Early Mobilization in Patients on Continuous Dialysis

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ASK THE QUESTION

Question(s): In patients with renal dysfunction on continuous renal replacement therapy (CRRT) or continuous veno-venous hemofiltration (CVVH), is early mobilization and physical therapy with patients safe and effective?

SEARCH FOR EVIDENCE

Databases: Cochrane Database of Systematic Reviews, PubMed, Scopus

PubMed search strategy: (continuous dialysis OR continuous renal replacement therapy OR CRRT OR continuous veno-venous hemofiltration OR CVVH) AND ("Physical Therapy Modalities"[Mesh] OR physical therapy OR physiotherapy OR rehabilitation OR mobilization OR mobility OR ambulation)

Keywords: “continuous dialysis”, “continuous renal replacement therapy”, CRRT, “continuous veno-venous hemofiltration”, CVVH, “physical therapy”, physiotherapy, rehabilitation, mobilization, mobility, ambulation

CRITICALLY ANALYZE THE EVIDENCE

There were 5 studies found addressing the use of early mobilization and physical therapy in ICU patients undergoing continuous renal replacement therapy (CRRT). All five studies supported the safety and efficacy of early mobilization and physical therapy in patients on CRRT. Brownback et al. (2014) was a case study description of an obese male on CRRT who began nurse-assisted mobilization “by accident” after being moved as a result of a bed malfunction. Kho et al. (2015) included 20 patients on CRRT in a study assessing the safety and efficacy of in-bed cycle ergometry, with no adverse events in these patients. Wang et al. (2014) assessed the effect of early mobilization on filter life, in addition to safety and efficacy. This study found that not only was early mobilization safe in patients undergoing CRRT, but that physical therapy resulted in an approximately a 3-hour increase in filter life per filter already placed in the patient.
Two studies (Talley et al., 2013; Toonstra et al., 2016) also evaluated mortality outcomes in patients on CRRT undergoing early mobility and physical therapy. Talley et al. (2013) found that in 109 patients undergoing CRRT, increasing progression in mobility resulted in a trending, though statistically insignificant, decrease in mortality without any adverse events. Similarly, Toonstra et al. (2016) found that not only was early mobility safe for patients undergoing CRRT, but that patients achieving higher levels of mobility were more likely to survive to discharge (sitting or greater 62% vs supine exercises 33%, p=0.05).

There were no studies directly addressing mobilization in patients undergoing continuous veno-venous hemofiltration.

**PICO Question:** In patients with renal dysfunction on continuous renal replacement therapy (CRRT) or continuous veno-venous hemofiltration (CVVH), is early mobilization and physical therapy with patients safe and effective?

<table>
<thead>
<tr>
<th>Author/Date/ Journal</th>
<th>Purpose of Study</th>
<th>Study Design</th>
<th>Sample &amp; Setting</th>
<th>Outcomes</th>
<th>Design Limitations</th>
</tr>
</thead>
</table>
| Brownback et al., 2014, American Journal of Critical Care | To evaluate the efficacy and safety of mobilization during continuous renal replacement therapy (CRRT) | Case study | 55 year old obese male with congestive heart failure -CRRT following unsuccessful intermittent hemodialysis (hypotension) | Over 9 total days of CRRT, patient underwent 11 episodes of OOB activity with no CRRT interruptions, device dislodgements or hemodynamic complications -mobilization started “by accident” when patient’s HOB elevation feature malfunctioned and activity continued as tolerated | Study Limitations = None Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)  
☑ Insufficient sample size  
☑ Sample not representative of patients in the population as a whole  
☑ Variables (confounders, exposures, predictors) were not described  
☑ Outcome criteria not objective or were not applied in blind fashion  
☑ Insufficient follow-up, if applicable  
☑ For prognostic study, sample not defined at common point in course of disease/condition  
☑ For diagnostic study, gold standard not applied to all patients  
☑ For diagnostic study, no independent, blind comparison between index test and gold standard |
| Kho et al., 2015, Journal of Critical Care | To evaluate the feasibility and safety of in-bed cycle geometry and part of routine ICU physical therapy (PT) | Prospective observational case-control study | 688 ICU patients receiving PT over 18 months -20 patients on CRRT | Patients who cycled were more likely to receive mechanical ventilation (82% vs 55%, p<0.001), received more PT sessions (median 4 vs 2, p<0.001) and had a longer ICU stay (median 10 vs 5 days) | Study Limitations = None Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)  
☑ Publication Bias (e.g. pharmaceutical company sponsors study on effectiveness of drug) |
<table>
<thead>
<tr>
<th>Practice</th>
<th>Data</th>
<th>Study Limitations</th>
<th>Increase Quality Rating if:</th>
<th>Level of evidence for studies as a whole:</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 PT sessions using CRRT No cycling (n=507)</td>
<td>3, p&lt;0.001). Only 1 single adverse event (dislodgement of arterial line) occurred in cycling patients (event rate 0.2%).</td>
<td>Insufficient sample size Sample not representative of patients in the population as a whole Variables (confounders, exposures, predictors) were not described Outcome criteria not objective or were not applied in blind fashion Insufficient follow-up, if applicable For prognostic study, sample not defined at common point in course of disease/condition For diagnostic study, gold standard not applied to all patients For diagnostic study, no independent, blind comparison between index test and gold standard</td>
<td>Large Effect</td>
<td>High</td>
</tr>
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<td>Talley et al., 2013, Critical Care Nursing Quality</td>
<td>To describe on hospital’s experience with developing and adopting an early mobility protocol for patients undergoing CRRT</td>
<td>Descriptive</td>
<td>Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)</td>
<td>Moderate</td>
</tr>
<tr>
<td>109 CRRT patients undergoing physical therapy during a 6-month period Phases: 0 – passive &amp; active range of motion 1 – extremity dangling, passive transfer to chair or bed in chair position 2 – standing at side of bed, ambulating with assistance</td>
<td>95.4% began early mobility within 48 hours of CRRT initiation -Phase 0: 88.5% -Phase 1: 9.2% -Phase 2: 1.8% Location of CRRT access did not affect participation. However, patients with jugular access were more likely to progress to Phase 1 (12%) or 2 (43%). Mortality appeared to trend downward with increasing degree of mobility in first 48 hours (80% non-mobility; 63% Phase 0; 60% Phase 1; 50% Phase 2), but not statistically significant. No CRRT patient falls, dislodgements or serious adverse events.</td>
<td>Study Limitations = None</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Toonstra et al., 2016, Annals of the American Thoracic Society</td>
<td>To evaluate the feasibility and safety of physical therapy</td>
<td>Prospective observational study</td>
<td>Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)</td>
<td>Very Low</td>
</tr>
<tr>
<td>57 CRRT patients undergoing physical therapy in the MICU over 13 months</td>
<td>57% of PT sessions occurred while patient was on mechanical ventilation.</td>
<td>Study Limitations = None</td>
<td></td>
<td></td>
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</table>

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## Interventions, delivered as part of routine clinical care, in patients undergoing CRRT in an ICU

- 268 PT sessions

<table>
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<th>Highest mobility achieved:</th>
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<tbody>
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<td>- In bed exercises: 29%</td>
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<tr>
<td>- supine cycle ergometry: 27%</td>
</tr>
<tr>
<td>- sitting edge of bed: 30%</td>
</tr>
<tr>
<td>- standing: 7%</td>
</tr>
<tr>
<td>- transfer to chair: 5%</td>
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<tr>
<td>- marching in place: 2%</td>
</tr>
</tbody>
</table>

Patients who survived to discharge achieved a significantly higher level of mobility (sitting or greater 62% vs supine exercises 33%, \( p=0.05 \)).

No CRRT-specific safety events occurred. However, hypotension did occur during 2.2% of PT sessions.

### Study Limitations =

- Non-Experimental/Observational Studies (case-control, cohort, cross sectional, longitudinal, descriptive, epidemiologic, case study/series, survey)
  - Insufficient sample size
  - Sample not representative of patients in the population as a whole
  - Variables (confounders, exposures, predictors) were not described
  - Outcome criteria not objective or were not applied in blind fashion
  - Insufficient follow-up, if applicable
  - For prognostic study, sample not defined at common point in course of disease/condition
  - For diagnostic study, gold standard not applied to all patients
  - For diagnostic study, no independent, blind comparison between index test and gold standard

### References

Wang et al., 2014, Critical Care

To test the safety and feasibility of mobilization in patients with femoral vascular catheters placed for CRRT

Prospective cohort study

33 patients undergoing CRRT at 2 MICUs in Australia

Mobility:
- Passive: supine, not eligible for active mobilization (n=11)
- Low-level: unable to stand, sitting mobilization (n=15)
- High-level: likely to stand (n=8)
- Included a filter life analysis

No adverse events occurred during or following the PT interventions, and filter alarms did not sound, and filter alarms did not sound.

An increasing effect of the PT intervention on filter life was evident in the higher the number of previous filters at the time of intervention (filter number \( \times \) PT interaction effect: regression coefficient = 3.5, robust 95% CI = 0.3 to 6.6, \( p=0.03 \)). The effect of PT was approximately a 3-hour increase in filter life per filter already placed in the patient.

Study Limitations =

- None

### References

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Appendix A: GRADE criteria for rating a body of evidence on an intervention
Developed by the GRADE Working Group

Grades and interpretations:
- High: Further research is very unlikely to change our confidence in the estimate of effect.
- Moderate: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
- Low: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
- Very low: Any estimate of effect is very uncertain.
### Type of evidence and starting level

<table>
<thead>
<tr>
<th>Type of Evidence</th>
<th>Starting Level</th>
</tr>
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<tbody>
<tr>
<td>Randomized trial</td>
<td>High</td>
</tr>
<tr>
<td>Observational study</td>
<td>Low</td>
</tr>
<tr>
<td>Any other evidence</td>
<td>Very low</td>
</tr>
</tbody>
</table>

### Criteria for increasing or decreasing level

**Reductions**
- Study quality has serious (–1) or very serious (–2) problems
- Important inconsistency in evidence (–1)
- Directness is somewhat (–1) or seriously (–2) uncertain
- Sparse or imprecise data (–1)
- Reporting bias highly probable (–1)

**Increases**
- Evidence of association† strong (+1) or very strong (+2)
- Dose-response gradient evident (+1)
- All plausible confounders would reduce the effect (+1)

†Strong association defined as significant relative risk (factor of 2) based on consistent evidence from two or more studies with no plausible confounders. Very strong association defined as significant relative risk (factor of 5) based on direct evidence with no threats to validity.