate in patients discharged directly to an IMCU was 67.9%. The distribution of the mortality rates of the overall study group and subgroups by the discharge destination is shown in Figure 3. Non-survivors were significantly older than survivors (p<0.001) and had significantly lower GOS-E scores on discharge (p<0.001). Additionally, the rate of those with two or more comorbidities (p=0.030 and p=0.040, respectively) and who were previously admitted to ICU (p=0.020 and p=0.010, respectively) was significantly higher among patients with three- and six-month mortality than in survivors (Table III).

Assessment of Mortality Predictors

The results of the multivariate logistic regression analysis conducted to determine the variables with a prognostic value to predict three- and six-month mortality after ICU discharge are shown in Table IV. Accordingly, age (OR: 1.073; 95% CI: 1.042-1.105), GOS-E on discharge (OR: 0.626; 95% CI: 0.480-0.818), and readmission to

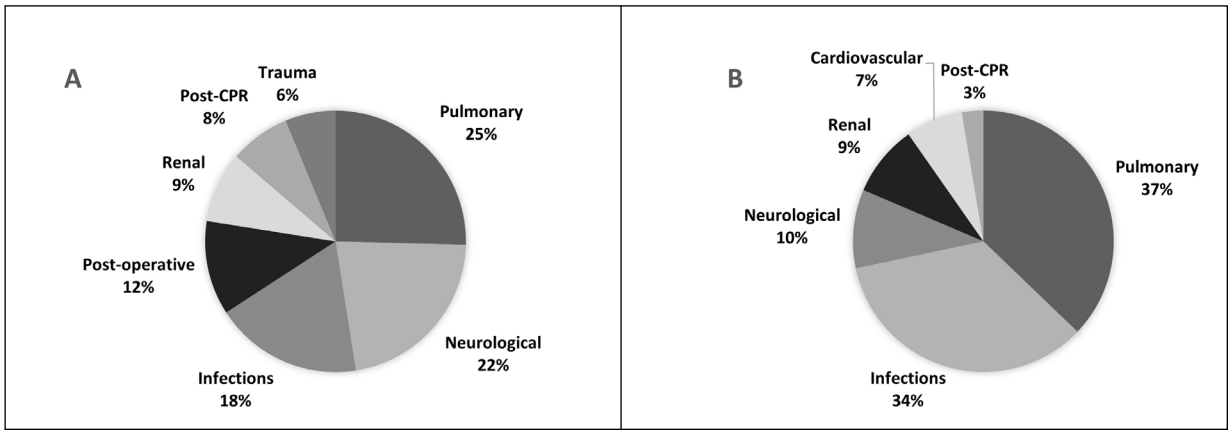

Figure 2. Causes of admission to the ICU (**A**) and readmission within 30 days of ICU discharge (**B**).

Table II. Demographic and clinical characteristics of patients readmitted within 30 days after ICU discharge.

Variables	Readmission (+) (n=113)	Readmission (-) (n=127)	*p*
Age (yrs)[a]	71 (22)	70 (21)	0.237[α]
Gender[b]			
Female	49/43.4	64/50.4	0.276[β]
Male	64/56.6	63/49.6	
Length of stay in ICU (days)[a]	32 (53)	22 (58)	0.279[α]
Total hospital stay (days)[a]	32 (56)	25 (55)	0.309[α]
Number of pre-existing diseases[b]			
0	4/3.5	13/10.2	**0.010*[β]**
1	37/32.7	58/45.7	
2	46/40.7	36/28.3	
≥3	26/23.0	20/15.7	
Requirement of ALS[b]			
MV	78/69.0	94/74.0	0.392[β]
Vasoactive agent infusion	41/36.3	39/30.7	0.360[β]
CRRT	22/19.5	10/7.9	**0.008*[β]**
Physiological status on discharge[b]			
Tracheostomy (T)	50/44.2	51/40.2	0.522[β]
Home-care ventilator (H)	33/29.2	16/12.6	**0.001**[β]**
PEG (P)	57/50.4	62/48.8	0.802[β]
T+P	40/35.4	40/31.5	0.522[β]
T+H+P	29/25.7	14/11.0	**0.003[β]**
Discharge destination[b]			
Home	55/48.7	67/52.8	0.528[β]
IMCU	58/51.3	60/47.2	
GCS on discharge[a]	11 (5)	11 (4)	0.090[α]
GOSE on discharge[a]	4 (2)	5 (3)	**0.020***[α]**
Previous ICU admission[b]	62/54.9	31/24.4	**<0.001**[β]**
Mortality[b]			
≤3 months	41/36.3	20/15.7	**<0.001**[β]**
≤6 months	51/45.1	27/21.3	**<0.001**[β]**

[a]median (IQR); [b]n/%; yrs: years; n: number; %: percentage; ICU: intensive care unit; IQR: Interquartile Range; GCS: Glasgow Coma Scale; ALS: Advanced Life Support; MV: Mechanical ventilation; PEG: Percutaneous endoscopic gastrostomy; GOSE: Extended Glasgow Outcome Score; IMCU: Intermediate long-care unit; **p*<0.01 very significant; ***p*<0.001 extremely significant; ****p*<0.05 statistically significant; [α]Mann-Whitney U test; [β]Chi-square test.

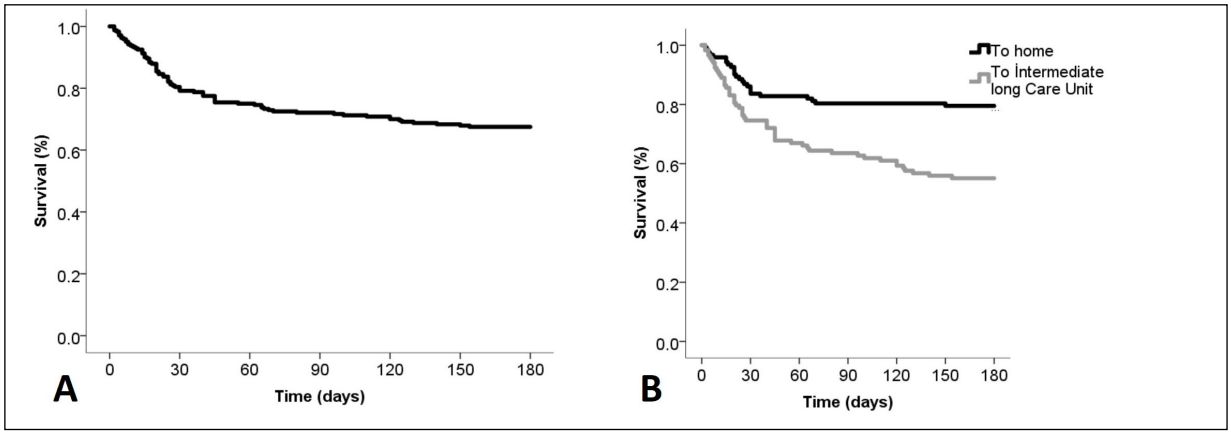

Figure 3. Kaplan-Mayer curves for the 6-month mortality of the full cohort (**A**) and sub-cohorts (**B**).

Table III. Data of survivors and non-survivors during the post-ICU period.

Variables	≤3 months			≤6 months		
	Survivors (n=179)	Non-survivors (n=61)	p	Survivors (n=162)	Non-survivors (n=78)	p
Age (yrs)[a]	68 (22)	80 (18)	**<0.001*α**	66 (21)	79 (17)	**<0.001*α**
Gender[b]						
Female	84/46.9	29/47.5	0.934β	75/46.3	38 (48.7)	0.725β
Male	95/53.1	32 /52.5		87/53.7	40 (51.3)	
Length of stay in ICU (days)[a]	28 (56)	28 (53)	0.749α	28 (56)	28.5 (50)	0.902α
Total hospital stay (days)[a]	30 (56)	30 (57)	0.816α	30 (56.3)	31 (56)	0.828α
Number of pre-existing diseases[b]						
0	17/9.5	----	**0.030**β**	16/9.9	1/1.3	**0.040**β**
1	74/41.3	21/34.4		66/40.7	29/37.2	
2	55/30.7	27/44.3		54/33.3	28 /35.9	
≥3	33/18.4	13/21.3		26/16.0	20/25.6	
Requirement of ALS[b]						
MV	130/72.6	42/68.9	0.572β	120/74.1	52/66.7	0.233β
Vasoactive agent infusions	57/31.8	23/37.7	0.402β	49/30.2	31/39.7	0.144β
CRRT	24/13.4	8/13.1	0.954β	21/13.0	11/14.1	0.808β
Physiological status on discharge[b]						
Tracheostomy (T)	78/43.6	23/37.7	0.423β	71/43.8	30/38.5	0.430β
Home-care ventilator (H)	36/20.1	13/21.3	0.841β	33/20.4	16/20.5	0.980β
PEG (P)	85/47.5	34/55.7	0.266β	74/45.7	45/57.7	0.080β
T+P	62/34.6	18/29.5	0.463β	56/34.6	24/30.8	0.559β
T+H+P	32/17.9	11/18	0.978β	29/17.9	14/17.9	1.000β
Discharge destination[b]						
Home	100/55.9	22/36.1	**0.008***β**	97/59.9	25 /32.1	**<0.001*β**
IMCU	79/44.1	39/63.9		65/40.1	53/67.9	
GCS on discharge[a]	11 (6)	11 (2.5)	0.167α	11 (6)	10 (3)	0.050α
GOSE on discharge[a]	5 (3)	4 (2)	**<0.001*α**	5 (2.3)	4 (2.0)	**<0.001*α**
Previous ICU admission[b]	62/34.6	31 /50.8	**0.020**β**	54/33.3	39/50.0	**0.010***β**
Readmission within 30 days[b]	72/40.2	41/67.2	**<0.001*β**	62/38.3	51/65.4	**<0.001*β**

[a]median (IQR); [b]n/%; yrs: years; n: number; %: percentage; ICU: intensive care unit; IQR: Interquartile Range; GCS: Glasgow Coma Scale; APACHE II: Acute Physiology and Chronic Health Evaluation; SOFA: Sequential Organ Failure Assessment Score; ALS: Advanced Life Support; MV: Mechanical ventilation; PEG: Percutaneous endoscopic gastrostomy; IMCU: Intermediate long-care unit; GOSE: Extended Glasgow Outcome Score; **p*<0.001 extremely significant; **; *p*<0.05 statistically significant; ***p*<0.01 very significant; αMann-Whitney U test; βChi-square test.

Table IV. Multivariate logistic regression model to predict 3 and 6-month mortality after ICU discharge.

Variables	Mortality ≤3 months 95% CI				Mortality ≤6 months 95% CI			
	Odds Ratio	Lower	Upper	p	Odds Ratio	Lower	Upper	p
Age	1.073	1.042	1.105	**<0.001**	1.069	1.040	1.099	**<0.001**
Number of pre-existing diseases (0-1 *vs.* ≥2)	1.068	0.689	1.656	0.768	1.134	0.746	1.722	0.557
Discharge destination (IMCU *vs.* Home)	1.560	0.772	3.153	0.216	2.492	1.270	4.891	**0.008**
GOSE on discharge	0.626	0.480	0.818	**0.001**	0.600	0.465	0.775	**<0.001**
Previous ICU admission	1.055	0.516	2.160	0.883	1.135	0.567	2.269	0.721
Readmission within 30 days	2.741	1.310	5.736	**0.007**	2.760	1.362	5.597	**0.005**

IMCU: Intermediate long-care unit; GOSE: Extended Glasgow Outcome Score; ICU: Intensive Care Unit.

the hospital within 30 days after discharge (OR: 2.741; 95% CI: 1.310-5.736) were determined as predictive factors for short-term (3-month) and long-term (6-month) mortality. There was no significant difference between patients discharged from the ICU directly to their homes or MICUs in short-term mortality (OR: 1.560; 95% CI: 0.772-3.153). However, the number of patients with long-term mortality was significantly higher in patients discharged from ICU directly to the IMCU than those discharged from ICU directly to their homes (OR: 2.492; 95% CI: 1.270-4.891).

Assessment of the Post-ICU Care

The mean satisfaction score of family members with post-ICU care was 6.5. Satisfaction scores ≤6 were considered low satisfaction, and satisfaction scores ≥7 points were considered high satisfaction. The satisfaction level of patients' families with post-ICU care decreased significantly with patients' age (p<0.001), systemic comorbidities (p=0.010), lower Glasgow Coma Scale (GCS) scores (p=0.004), and lower GOS-E scores on discharge (p=0.030) and increased significantly with discharge to home after the ICU compared to those discharged to IMCU (p=0.002) (Table V).

Discussion

This study's sample consisted of 240 dependent patients recovering from a critical illness discharged directly from the ICU, either to their homes or IMCUs. Of these patients, 113 (47.1%) were readmitted to a hospital within 30 days of discharge. Patients with at least two or more pre-existing comorbidities, who received CCRT while in ICU, who were discharged with a home-care ventilator, and who were discharged with a home-care ventilator along with a tracheostomy and PEG were significantly higher among patients who were readmitted to the hospital within 30 days of discharge from ICU than in other patients. Additionally, patients readmitted to the hospital within 30 days of discharge from the ICU had significantly lower GOS-E scores on discharge and a significantly higher number of previous ICU admissions. The three- and six-month mortality rates were also significantly higher in readmitted patients than in others. The mortality rate in patients discharged from the ICU directly to IMCUs was higher than in patients from the ICU directly to their homes. Advanced age, a low GOS-E score on discharge, and readmission to the hospital within 30 days of discharge were independent risk factors for long-term (six-month) mortality. The satisfaction level of family members with post-ICU care was significantly higher in the case of patients discharged directly to their homes compared to those discharged directly to IMCUs. In sum, it was determined that discharging patients from the ICU directly to their homes is associated with better outcomes and post-ICU care management than being discharged directly to the IMCUs. This result supports the literature suggesting that direct home discharge from the ICU should be routinely considered in selected critically ill patients.

Direct home discharge from the ICU is a common practice for palliative care patients for whom there is nothing to do medically[6-8]. However, in parallel with the increasing demand for inten-

Table V. Distribution of patients according to the level of family member's satisfaction scores.

Variables	Satisfaction score[1]		p
	≤6 (n=120)	≥7 n(120)	
Age (yrs)[a]	74 (21)	66 (25)	**<0.001*[α]**
Gender[b]			
Female	60/60.0	53/44.2	0.365[β]
Male	60/60.0	67/55.8	
Number of pre-existing diseases[b]			
0	4/3.3	13/10.8	
1	41/35.0	53/44.2	**0.010**[β]
2	44/36.7	38/31.7	
≥3	30/25.0	16/13.3	
Physiological status on discharge[b]			
Tracheostomy (T)	51/42.5	50/41.7	0.896[β]
Home-care ventilator (H)	28/23.3	21/17.5	0.262[β]
PEG (P)	65/54.2	54/45.0	0.156[β]
T+P	44/36.7	36/30.0	0.273[β]
Discharge destination[b]			
Home	49/40.8	73/60.8	**0.002**[β]
IMCU	71/59.2	47/39.2	
GCS on discharge[a]	11 (4)	11.5 (5)	**0.004**[α]
GOSE on discharge[a]	4 (2)	5 (3)	**0.030**[α]
Previous ICU admission[b]	53/44.2	40/33.3	0.080β

[1]The score ≤6 and ≥7 expressed low and high satisfaction of family members after ICU discharge, respectievly. [a]median (IQR); [b]n/%; yrs: years; n: number; %: percentage; ICU: intensive care unit; IQR: Interquartile Range; GCS: Glasgow Coma Scale; PEG: Percutaneous endoscopic gastrostomy; GOSE: Extended Glasgow Outcome Score; IMCU: Intermediate long-care unit; **p*<0.001 extremely significant; ***p*<0.01 very significant; ****p*<0.05 statistically significant; [α]Mann-Whitney U test; [β]Chi-Square test.

sive care beds, the rapid discharge of patients recovering from critical diseases has gained more importance. While the traditional approach was to discharge patients from intensive care units to hospital wards, increasing patient density and cramped wards, have made this no longer a viable approach. On the other hand, delayed discharge increases the length of hospital stay and has potential iatrogenic clinical consequences[9]. In parallel with these trends, direct home discharge from ICU practice has been used more commonly in recent years, with outcomes comparable to those of traditional discharge practices[10,11]. Although the increased use of direct home discharge from ICU practice has reportedly stemmed from the chronic ward occupancy problem, the literature findings on the correlations between the increased use of direct home discharge from ICU practice and ward and ICU occupancy rates were inconclusive possibly due to the variable ward and ICU occupancy rates and the fact that ICU occupancy is not correlated with the ward occupancy[11]. In this study, the overall direct discharge rate was found as 16.5 % for all survivors, in line with the literature.

Literature data on readmission rates of discharged patients vary widely, possibly due to differences in the characteristics of the patient populations involved. Stelfox et al[12] reported the readmission rate of patients discharged from the ICU directly to the home as 10%. However, the patients in the study of Stelfox et al[12] were younger, had fewer systemic comorbidities, and had no previous ICU admissions, unlike the patients in this study. Lau et al[13] reported the unplanned readmission rate for the patients discharged from ICU directly to the home as 24%. Lau et al[13] also reported very good 8-week post-ICU discharge outcomes in this patient population. Xing et al[10] did not find any significant difference in readmission rates or mortality between patients discharged from ICU directly to home and patients discharged from hospital ward to home. Chawla et al[7] reported 23.2% mortality in patients discharged from an oncologic ICU directly to home.

Chronic comorbidities are likely the cause of most readmissions in this patient population. These varying results necessitate a model that can predict the patients that can be discharged directly to home and guide clinicians in the decision-making process regarding discharge[14].

Contrary to the vast majority of relevant data in the literature, the readmission rate in patients included in this study was 47.1%. Of these, 23 (20.35%) were re-hospitalized in a healthcare facility. This finding was attributed to the fact that the patient population served in the ICU subject to this research includes mainly geriatric patients with multiple systemic comorbidities, oncologic patients, patients with trauma, and patients undergoing advanced surgical procedures. Each of these patient groups has unique challenges with respect to ICU admissions with different outcomes. Therefore, future studies are needed to determine the patients likely to be readmitted and the causes of these readmissions.

MICUs are tasked with providing continuous patient care. However, the literature findings on whether MICUs decrease post-discharge mortality are inconclusive. MICUs are usually used as "step-down" facilities for patients recovering from critical illnesses, enabling the earlier discharge of patients from ICUs without interruption in the delivery of care[15]. Ranzani et al[16] did not find any significant difference in the 90-day mortality rate between patients discharged from the ICU directly to an IMCU or a hospital ward. A recent review[17] stated that there is limited published evidence to support the benefits of MICUs in reducing costs or improving outcomes and that local considerations may be more critical in decision-making. In comparison, in this study, although no significant difference was found between patients discharged from ICU directly to their homes or MICUs in readmission rates, the number of patients with long-term mortality was significantly higher in patients discharged from ICU directly to the IMCU compared to the patients discharged from ICU directly to their homes. This finding raises suspicion about the effectiveness of MICUs as it may suggest that institutional approaches and nursing services are not as effective as expected regarding the care of dependent patients. Then again, the difference in the mortality rate between the patients discharged from ICU directly to the IMCU and the patients discharged from ICU directly to home might also be caused by the differences between the two patient populations, as the conditions of the patients discharged from ICU directly to MICUs may be more severe. The limited sample size did not allow further analyses within the groups. Therefore, further large-scale studies are needed to shed more light on the differences between patients discharged from ICUs directly to home and MICUs.

Patients with chronic health problems after recovery from a critical illness constitute a public health issue. These patients often have long-term physical, neurocognitive, and mental health disorders that require care, referred to as post-intensive care syndrome (PICS). PICS is a major cause of long-term mortality[18]. The French and European Outcome Registry in Intensive Care Unit (FROG-ICU) study reported one-year mortality among the patients discharged from ICU as 20% and found older age and a higher number of comorbidities as independent risk factors for mortality[19]. Discharge destination has not been evaluated in the said study; however, the outcomes reported for discharged patients were comparable to those reported in other studies[20,21] for patients discharged from ICU to home or the hospital ward. In comparison, the three- and six-month overall mortality rate in this study was 25.4% and 32.5%, respectively. As in the FROG-ICU study, age was found to be an independent risk factor for long-term (six-month) mortality. On the other hand, unlike the FROG-ICU study, the number of comorbidities was not found to be associated with mortality. Instead, low GOS-E scores on discharge and readmission to the hospital within 30 days of discharge have been found to be independent risk factors for mortality.

The post-ICU care of these patients is another matter of concern that needs to be addressed. Family members usually experience high levels of post-traumatic stress and uncertainty during the ICU stay of their patients, referred to as post-intensive care syndrome-family (PICS-F)[22]. Most literature focused on patients' satisfaction with ICU stay even though the assessment of the post-ICU period seems to be more important given the complications that may arise in this period. Lam et al[23] reported that patients discharged directly from ICU to home and their family members were both highly satisfied with post-ICU care. Family members of patients discharged from ICU directly to home were broadly satisfied with post-ICU care at home, similar to the results of this study. This finding can be attributed to the fact that the patient's family members can spend more time with the patient and control the post-intensive care process.

Strengths and Limitations of the Study

The fact that the study cohort comprised high-risk dependent patients distinguishes this study from other studies on the subject. On the other hand, there were also some limitations to this study, including its retrospective single-center design. The screening of the patients' medical records retrospectively might have resulted in accessing data about comorbidities that are misleading or misreported. Secondly, the study was subject to local biases. Thus, its generalizability is limited. Thirdly, the phone interviews with family members were not free from subjective evaluation.

Conclusions

The study's findings suggest that discharging patients from the ICU directly to their homes may yield better outcomes in selected patients compared to being discharged directly to the IMCUs. Discharging patients from the ICU directly to their homes will likely enable more efficient use of hospital resources and reduce ICU occupancy rate and associated patient costs. Developing discharge protocols and training healthcare professionals to that effect will guide the relevant decision-making process and help promote this practice.

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Conflict of Interest

There is no conflict of interest.

Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

Ethics Approval

The Local Kartal Dr Lütfi Kırdar Clinical Research Ethics Committee approved this study on date: 25.01.2023, number: 2022 / 514 /242/ 7). The analysis was performed in accordance with the principles of the Helsinki Declaration.

Informed Consent

Written informed consent could not be obtained from the patients included in the study due to the study's retrospective design.

References

1) Lau VI, Priestap FA, Lam JN, Basmaji J, Ball IM. Clinical predictors for unsafe direct discharge home patients from intensive care units. J Intensive Care Med 2020; 35: 1067-1073.
2) Martin CM, Lam M, Allen B, Richard L, Lau V, Ball IM, Wunsch H, Fowler RA, Scales DC. Determinants of direct discharge home from critical care units: A population-based cohort analysis. Crit Care Med 2020; 48: 475-483.
3) Von Kaeppler EP, Kramer EJ, Donnelley CA, Wu HH, Marseille E, Eliezer E, Roberts HJ, Shearer D, Morshed S. The initial economic burden of femur fractures on informal caregivers in Dar es Salaam, Tanzania. Malawi Med J 2021; 33: 135-139.
4) Patel PM, Fiorella MA, Zheng A, McDonnell L, Yasuoka M, Yoo EJ. Characteristics and outcomes of patients discharged directly home from a medical intensive care unit: A retrospective cohort study. J Intensive Care Med 2021; 36: 1431-1435.
5) Lau VI, Donnelly R, Parvez S, Gill J, Bagshaw SM, Ball IM, Basmaji J, Cook DJ, Fiest KM, Fowler RA, Mailman JF, Martin CM, Rochwerg B, Scales DC, Stelfox HT, Iansavichene A, Sy EJ. Safety outcomes of direct discharge home from ICUs: An updated systematic review and meta-analysis (direct from ICU sent home study). Crit Care Med 2023; 51: 127-135.
6) Giovannini S, Tamburrano A, Sganga F, Serra ML, Loreti C, Coraci D, Barillaro C. A new model of multidimensional discharge planning: continuity of care for frail and complex inpatients. Eur Rev Med Pharmacol 2020; 24: 13009-13014.
7) Chawla S, D'Agostino RL, Pastores SM, Thirumala R, Kostelecky N, Chou JF, Thaler HT, Halpern NA. Homeward bound: an analysis of patients discharged home from an oncologic intensive care unit. J Crit Care 2012; 27: 681-687.
8) Kalavina R. The challenges and experiences of stroke patients and their spouses in Blantyre, Malawi. Malawi Med J 2019; 31: 112-117.
9) Tiruvoipati R, Botha J, Fletcher J, Gangopadhyay H, Majumdar M, Vij S, Paul E, Pilcher D; Australia and New Zealand Intensive Care Society (ANZICS) Clinical Trials Group. Intensive care discharge delay is associated with increased hospital length of stay: A multicentre prospective observational study. PLoS One 2017; 12: e0181827.
10) Xing S, Roshdy A, Radhakrishnana J, Kiff K, Collins J. Discharge home from critical care: safety assessment in a resource constrained system. J R Coll Physicians Edinb 2019; 49: 23-25.
11) Lau VI, Priestap FA, Lam JNH, Ball IM. Factors associated with the increasing rates of discharg-

es directly home from intensive care units-A Direct from ICU sent home study. J Intensive Care Med 2018; 33: 121-127.

12) Stelfox HT, Soo A, Niven DJ, Fiest KM, Wunsch H, Rowan KM, Bagshaw SM. Assessment of the safety of discharging select patients directly home from the intensive care unit: A multicenter population-based cohort study. JAMA Intern Med 2018; 178: 1390-1399.
13) Lau VI, Lam JN, Basmaji J, Priestap FA, Ball IM. Survival and safety outcomes of ICU patients discharged directly home-A Direct From ICU Sent Home Study. Crit Care Med 2018; 46: 900-906.
14) Talarska D, Kropińska S, Strugała M, Szewczyczak M, Tobis S, Wieczorowska-Tobis K. The most common factors hindering the independent functioning of the elderly at home by age and sex. Eur Rev Med Pharmacol Sci 2017; 21: 775-785.
15) Silva MC, Sousa RM, Padilha KG. Patient destination after discharge from intensivecare units: wards or intermediate care units? Rev Lat Am Enfermagem 2010; 18: 224-232.
16) Ranzani OT, Zampieri FG, Taniguchi LU, Forte DN, Azevedo LC, Park M. The effects of discharge to an intermediate care unit after a critical illness: a 5-year cohort study. J Crit Care 2014; 29: 230-235.
17) Vincent JL, Rubenfeld GD. Does intermediate care improve patient outcomes or reduce costs? Crit Care 2015; 19: 89.
18) Yanagi N, Kamiya K, Hamazaki N, Matsuzawa R, Nozaki K, Ichikawa T, Valley TS, Nakamura T, Yamashita M, Maekawa E, Koike T, Yamaoka-Tojo M, Arai M, Matsunaga A, Ako J. Post-intensive care syndrome as a predictor of mortality in patients with critical illness: A cohort study. PLoS ONE 2021; 16: e0244564.
19) Gayat E, Cariou A, Deye N, Vieillard-Baron A, Jaber S, Damoisel C, Lu Q, Monnet X, Rennuit I, Azoulay E, Léone M, Oueslati H, Guidet B, Friedman D, Tesnière A, Sonneville R, Montravers P, Pili-Floury S, Lefrant JY, Duranteau J, Laterre PF, Brechot N, Chevreul K, Michel M, Cholley B, Legrand M, Launay JM, Vicaut E, Singer M, Resche-Rigon M, Mebazaa A. Determinants of long-term outcome in ICU survivors: results from the FROG-ICU study. Crit Care 2018; 22: 8.
20) Martin CM, Lam M, Le B, Pinto R, Lau V, Ball IM, Wunsch H, Fowler RA, Scales DC. Outcomes after direct discharge home from critical care units: A population-based cohort analysis. Crit Care Med 2022; 50: 1256-1264.
21) Sy E, Gupta C, Shahab Z, Fortin N, Kassir S, Mailman JF, Lau VI. Long-term safety of directly discharging patients home from the ICU compared to ward transfer. J Intensive Care Med 2022; 37: 1344-1352.
22) Davidson JE, Jones C, Bienvenu OJ. Family response to critical illness: postintensive care syndrome-family. Crit Care Med 2012; 40: 618-624.
23) Lam JNH, Lau VI, Priestap FA, Basmaji J, Ball IM. Patient, family, and physician satisfaction with planning for direct discharge to home from intensive care units: Direct from ICU sent home study. J Intensive Care Med 2020; 35: 82-90.