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Early Mobility Activities During Continuous Renal Replacement Therapy

By Cherylynn A. Brownback, RN, BSN, CCRN, Patricia Fletcher, RN, BSN, CCRN-CMC, Lynelle N. B. Pierce, RN, MSN, CCRN, CCNS, and Susan Klaus, RN, PhD

Abstract Continuous renal replacement therapy (CRRT) is a therapeutic technique used to support critically ill patients with acute renal failure in intensive care units. CRRT is preferred over hemodialysis for patients who cannot tolerate the rapid fluid and electrolyte shifts associated with hemodialysis because of their tenuous hemodynamic state. Traditionally, such patients have not been candidates for mobilization and have remained on strict bed rest. Mobilization is now being initiated on patients undergoing CRRT in intensive care units. This case study chronicles the successful mobilization of a patient undergoing CRRT. This experience suggests that CRRT patients who are appropriate candidates may be mobilized safely and therefore should not automatically be excluded from mobilization therapies. (*American Journal of Critical Care.* 2014;23:348-352)

CNE 1.0 Hour

Notice to CNE enrollees:

A closed-book, multiple-choice examination following this article tests your understanding of the following objectives:

1. Describe the complications associated with prolonged bed rest and the potential benefits of instituting early mobility activities in critically ill patients.
2. Identify barriers to progressive mobility for patients undergoing continuous renal replacement therapy (CRRT).
3. Discuss considerations for determining which patients are appropriate candidates for early mobility activities while undergoing CRRT and ideas for accomplishing mobilization of these patients safely.

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Therapeutic advances in the care of critically ill patients have led to an increasing clinical demand for renal replacement therapy. Patients with renal failure are treated with continuous renal replacement therapy (CRRT) because of hemodynamic instability and the inability to tolerate the fluid shifts that occur with intermittent hemodialysis.[1] Historically, patients undergoing CRRT have been limited to bed rest,[2] and the progressive upright mobility protocol at The University of Kansas Hospital explicitly excluded patients receiving CRRT from mobilization.

Prolonged bed rest has been associated with a number of well-documented adverse outcomes. Complications of immobility such as neuromuscular weakness and cognitive dysfunction may lead to long-lasting impairment in physical function and

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quality of life.[3,4] Patients undergoing CRRT at The University of Kansas Hospital were traditionally not considered for progressive mobility because of potential hemodynamic instability, safety risks, and the technical aspects of the therapy. Studies have suggested that mobilizing patients in the intensive care unit may be safe and beneficial in reducing the ill effects of immobility.[5,6] Only recently have patients undergoing CRRT been the explicit focus of mobility studies.[7] This case study describes the successful mobilization of a patient who refused to be on bed rest during CRRT. Successful mobilization was defined as the ability to move the patient without an interruption of CRRT, no significant change from baseline vital signs, and with no intolerance reported by the patient. Although this case consists predominantly of nursing efforts to mobilize a complex patient, interprofessional efforts toward comprehensive recovery from critical illness have resulted in improved patient outcomes.[4,6] To ensure patients' anonymity, certain nonessential demographic characteristics have been modified. This case report was evaluated by the local institutional review board, which determined that it fell outside the definition of human subjects research.

Case Report

A 55-year-old obese man with a history of congestive heart failure sought medical attention after noting a 15-pound (6.75 kg) weight gain at home. He was admitted to a progressive care unit for management of congestive heart failure. Shortly after his arrival in the unit, he became short of breath and was transferred to the intensive care unit. That same evening, a temporary hemodialysis catheter was placed in the patient's left femoral vein and hemodialysis was immediately started to correct a potassium level of 8.0 mEq/L in the setting of acute renal failure. A blood pressure of 74/51 mm Hg complicated the delivery of therapy and hemodialysis was suspended.

Hemodialysis was again attempted on hospital day 2. Once more, the patient had hypotension develop, with a blood pressure of 74/42 mm Hg. Therefore the decision was made to initiate CRRT. On the third day of CRRT (hospital day 4), at the request of the nephrology service, the hemodialysis access in the left femoral site was discontinued and replaced with a right internal jugular access. The following morning, the patient needed to be moved to a new bed because of mechanical failure of the head-of-bed elevation feature. To facilitate moving the patient to the new bed, the nursing staff assisted the patient to a sitting position on the edge of the bed with the feet dangling and then advanced to a standing position, all while he was undergoing CRRT. The patient remained alert, cooperative, and hemodynamically stable during the activity. Just before the activity, the nurse reported the patient's musculoskeletal status as intact, the absence of abnormalities, and that the patient was assisting with active range of motion.

Before admission, the patient was independent with activities of daily living. Because of his obesity, he had difficulty getting around the house, but he denied the use of ambulatory assistive devices. The patient expressed to the attending physician the desire to get out of bed, prompting an activity order to be placed allowing standing and transfer to chair. On days 4 and 5, while the patient was undergoing CRRT, he stood and took several steps to the chair, where he sat up for 5 hours, tolerating the activity without any complications. Three nurses assisted with mobilizing the patient, including a nurse assigned to ensuring the security of the patient's CRRT circuit. Throughout the episode, a registered nurse provided constant observation of the security of the tubing and adequacy of flow. CRRT was discontinued on day 6, but was restarted later in the day to correct an increasing creatinine level of 3.0 mg/dL (to convert creatinine level to micromoles per liter, multiply by 88.4). The patient continued to get out of bed to the chair and commode with the assistance of nurses on days 7 and 8. Throughout the total of 9 days of CRRT, the patient underwent 11 episodes of out-of-bed activity with no CRRT interruptions, device dislodgements, or hemodynamic complications (see Figure).

> The out-of-bed activity resulted in no hemodynamic complications or interruptions of continuous renal replacement therapy.

On hospital day 10, after a consultation with the critical care clinical nurse specialist and nephrologists, the patient's activity order was changed to strict bed rest. These team members, new on the service and unaware of how the patient had been mobilizing without complications, expressed concern regarding the logistics and lack of evidence supporting mobilization of patients undergoing CRRT. Therefore the institution's current mobility standard excluding patients undergoing CRRT was

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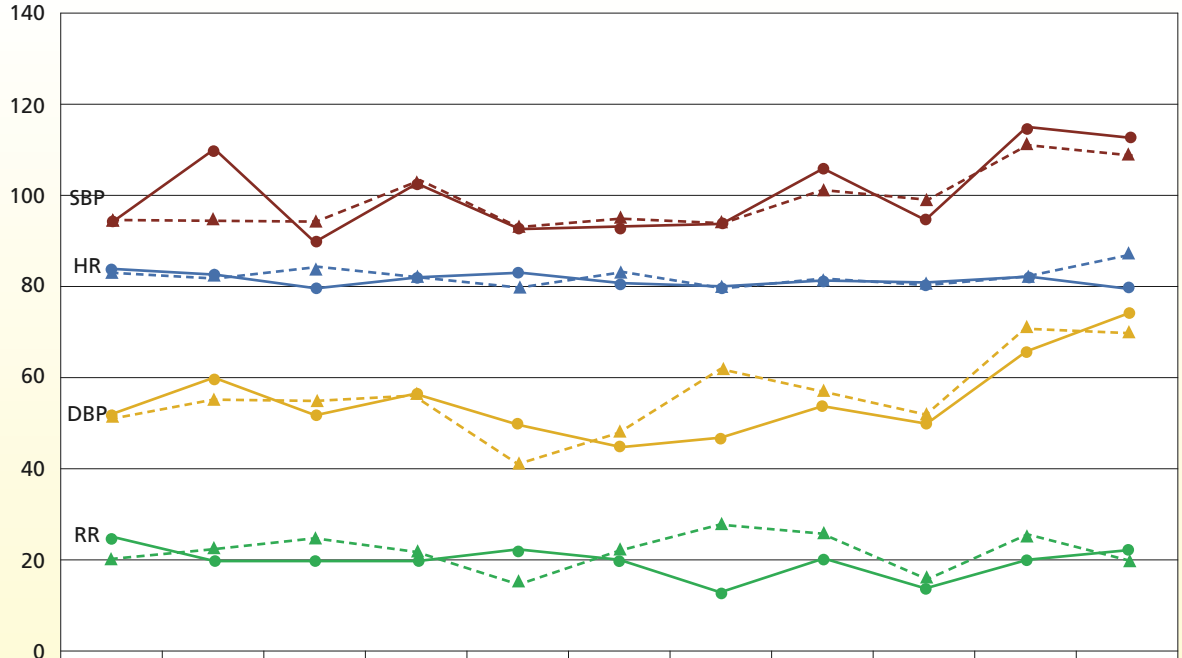

	Episode 1	Episode 2	Episode 3	Episode 4	Episode 5	Episode 6	Episode 7	Episode 8	Episode 9	Episode 10	Episode 11
BP systolic before	94	110	90	103	93	93	94	105	95	115	113
BP systolic after	95	95	94	102	93	95	94	101	99	111	109
HR before	84	83	80	82	83	81	80	81	81	82	80
HR after	83	82	84	82	80	83	80	82	80	82	87
BP diastolic before	52	60	52	57	50	45	47	54	50	66	74
BP diastolic after	51	55	55	56	41	48	62	57	52	71	70
RR before	25	20	20	20	22	20	13	20	14	20	22
RR after	20	22	25	22	15	22	28	26	16	26	20

Figure Vital signs during all activity episodes: chair and ambulation.

Abbreviations: BP, blood pressure; DBP, diastolic blood pressure; HR, heart rate; RR, respiratory rate; SBP, systolic blood pressure.

reinstituted. When the patient was informed that he was to remain in the bed, he became very upset and decided that he would not participate in physical therapy interventions or eat until he spoke with the nephrology team. Additionally, he refused to be on CRRT any longer if he was not going to be allowed to get out of bed to the chair. At that time, the intensive care unit and nephrology teams conferred and made the decision to stop CRRT and the patient was successfully transitioned to hemodialysis.

The patient was subsequently transferred out of the intensive care unit 3 days after stopping CRRT and discharged home 6 days later with a hemodialysis catheter in place.

Discussion

Clinicians have known for decades that bed rest is associated with significant complications such as orthostatic intolerance, reduction in the cardiac reserve, muscle wasting, pulmonary embolus, and deep vein thrombosis.[8] Bed rest is also associated with adverse effects on cardiovascular, pulmonary, musculoskeletal, neuroendocrine, hematological, and metabolic body systems.[5,9] Providers are now increasingly realizing the benefits of mobility for patients in intensive care units, despite the barriers that make mobilizing complex patients difficult.[5,6] Furthermore, patients discharged from the intensive care unit have been reported to have major physical impairments with decreased functional status and slow recovery.[10] Practitioners increasingly consider preservation of the patient's functional status after leaving the intensive care unit as an important outcome goal. This case study, although not assumed to represent all patients requiring CRRT, demonstrated that nurses can safely and successfully mobilize patients who were previously considered ineligible for mobilization at this institution.

Research has shown that early mobilization is a safe and effective practice in the intensive care unit; adverse events such as desaturation or ventilator asynchrony that resulted in cessation of activity

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occurred during 4% of episodes but did not have serious consequences.[4,6] In a case study of ambulation in intensive care units, a patient with multiple invasive devices along with mechanical ventilation was successfully and safely ambulated.[11]

Potential limitations to progressive mobility have been the presence of life-supporting invasive devices including dialysis catheters, central catheters, endotracheal tubes, arterial catheters, or vascular access devices.[2] There has been concern over the potential dislodgement of these important devices, resulting in reluctance to initiate progressive mobility.[12] Recent evidence has suggested that patients receiving mechanical ventilation are able to be safely mobilized.[6] More recently, patients with femoral vascular access devices safely received physical therapy that included standing, sitting, and cycling while in the intensive care unit.[13] Patients who are mobilized in the intensive care unit have fewer ventilator days and are more likely to return to independent functional status.[4] The mobility barriers for patients undergoing CRRT include risk to the hemodialysis catheter that is accessed and attached to an extracorporeal circuit at all times, along with the potential to disrupt flow, leading to clotting of the circuit and interruption of therapy. In addition, other barriers to consider include disease severity, cognitive state and ability to follow commands, adequate staff to assist, and equipment that is needed for the mobilization. In a study to evaluate the impact of prone positioning on 42 patients undergoing CRRT, no patients experienced inadvertent cannula removal, and only 2 patients had flow-related issues, 1 of which was related to the prone positioning.[14] In another study, patients with femoral arterial catheters participated in standing, sitting, transferring to the chair, and ambulation. None of the patients experienced any catheter-related adverse events.[15]

Mobilizing patients receiving CRRT does present some challenges. However, as more evidence points to the safety and feasibility of mobilization, all patients who are safely mobilized may experience improved functional status and shorter stays in the intensive care unit. This case report illustrates the successful mobilization of a patient undergoing CRRT that ultimately improved the patient's hospitalization. Beyond this single experience, nurses should employ the expertise of their interprofessional colleagues to maximize the functional benefits of mobility to critically ill patients. Future research is needed to discover the benefits and risks of implementing this intervention in all qualifying patients undergoing CRRT. In addition, the critical care team at our institution is reviewing the current policy on critical care mobility to consider expansion of inclusion criteria and undertaking initiatives to remove cultural barriers to aggressive mobilization of critically ill patients.

FINANCIAL DISCLOSURES
None reported.

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CNE Test Test ID A1423043: Early Mobility Activities During Continuous Renal Replacement Therapy

Learning objectives: 1. Describe the complications associated with prolonged bed rest and the potential benefits of instituting early mobility activities in critically ill patients. 2. Identify barriers to progressive mobility for patients undergoing continuous renal replacement therapy (CRRT). 3. Discuss considerations for determining which patients are appropriate candidates for early mobility activities while undergoing CRRT and ideas for accomplishing mobilization of these patients safely.

1. The patient's development of which of the following symptoms most influenced the decision to stop hemodialysis and initiate continuous renal replacement therapy (CRRT)?
a. Shortness of breath
b. Weight gain of 15 pounds
c. Potassium level of 8.0 mEq/L
d. Hypotension

2. Which of the following was specifically documented about the patient before he first participated in mobilization activities while undergoing CRRT?
a. His regular use of assistive devices for ambulation at home
b. His musculoskeletal status
c. His daily weight
d. His expressed desire to get out of bed

3. Which of the following best describes the reason the patient's activity order was changed to strict bed rest on day 10 of his CRRT?
a. Reinstitution of the facility's current mobility standard for patients undergoing CRRT
b. Concerns about the logistics of mobilization of a patient undergoing CRRT
c. Lack of sufficient nursing staff to ensure patient's CRRT circuitry safely secured during mobilization
d. Lack of specific documentation about the patient's vital signs and other clinical indicators of how well he was tolerating mobilization for the several days prior to that time

4. Continuous renal replacement therapy would most be preferred over hemodialysis in a patient with which of the following conditions?
a. Hemodynamic instability
b. Respiratory failure requiring mechanical ventilation
c. Hemorrhagic stroke
d. Coronary artery disease

5. According to the authors, which of the following statements regarding progressive mobility in patients undergoing CRRT is true?
a. Patients undergoing CRRT are more susceptible to complications associated with prolonged bed rest than patients undergoing hemodialysis.
b. Patients undergoing CRRT are less susceptible to complications associated with prolonged bed rest than patients undergoing hemodialysis.
c. Early institution of progressive mobility measures in patients undergoing CRRT may decrease cognitive dysfunction in these patients.
d. Patients undergoing CRRT have traditionally been confined to bed rest because of the lack of research about mobilization in these patients specifically.

6. Which of the following best describes the changes that occurred in the patient's vital signs before and after activity episodes?
a. Systolic and diastolic blood pressure measurements increased after episodes of activity more frequently than they decreased after activity episodes.
b. Heart rate, respiratory rate, systolic and diastolic blood pressure measurements showed no significant change from baseline vital signs before and after activity episodes.
c. Heart rate and respiratory rate increased after episodes of activity more frequently than they decreased after activity episodes.
d. Heart rate and respiratory rate decreased after episodes of activity more frequently than they increased after activity episodes.

7. The physician's initial activity order for the patient specifically allowed him to do which of the following activities?
a. Active range of motion and sitting on the edge of the bed with feet dangling
b. Sitting on the edge of the bed with feet dangling and standing
c. Standing and transferring to a chair
d. Transferring to a chair and walking short distances

8. Why was the patient's CRRT restarted after it had been discontinued on day 6?
a. His mental status deteriorated.
b. He gained more than 6 kg.
c. The physician wrote an activity order allowing him to get out of bed during CRRT.
d. His creatinine level increased to 3.0 mg/dL.

9. Which of the following statements accurately reflects the authors' evaluation of the case study's results?
a. This case study is not representative of all patients who require CRRT.
b. Patients who are mobilized in the intensive care unit (ICU) while undergoing CRRT are more likely to return to independent functional status than those who are not.
c. Nurses cannot safely mobilize ICU patients undergoing CRRT.
d. The presence of a hemodialysis catheter that is accessed and attached to an extracorporeal circuit at all times is not really a barrier to mobility of patients undergoing CRRT.

10. Of the following, what catheter-related adverse event was documented in a prior study that evaluated the impact of positioning on patients undergoing CRRT?
a. Inadvertent catheter removal
b. Clotting of the catheter with resultant interruption of therapy
c. Dislodgement of the catheter with resultant clotting of the circuit
d. Decreased catheter flow due to patient positioning

11. Throughout mobilization episodes of the patient in this case study, a registered nurse provided constant observation of which of the following?
a. Patient's vital signs
b. Patient's cognitive state
c. Catheter access site
d. Adequacy of blood flow

12. Which of the following was included in the criteria for successful mobilization?
a. Patient was able to tolerate sitting in a chair for at least 2 hours
b. Patient reported no intolerance to the activity
c. No more than minimal interruption of CRRT occurred
d. Vital signs were elevated during activity episode

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