RESEARCH

# Early Mobility and Walking for Patients with Femoral Arterial Catheters in Intensive Care Unit: a Case Series

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## ABSTRACT

**Background:** Patients with femoral arterial catheters for hemodynamic monitoring are sometimes placed on bed rest because of the anatomical location and perceived risk of catheter-related complications associated with mobility. This practice subjects these patients to the well known adverse effects of inactivity on functional mobility and functional outcomes. Because of limited evidence to link mobility with femoral artery displacement or damage, this practice may be unwarranted and may add to the treatment burden of the patient in the intensive care unit.

**Objective:** The purpose of this study was to explore whether physical therapy-directed mobilization of patients with femoral arterial catheters resulted in adverse events.

**Methods:** A retrospective case series was undertaken on patients in a 40-bed cardiovascular and thoracic intensive care unit. The list of potential catheter-related adverse events investigated included bleeding at the femoral arterial catheter site, accidental catheter dislodgement and/or removal, non-functioning catheter after activity event, and acute limb ischemia within 24 hours.

**Results:** The 30 patients identified for the study underwent 47 physical therapy sessions with a total of 156 activity events including sitting on the side of the bed, standing at bedside, transfers to a regular chair or a stretcher chair, and walking. No femoral arterial catheter-related adverse events that could be attributed to participation in physical therapy were documented in either the nursing or physical therapy notes.

**Conclusion:** The data from this single center retrospective case series suggest that early mobility and walking activities do not affect femoral arterial catheters used for hemodynamic monitoring and orders for bed rest may unnecessarily add to symptom burden faced by these patients.

Indwelling arterial catheters are used to continuously monitor blood pressure, to titrate vasoactive agents, and to obtain blood gases or other laboratory specimens in critically ill patients.[1] Femoral arterial catheterization for hemodynamic monitoring is the most commonly used location after the radial artery. The brachial, axillary, and dorsalis pedis can also be used. One retrospective study of 4,932 patients with arterial catheters revealed that the femoral artery was cannulated in 45 percent of patients in the medical intensive care unit (MICU) and in 11.5 percent of patients in the surgical intensive care unit (SICU). The radial artery was used in 52 percent of patients in the MICU and 78 percent of patients in the SICU.[2]

Informal discussions with critical care nurses, physicians, and physical therapists indicated that placing patients with femoral arterial catheters on bed rest appears to be common practice in the intensive care unit (ICU). The perceived risk of catheter-related complications has been discussed in nursing textbooks.[3] In contrast, some physical therapy literature has promoted the mobilization of patients with femoral arterial lines.[4] Although some conservative physicians prefer not to have their patients sit with femoral arterial lines, Ciesla et al. state that patients with femoral arterial catheters who tolerate getting out of bed should be allowed to sit in a chair as long as the waveform on the monitor is maintained. Other recommendations include allowing patients to turn onto the side that does not have the femoral line and to transfer to the upright position for ambulation with minimal hip flexion as long as the arterial lines are sutured in place.[4] The lack of literature citing problems occurring with femoral arterial catheters during patient mobilization suggests that the decision to keep a patient on bed rest appears to be strongly linked to the culture of a medical institution or that of a particular ICU within the institution.

**Background and Purpose**

Although not directly related to patient mobilization, a number of studies have been published related to the rate of femoral arterial catheter-related infections and complications.[1, 2, 5, 6] A large meta-analysis covering 78 studies from 1978 to 2001 and a total of 19,617 radial, 3,899 femoral, and 1,989 axillary arterial cannulations found that the rates of major complications were similar for all three locations and occurred in less than 1% of the cases.[5] The complications reported included accidental catheter removal,[6] vascular insufficiency,[2] infection,[1,2,5,6] circulatory impairment,[1] bleeding at the femoral arterial catheter site,[2] arterial occlusion,[5] neurological impairment,[1] vessel perforation,[1] local infection,[1,5] and clot formation in the catheter.[1]

Bed rest is often perceived as an intervention that can reduce these risks. However, prolonged bed rest results in disuse atrophy, increases in inflammatory markers, insulin resistance, microvascular dysfunction, fluid losses that contribute to postural hypotension, tachycardia, decreased stroke volume, decreased peak oxygen uptake and decreased cardiac output.[7]

Recent literature has described early mobilization in the ICU as essential to minimize functional decline and decrease the length of hospital and ICU stay.[8-14] Other anticipated outcomes of early mobilization include improved attitude towards recovery, improved cardiopulmonary and neuromuscular function, increased level of arousal, maximized independence, and facilitation of ventilator weaning.[12] Large studies of patients with respiratory failure requiring mechanical ventilation have concluded that early activity is safe and should be utilized as adjunctive therapy to prevent or treat complications of critical illness.[13,15] Although Pohlman et al also included information about mobilization of patients with arterial catheters, the location of the catheters was not specified. Collaboration is particularly important in identifying barriers and outcomes for progressive mobility in addition to making a cultural change to make early mobility a priority in avoiding the adverse effects of immobility on long-term outcomes.[8]

Although the importance of early mobilization is well supported, the fear of injury due to femoral arterial catheter complications during mobilization may outweigh the benefits in some ICU cultures. Recommendations such as strict bed rest with the cannulated lower extremity straight for patients with a femoral arterial catheter in place have been placed in textbooks without any rationale.[3] Our review of available literature has yet to find any published studies within the fields of critical care medicine, nursing, or physical therapy that address safety guidelines or adverse outcomes related to mobility in patients with femoral arterial catheters for hemodynamic monitoring in the ICU. The purpose of this study was to explore whether mobilizing patients with femoral arterial catheters for hemodynamic monitoring in a cardiovascular ICU (CVICU) is associated with any catheter-related complications using a retrospective chart review.

## METHODS

A retrospective, single-center case series study was conducted in a 40-bed CVICU at a large metropolitan 900-bed teaching hospital from June 1, 2005 to December 31, 2005. The study was approved by The Methodist Hospital Research Institute's Institutional Review Board.

Inclusion criteria were individuals 18 years old and older who received physical therapy and had a femoral arterial catheter for the purpose of hemodynamic monitoring. The electronic medical record system identified 30 patients who met the inclusion criteria during this six-month period.

The CVICU has a mixed population of adult cardiovascular and thoracic surgical patients. Patients in this study underwent coronary artery bypass, aortic valve replacement, mitral valve replacement, heart

**Table 1.** Patient Characteristics

| Patient | Age | Sex | Surgery | Number of Physical Therapy sessions with femoral arterial catheter in place | Total number of days patients had femoral arterial catheter in place |
|---|---|---|---|---|---|
| 1 | 58 | Male | CABG | 2 | 4 |
| 2 | 75 | Female | Redo MV R | 1 | 8 |
| 3 | 54 | Female | CABG | 1 | 25 |
| 4 | 52 | Female | Tracheal resection | 1 | 6 |
| 5 | 73 | Male | AAA repair | 2 | 3 |
| 6 | 77 | Male | CABG | 1 | 2 |
| 7 | 49 | Male | Heart Transplant | 1 | 17 |
| 8 | 60 | Female | Pericardial window | 3 | 6 |
| 9 | 61 | Male | Cholecystectomy | 1 | 1 |
| 10 | 65 | Male | Thoracotomy | 1 | 4 |
| 11 | 60 | Female | Lobectomy | 1 | 10 |
| 12 | 71 | Male | CABG, CEA | 1 | 11 |
| 13 | 63 | Male | CABG | 1 | 12 |
| 14 | 63 | Female | Mitral Valve repair | 1 | 17 |
| 15 | 62 | Female | Heart transplant | 2 | 4 |
| 16 | 90 | Male | Thoracotomy | 1 | 10 |
| 17 | 64 | Male | CABG | 2 | 16 |
| 18 | 67 | Female | Bilateral TKR | 2 | 7 |
| 19 | 75 | Female | AVR, MVR | 1 | 1 |
| 20 | 50 | Male | Previous liver transplant, Septic shock | 2 | 10 |
| 21 | 73 | Male | Redo CABG | 4 | 11 |
| 22 | 77 | Male | CABG | 2 | 4 |
| 23 | 72 | Female | AVR | 1 | 3 |
| 24 | 90 | Male | AVR | 1 | 5 |
| 25 | 41 | Male | Heart Transplant | 2 | 2 |
| 26 | 61 | Male | Bi-ventricular assistive device | 1 | 11 |
| 27 | 61 | Male | Colostomy | 1 | 12 |
| 28 | 41 | Female | Mitral Valve repair | 2 | 6 |
| 29 | 85 | Female | CABG, AVR | 4 | 8 |
| 30 | 65 | Male | AVR | 1 | 2 |

CABG: Coronary Artery Bypass Graft; MVR: Mitral valve replacement; AAA: Ascending Aortic Aneurysm; CEA: Carotid Endarterectomy; TKR: Total knee replacement; AVR: Aortic valve replacement

transplant, lobectomy, and a variety of other cardiothoracic surgical procedures that were performed less frequently. The femoral arterial catheter insertion technique was consistent and standardized among physicians by use of an indwelling catheter via the modified Seldinger approach.[16]

During the chart review process, a standardized data entry form was used for each patient. Once the date and time of a physical therapy evaluation were identified, the nursing documentation was reviewed for the presence of a femoral arterial catheter at the time of initial physical therapy evaluation. Then, for each selected patient, the dates and times of daily physical therapy sessions were obtained. The nurse's notes were reviewed during the 24-hour period after the physical therapy sessions were completed. The nurse's notes included information about the arterial line site, site appearance, waveform and any documented catheter-related adverse events. The potential catheter-related adverse events examined in this study included bleeding at the catheter site, accidental catheter dislodgement and/or removal, non-functioning catheter after activity events, and acute limb ischemia within 24 hours of activity events supervised by physical therapy.

The data collected from the physical therapy documentation included the frequency of activity events and any documentation of catheter-related complications during physical therapy interventions while the patient had a femoral arterial catheter in place. Activity events for the purpose of this study included sitting on the side of bed, standing at bedside, transfers to a stretcher chair or a regular chair, and walking of any distance. The stretcher was used in patients who were unable to bear weight and safely take steps to a regular chair. Any activities performed

**Table 2.** Number of physical therapy sessions and frequency of activity events

| Patient | Physical Therapy Sessions (47) | Sitting on the edge of bed | Standing at the bedside | Transfer to a bedside chair | Transfer to a stretcher chair | Ambulation (Feet) |
|---|---|---|---|---|---|---|
| 1 | 1 | Yes | Yes | Yes | No | 0 |
| | 2 | Yes | Yes | Yes | No | 200 |
| 2 | 1 | Yes | Yes | No | Yes | 0 |
| 3 | 1 | Yes | Yes | Yes | No | 200 |
| 4 | 1 | Yes | Yes | Yes | No | 60 |
| 5 | 1 | Yes | Yes | No | Yes | 0 |
| | 2 | Yes | Yes | No | Yes | 0 |
| 6 | 1 | Yes | Yes | Yes | No | 400 |
| 7 | 1 | Yes | No | No | Yes | 0 |
| 8 | 1 | Yes | Yes | No | Yes | 0 |
| | 2 | Yes | Yes | Yes | No | 30 |
| | 3 | Yes | Yes | Yes | No | 100 |
| 9 | 1 | Yes | Yes | Yes | No | 0 |
| 10 | 1 | Yes | Yes | Yes | No | 200 |
| 11 | 1 | Yes | Yes | Yes | No | 50 |
| 12 | 1 | Yes | Yes | Yes | No | 120 |
| 13 | 1 | Yes | Yes | No | Yes | 0 |
| 14 | 1 | Yes | No | No | Yes | 0 |
| 15 | 1 | Yes | Yes | Yes | No | 0 |
| | 2 | Yes | Yes | Yes | No | 200 |
| 16 | 1 | Yes | No | No | Yes | 0 |
| 17 | 1 | Yes | Yes | No | Yes | 0 |
| | 2 | Yes | Yes | Yes | No | 200 |
| 18 | 1 | Yes | No | No | Yes | 0 |
| | 2 | Yes | No | No | Yes | 0 |
| 19 | 1 | Yes | Yes | Yes | No | 120 |
| 20 | 1 | Yes | No | No | Yes | 0 |
| | 2 | Yes | No | No | Yes | 0 |
| 21 | 1 | Yes | Yes | Yes | No | 350 |
| | 2 | Yes | Yes | Yes | No | 500 |
| | 3 | Yes | Yes | Yes | No | 350 |
| | 4 | Yes | Yes | Yes | No | 400 |
| 22 | 1 | Yes | Yes | Yes | No | 80 |
| | 2 | Yes | Yes | Yes | No | 120 |
| 23 | 1 | Yes | No | No | No | 0 |
| 24 | 1 | Yes | Yes | No | Yes | 0 |
| 25 | 1 | Yes | Yes | Yes | No | 0 |
| | 2 | Yes | Yes | Yes | No | 50 |
| 26 | 1 | Yes | No | No | Yes | 0 |
| 27 | 1 | Yes | Yes | No | Yes | 0 |
| 28 | 1 | Yes | Yes | Yes | No | 60 |
| | 2 | Yes | Yes | Yes | No | 60 |
| 29 | 1 | Yes | Yes | Yes | No | 120 |
| | 2 | Yes | Yes | Yes | No | 200 |
| | 3 | Yes | Yes | Yes | No | 120 |
| | 4 | Yes | Yes | Yes | No | 270 |
| 30 | 1 | Yes | Yes | Yes | No | 0 |

during physical therapy sessions prior to femoral catheter insertion and after catheter removal were not included. All subjects performed at least one activity event during physical therapy sessions and each activity was recorded as a separate event. The electronic medical record system did not allow us to determine the duration of specific activity events.

During the activity events, no restrictions were placed on the degree of hip flexion on the side with the arterial catheter. The only restriction enforced was for excessive repetitive hip flexion that would typically occur during activities such as cycling.

## RESULTS

The 30 patients identified for the study underwent 47 physical therapy (PT) sessions with a total of 156 activity events. Of the 30 patients, 18 (60%) were male and 12 (40%) were female and the mean age was 65.17 ± 12.37 years. The number of PT sessions each patient received varied from 1 to 4 sessions with a mean of 1.56 ± 0.86 sessions. The number of days with the femoral arterial catheter in place varied from 1 to 25 days with a mean of 7.9 ± 5.6 days. The frequency of activity events that occurred in relation to the number of PT sessions (47) was sitting on the side of bed 47 times (100%), which means that patients sat on the side of bed once every PT session. Standing at the bedside occurred 38 times (81%); transfers to bedside chair, 30 (64%); transfers to a stretcher chair, 16 (34%); and ambulation, 25 (53%). The distance walked was between 30 and 500 feet (mean distance of 182 ± 129 feet). In 8 sessions, patients were able to walk equal or less than 100 feet and in 17 sessions patients were able to walk more than 100 feet. No femoral arterial catheter-related adverse events that could be attributed to participation in physical therapy were documented in either the nursing or physical therapy notes. See Tables 1 and 2 for detailed results.

## DISCUSSION

This case series examined the incidence of catheter-related complications

associated with mobilizing patients with femoral arterial catheters for hemodynamic monitoring in ICU. Because of the importance of preventing decline in functional mobility associated with prolonged bed rest, investigating strategies to provide early mobility interventions and to confirm their feasibility is vital. The data from this case series suggest that early mobility and walking in the CVICU are safe for patients with femoral arterial catheters as no catheter-related complications were found in either the physical therapy or nursing documentation.

Potential limitations of this case series include a single center retrospective study, the small number of patients (n=30) and that one physical therapist was primarily providing care to all patients referred to physical therapy. The limited number of subjects may not be sufficient to argue against the clinical theory that participating in functional mobility could make a femoral arterial catheter unstable and result in serious injury. Physical therapists with less experience mobilizing patients with femoral arterial catheters might also be at greater risk of encountering complications. Because the data in this case series were collected retrospectively, the investigators had no control over what data were available for interpretation; some adverse events may have occurred that were not documented in the medical records. Additionally, findings specific for patients in the CVICU may not be generalized to other ICU patient populations, including infants or children.

## CONCLUSION

The data from this single center retrospective case series suggest that early mobility and walking activities appear to be safe and do not affect femoral arterial catheters used for hemodynamic monitoring. Further investigation with larger samples, more institutions and therapists, and different ICU settings is crucial to evaluate the safety and feasibility of such practice. The authors are currently working on a funded prospective study to potentially confirm the aforementioned findings and assist in the development of treatment guidelines for the practice of physical therapy in critical care.

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