Bridging the Gap Between the Intensive Care Unit and the Acute Medical Care Unit

By Eileen Kim, MD, Charles Kast, MD, Anika Afroz-Hossain, MD, Michael Qiu, MD, PhD, Karalyn Pappas, BS and Liron Sinvani, MD

Background Despite a growing cohort of intensive care unit (ICU) survivors, little is known about the early ICU aftercare period.
Objective To identify gaps in early ICU aftercare and factors associated with poor hospital outcomes.
Methods A multisite, retrospective study (January 1 to December 31, 2017) was conducted among randomly selected patients admitted to the medical ICU and subsequently transferred to acute medical care units. Records were reviewed for patient characteristics, ICU course, and early ICU aftercare practices and syndromes. Associations between practices and hospital outcomes were calculated with χ^2 and Wilcoxon rank sum tests, followed by logistic regression.
Results One hundred fifty-one patients met inclusion criteria (mean [SD] age, 64.2 [19.1] years; 51.7% male; 44.4% White). The most frequent diagnoses were sepsis (35.8%) and respiratory failure (33.8%). During early ICU aftercare, 46.4% had dietary restrictions, 25.8% had bed rest orders, 25.0% had a bladder catheter, 26.5% had advance directive documentation, 33.8% had dysphagia, 34.3% had functional decline, and 23.2% had delirium. Higher Charlson Comorbidity Index (odds ratio, 1.6) and midodrine use on medical units (odds ratio, 7.5) were associated with in-hospital mortality; mechanical ventilation in the ICU was associated with rapid response on medical unit (odds ratio, 12.9); and bladder catheters were associated with ICU readmission (odds ratio, 5.2).
Conclusions Delirium, debility, and dysphagia are frequently encountered in early ICU aftercare, yet bed rest, dietary restriction, and lack of advance directive documentation are common. Future studies are urgently needed to characterize and address early ICU aftercare. (*American Journal of Critical Care.* 2021;30:193-200)

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The aging population and advances in critical care medicine have led to a large and growing cohort of intensive care unit (ICU) survivors.[1] In the past 3 decades, there has been a 35% relative decrease in ICU mortality.[2] Despite increased survival, unplanned ICU admissions result in high short-term and long-term mortality rates.[2-4] Furthermore, survivors are at risk for post–intensive care syndrome, a constellation of debilitating cognitive, functional, and mental health impairments that persist throughout hospitalization and well after hospital discharge.[5,6]

In the past decade, tremendous effort has been made to standardize ICU care to improve patient outcomes. In 2013, the Society of Critical Care Medicine published a set of evidence-based, person-centered guidelines targeting the management of pain, agitation, and delirium.[4] In 2015, the Institute for Healthcare Improvement sponsored the Rethinking Critical Care initiative, advocating for a bundle that serves as the implementation framework for the pain, agitation, and delirium guidelines in the ICU.[7] The awakening and breathing coordination, delirium monitoring/management, early exercise/mobility, and family engagement (ABCDEF) bundle, recommended by the Society of Critical Care Medicine and regarded as the standard of ICU care, is a group of interventions proven in the ICU to reduce ventilator days, delirium, and length of hospitalization, which are key precursors to the development of post–intensive care syndrome.[4,7-10]

Critically ill survivors spend most of their hospitalization in an acute medical care unit, a period referred to as *early ICU aftercare.*

Although these evidence-based protocols exist in the ICU, critically ill survivors spend most of their hospitalization in an acute medical care unit after they are transferred out of the ICU and before hospital discharge, a period referred to as *early ICU aftercare.* Very little is known about the early ICU aftercare period. Previous studies have highlighted the continued use of high-risk medications, unnecessary devices (eg, bladder catheters), and potential risk for delirium and functional decline.[11-14] Whether interventions targeting early ICU aftercare could further improve outcomes is also unclear. Strategies to improve outcomes, including ICU clinics and diaries, have mainly focused on the posthospital period, or late ICU aftercare.[15-17] Although a few European countries have ongoing efforts to target early ICU aftercare with transitional nurses and follow-up visits, these efforts have been few and failed to show benefit.[18,19] Step-down units with more favorable nurse to patient ratios and training may help reduce ICU readmissions, but they are more costly to maintain and have limited bed availability.[20] Furthermore, ICU survivors are typically under the care of non–critical care providers, namely hospitalists, who do not receive any specialized training or instruction on the care of ICU survivors.[6,21]

Although the body of literature on evidence-based protocols to improve patient outcomes in the ICU is robust and increasing, there is a dearth of evidence on the care of ICU survivors in the early ICU aftercare period. Our study aimed to characterize early ICU aftercare by identifying gaps as well as patient and clinical factors associated with poor short-term hospital outcomes in this vulnerable population.

Methods

We conducted a retrospective cohort study of randomly selected adult patients admitted to the medical ICU and subsequently transferred to the acute medical care unit within a 12-month period (January 1 to December 31, 2017) in 2 large tertiary centers in the New York metropolitan area. The 2 hospitals had identical electronic health record systems. Two independent internal medicine physicians performed an in-depth medical record review. Data elements that were discordant were discussed and

About the Authors
Eileen Kim, **Charles Kast**, and **Anika Afroz-Hossain** are assistant professors, Division of Hospital Medicine, Department of Medicine, Zucker School of Medicine at Hofstra/Northwell, Manhasset, New York. **Michael Qiu** is a data analyst and **Karalyn Pappas** is a biostatistician, Feinstein Institutes for Medical Research, Northwell Health, Manhasset, New York. **Liron Sinvani** is an associate professor, Division of Hospital Medicine, Department of Medicine, Zucker School of Medicine at Hofstra/Northwell, and an assistant professor, Feinstein Institutes for Medical Research, Northwell Health.

Corresponding author: Liron Sinvani, MD, Zucker School of Medicine at Hofstra/Northwell, Center for Health Innovations and Outcomes Research, Feinstein Institutes for Medical Research, 600 Community Drive, Manhasset, NY 11030 (email: ldanay@northwell.edu).

decided upon by a third physician. Only patients who were admitted directly to the medical ICU from the emergency department and subsequently transferred to the acute medical care unit were included. Patients who were initially admitted to the acute medical care unit and then transferred to the ICU were excluded to minimize study heterogeneity. Patients were also excluded if they died in the ICU or were admitted to the ICU because of diabetic ketoacidosis or for monitoring after receipt of tissue plasminogen activator for an acute cerebrovascular event. Patients with these conditions were excluded because they are generally admitted to the ICU for nursing care (ketoacidosis) or are primarily under the care of the neurological service (acute cerebrovascular event). Neither hospital has a step-down unit; all ICU survivors are transferred to acute medical care units throughout the hospital.

Data Variables

Patient characteristics consisted of demographics (age, sex, race); Charlson Comorbidity Index (CCI); ICU admitting diagnosis; severity of the acute illness, as measured by mechanical ventilation and pressor use (defined as intravenous administration of norepinephrine, epinephrine, vasopressin, phenylephrine, or dopamine); and ICU length of stay (LOS).

Continuous variables included age, CCI, and ICU LOS. Categorical variables were sex, race, and ICU admitting diagnosis. Mechanical ventilation and pressor use were considered binary variables (present or not present).

Early ICU aftercare practices that were ordered or continued on the acute medical care units were (1) complete dietary restriction (nothing by mouth), (2) indwelling bladder catheter, (3) bed rest, (4) use of high-risk medications (benzodiazepines, antipsychotics, and opiates), (5) use of oral midodrine for blood pressure support, and (6) documentation of advance care planning, including health care proxy, preferences for life-sustaining treatments (eg, do-not-resuscitate orders), and goals of care. Midodrine is used as a blood pressure stabilizer to taper patients off intravenous pressors and shorten ICU stays.[22,23]

Early ICU aftercare syndromes consisted of delirium, functional decline, and dysphagia. *Delirium* was defined as delirium documentation or an order for physical restraints, constant observation (continuous one-to-one monitoring), and/or receipt of antipsychotic medications for behaviors such as agitation, combativeness, delusions, and hallucinations. *Functional decline* was defined as a decrease in functional status between baseline and hospital discharge, as documented in nursing and physical therapy notes. Functional status was categorized as independent, needs assistance, or completely dependent. All early ICU aftercare practices and syndromes were considered binary variables (present or not present).

Short-term hospital outcomes were ICU readmission, rapid response team (RRT) activation, hospital LOS, in-hospital mortality, and 30-day hospital readmission. Hospital LOS was considered a continuous variable and all other outcomes were considered binary (present or not present).

Statistical Analysis

Data were summarized with descriptive statistics. Continuous variables were detailed with means and SDs; categorical variables were summarized with frequencies and percentages.

Associations between patient characteristics and short-term hospital outcomes (ICU readmission, RRTs, hospital mortality, and 30-day hospital readmission) were calculated. The χ^2 test was used for binary patient characteristics (mechanical ventilation and intravenous pressor use), the Fisher exact test was used for categorical variables (sex, race, and admitting diagnosis), and the Wilcoxon rank sum test was used for continuous variables (age, CCI, and ICU LOS). The Spearman correlation test was used to analyze associations between patient characteristics and hospital LOS. A multiple logistic regression model was used to analyze the association between patient characteristics and clinical outcomes. A backwards selection method was used until only significant variables were left in the model.

Early ICU aftercare syndromes consisted of delirium, functional decline, and dysphagia.

Associations between early ICU aftercare practices/syndromes and short-term hospital outcomes (ICU readmission, RRTs, hospital mortality, and 30-day hospital readmission) were evaluated with the χ^2 test. The Spearman correlation test was used to evaluate associations between early ICU aftercare practices/syndromes and hospital LOS. A multiple linear regression model was used to analyze the association between ICU aftercare practices/syndromes and short-term hospital outcomes. A backwards selection method was used until only significant variables were left in the model.

An observed *P* value of less than .05 was considered significant. The data analysis for this study was generated with SAS software (SAS Studio version 3.8, SAS Institute Inc).

Table 1
Baseline characteristics

Characteristic	No. (%)[a]
Age, mean (SD), y	64.2 (19.1)
Sex	
Male	78 (51.7)
Female	73 (48.3)
Race/ethnicity	
White	67 (44.4)
Black	44 (29.1)
Asian	17 (11.3)
Hispanic	9 (6.0)
Other	14 (9.3)
Diagnosis	
Sepsis	54 (35.8)
Respiratory failure	51 (33.8)
Gastrointestinal bleeding	12 (7.9)
Urgent hemodialysis	10 (6.6)
Delirium tremens	7 (4.6)
Pulmonary embolism	2 (1.3)
Other	15 (9.9)
Charlson Comorbidity Index, mean (SD)	3.4 (2.7)
Intravenous pressor support	73 (48.3)
Mechanical ventilation	75 (49.7)
Length of stay in ICU, mean (SD), d	4.1 (3.8)

Abbreviation: ICU, intensive care unit.

[a] Data are expressed as number (percentage) of all 151 patients unless otherwise indicated.

Table 2
Early ICU aftercare practices and syndromes

Practice	No. (%)[a]
Complete dietary restriction	70 (46.4)
Indwelling bladder catheter (n = 148)	37 (25.0)
Bed rest order	39 (25.8)
Opioid use	36 (23.8)
Benzodiazepine use	23 (15.2)
Antipsychotic use (n = 150)	18 (12.0)
Acetaminophen use	68 (45.0)
Midodrine use	19 (12.6)
Advance directive documentation	
In ICU	17 (11.3)
In acute medical care unit	23 (15.2)
Syndrome	
Delirium documentation	35 (23.2)
Physical restraints	7 (4.6)
Constant observation	20 (13.2)
Dysphagia	51 (33.8)
Functional decline (n = 143)	49 (34.3)

Abbreviation: ICU, intensive care unit.

[a] Percentages are based on the total of 151 patients unless otherwise indicated in the first column.

Results

A total of 151 of 400 patients met the inclusion criteria. One hundred five patients were excluded because they were admitted to the acute medical care unit before being admitted to the ICU; 24 patients were excluded because they died while still in the ICU; 59 patients were excluded because they were admitted to the ICU for diabetic ketoacidosis nursing care (n = 22) or observation after receiving tissue plasminogen activator (n = 37); and 61 were excluded either because they were discharged from ICU before transfer to the acute medical care unit or they were medical ICU boarders (not admitted to the medicine service). Among the patients meeting the inclusion criteria, the mean (SD) age was 64.2 (19.1) years, 51.7% were male, and 44.4% were White. The most frequent admission diagnoses were sepsis, respiratory failure, and gastrointestinal bleeding. The mean (SD) CCI was 3.4 (2.7). Nearly half of patients received intravenous pressor support and nearly half required mechanical ventilation. The mean (SD) ICU LOS was 4.1 (3.8) days (Table 1).

Early ICU Aftercare Practices

One-quarter of patients had an indwelling bladder catheter newly placed during ICU admission (not present before hospitalization) that persisted upon transfer to the acute medical care unit. Thirty-six of those patients underwent voiding trials, 32 (88.9%) of which were successful. More than one-quarter of patients had bed rest orders. With regard to pain control, 23.8% of patients had opiates ordered, and of these only 58.5% had a concomitant order for acetaminophen. Fifteen percent of patients received a newly prescribed benzodiazepine in the acute medical care unit. Nearly half of patients had an order for complete dietary restriction. Most ICU survivors (73.5%) did not have documentation of advance directives; only 11.3% had documented advance directives in the ICU, and an additional 15.2% had advance directive documentation in the acute medical care unit (Table 2).

Early ICU Aftercare Syndromes

Nearly one-quarter of patients had surrogate markers for delirium (restraint use, 4.6%; new antipsychotic medication, 12.0%; and constant observation, 13.2%; some patients had >1 marker). More than one-third of patients had dysphagia. More than one-third had evidence of functional decline (Table 2).

Short-Term Hospital Outcomes

Following ICU transfer, 7.9% of patients had an RRT, 6.6% required readmission to the ICU, 4.6%

died during hospitalization, and 18.5% had a 30-day hospital readmission. The mean (SD) hospital LOS was 13.3 (12.2) days (Table 3).

Table 3
Post-ICU outcomes

Outcome	No. (%)[a]
Rapid response team	12 (7.9)
ICU readmission	10 (6.6)
In-hospital mortality	7 (4.6)
Hospital length of stay, mean (SD), d	13.3 (12.2)
30-Day hospital readmission	28 (18.5)

Abbreviation: ICU, intensive care unit.
[a] Data are expressed as number (percentage) of all 151 patients unless otherwise indicated.

Associations Between Patient Characteristics/Clinical Practices and Outcomes

With regard to patient characteristics, CCI was associated with hospital mortality and functional decline. Severity of illness indicators (mechanical ventilation and pressor support) were associated with longer hospital stays; mechanical ventilation was associated with RRT activation. Early ICU aftercare use of midodrine was associated with in-hospital mortality (Table 4).

With regard to clinical practices, the presence of a bladder catheter was associated with ICU readmission (Table 4). The other post-ICU practices were not associated with short-term hospital outcomes.

Discussion

Although evidence-based protocols exist to improve ICU care, information about the early ICU aftercare period, when patients are transferred to the acute medical care unit, is scarce.[24,25] We aimed to characterize early ICU aftercare with the goal of informing future interventions that could improve care for this high-risk population during this vulnerable time. Our findings suggest that the complexity of ICU care continues even after patients are transferred to acute medical care units, where ICU survivors frequently experience delirium, functional decline, and dysphagia. Furthermore, practices such as continued use of bladder catheters, dietary restriction, bed rest, use of high-risk medications, and lack of documented advance directives and goals of care are common in early ICU aftercare.

One of the most frequently encountered conditions persisting beyond the ICU is delirium. Delirium is complex, devastating, and underrecognized.[4,7] Delirium occurs in up to 80% of ICU patients.[26] However, less evidence exists as to persistent delirium rates among those exiting the ICU. In our study, nearly a quarter of patients received constant observation, physical restraints, and/or antipsychotic medications. These surrogate markers most likely represent the management of hyperactive delirium. However, hyperactive delirium represents only approximately 25% of patients, whereas hypoactive delirium represents up to 75%.[27] Therefore, improving delirium recognition and management in this population is essential.

In addition to improving delirium screening, we also found opportunities to improve prevention and management strategies for delirium. A well-established and important risk factor for delirium is the presence of a bladder catheter.[28] We found that 25% of patients were transferred to the acute medical care units with new bladder catheters. Bladder catheters have been associated with infectious adverse events (urinary tract infections) and noninfectious adverse events (falls).[13] Furthermore, having a bladder catheter in

Table 4
Associations between patient characteristics/clinical practices and outcomes

Outcome	Significant predictors	β (95% CI)	Odds ratio (95% CI)	*P*[a]
Change in functional status	CCI	0.07 (0.002-0.142)	NA	.04
Rapid response team	Mechanical ventilation	NA	12.9 (1.6-102.6)	.02
ICU readmission	Bladder catheter	NA	5.2 (1.4-19.5)	.02
In-hospital mortality	Midodrine use	NA	7.5 (1.3-44.5)	.03
	CCI	NA	1.6 (1.1-2.3)	.007
Hospital length of stay	Mechanical ventilation	0.44 (0.16-0.73)	NA	.002
	Pressor support	0.57 (0.28-0.85)	NA	<.001

Abbreviations: CCI, Charlson Comorbidity Index; ICU, intensive care unit; NA, not applicable.
[a] Fisher exact test was used for categorical variables, and Wilcoxon rank sum test was used for continuous variables.

the acute medical care unit was a significant predictor of ICU readmission. Eighty-nine percent of patients with a bladder catheter successfully underwent a trial of voiding, emphasizing the importance of catheter reevaluation in early ICU aftercare.

In our study, more than one-third of patients experienced functional decline during the hospital stay. Although this finding is not unexpected given the complicated course faced by critically ill patients, we identified gaps in early ICU aftercare that may improve functional status. We found that about one-quarter of patients had bed rest orders while on the acute medical care unit. Hospitalized patients spend 83% of their time in bed and only 4% standing or walking.[29] Functional decline and deconditioning can occur as early as the second day of hospitalization and even earlier in critically ill patients.[30] Intensive care unit guidelines strongly emphasize the importance of early mobilization to improve functional outcomes and reduce delirium.[31] Patients may be taken for ambulation while intubated. However, such programs require strong interdisciplinary support, which may not be available on acute medical care units.[24] Furthermore, staff members may hesitate to take patients who are still very ill for ambulation.[32] In the early ICU aftercare period, the focus should be on assessing function and helping patients regain function.

Practices such as continued use of bladder catheters, dietary restriction, bed rest, use of high-risk medications, and lack of documented advance directives and goals of care are common in early ICU aftercare.

Dysphagia is also commonly encountered in early ICU aftercare. Previous publications have demonstrated that 60% of those extubated experience dysphagia and 50% have evidence of aspiration.[33,34] In our study, nearly half of patients had orders for complete dietary restriction and one-third of patients had dysphagia. Patients with suspected dysphagia are often prescribed dysphagia diets, which generally lack evidence for reducing aspiration and may lead to dehydration, weight loss, and poor quality of life.[35,36] Previous literature has also shown that 40% of patients in the hospital are malnourished.[37] Addressing dysphagia in early ICU aftercare is critical to prevent dietary restrictions, reduce adverse events, and improve quality of life for ICU survivors.

Addressing goals of care and advance directives is essential to ensure preference-congruent care, prevent unnecessary interventions, and ensure that patients and family members are aware of prognosis and illness trajectory.[38] However, we found that these discussions were rarely documented in the medical records. Although it is impossible to know whether discussions were held and not documented, this lack of documentation is problematic. As patients transition from the ICU to the acute medical care unit and from the hospital to a skilled nursing facility or home, it is necessary to ensure that the patient's goals are known. Addressing and documenting the patient's priorities and wishes are essential parts of providing high-quality care.

Another important gap identified in our study was the use of high-risk medications. Morandi et al[14] reported that the percentage of patients prescribed at least 1 potentially inappropriate medication increased from 66% before ICU admission to 85% at hospital discharge. We found that 15.2% of patients either continued receiving or were newly prescribed benzodiazepines in the acute medical care unit. Previous publications have highlighted that ICU survivors often experience emotional dysfunctions such as anxiety and adjustment disorder.[16] Addressing these issues through tools such as ICU diaries may be important in the early ICU aftercare period.[17] Critically ill patients also often experience pain, which most likely persists upon transfer to the acute medical care unit.[39] We found that nearly a quarter of ICU survivors received opiates to address pain. However, of those that received opiates, less than 60% had a concurrent order for acetaminophen. The use of nonopiate medications to address pain in early ICU aftercare could reduce opiate use, which may reduce adverse events such as constipation and delirium.[4]

Finally, we found that the implications of the ICU course itself may be carried over to the acute medical care unit. For example, mechanical ventilation was associated with acute decompensation and longer hospital stay. Therefore, awareness of the ICU course is important for post-ICU outcomes. The use of midodrine upon transfer to the acute medical care unit was associated with increased in-hospital mortality. Midodrine has been used as a blood pressure stabilizer to taper patients off intravenous pressors and shorten ICU stays. The use of midodrine should therefore raise a flag for post-ICU clinicians.[22,23] Although most other practices on the acute medical care unit did not appear to be associated with short-term clinical outcomes, this area needs further investigation.

Our study is not without limitations. First, because of its retrospective nature, the study was limited to available electronic health record data. Therefore, elements such as the Acute Physiology and Chronic Health Evaluation scoring system were not available. To assess severity of illness, we used the CCI, which is a predictor of in-hospital mortality, along with surrogate markers for severity of illness (intravenous pressor administration and mechanical ventilation). Second, practices could be ascertained only if they were documented in the electronic health record. Therefore, it is possible that practices such as advance care planning were addressed but lacked documentation. Third, since the hospitals studied did not have step-down units, nurse to patient ratios ranged between 1:6 and 1:8. Therefore, our findings may not be generalizable to places that have lower or higher nurse to patient ratios or those with step-down units. Fourth, because of the relatively small sample size and evaluation of hospitals within a single health care system, our findings may have limited generalizability. Fifth, the study used a hypothesis-generating, *P* value–driven method to characterize associations between patient and clinical factors and short-term outcomes. Therefore, further studies are warranted to evaluate these associations. Despite these limitations, our study is one of the first to characterize early ICU aftercare. Critical care and non–critical care stakeholders have recognized this crucial gap in early ICU aftercare, calling for new initiatives to engage non–critical care providers beyond the ICU as a potential target to further improve patient outcomes.[40]

Conclusions

Despite a large and growing cohort of ICU survivors, very little is known about the early ICU aftercare period, in which patients spend most of their hospitalization. Our study demonstrated that ICU survivors often experience delirium, functional decline, and dysphagia in the early ICU aftercare period. Addressing common practices such as mobility, diet, indwelling bladder catheters, high-risk medications, and advance directives may improve quality of care for this population. Our findings highlight the urgent need to understand and address the unmet needs of ICU survivors in early ICU aftercare.

FINANCIAL DISCLOSURES
None reported.

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CE 1.0 Hour Category A

Notice to CE enrollees:

This article has been designated for CE contact hour(s). The evaluation demonstrates your knowledge of the following objectives:

1. Describe early ICU aftercare for ICU survivors on the acute medical units regarding syndromes such as delirium, debility, and dysphagia.
2. Identify gaps in early ICU aftercare including practices such as bed rest, documentation of advance directives, and dietary restriction.
3. Determine patient characteristics as well as ICU and early ICU aftercare practices associated with poor hospital outcome.

To complete the evaluation for CE contact hour(s) for this article #A21501, visit www.ajcconline.org and click the "CE Articles" button. No CE evaluation fee for AACN members. This expires on May 1, 2023.

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