

Femoral catheters and deep venous thrombosis in the critically ill patient:

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A. Introduction

a. Rationale

Central venous access is often required in the care of critically ill patients, for volume resuscitation and administration of vasoactive and other medications. Complications associated with central venous cannulation include an association with deep venous thrombosis (DVT)¹, however the frequency of DVT associated with central venous, catheterization has not been well studied and may vary with the site of cannulation. The femoral vein is used frequently in the critical care setting to establish central access for several reasons: it is easily accessible, it can be directly compressed if there are bleeding complications, and there is no associated risk of pneumothorax.²³ Sporadic deep venous thrombosis occurs more frequently in the lower extremities than the upper extremities⁴ and is a source of significant morbidity and mortality in hospitalized patients occurring in approximately 15% of acutely ill medical patients.⁵ Additionally up to 50% of patients with lower extremity DVT may sustain pulmonary embolism.⁶⁷ If femoral catheters are associated with an increased risk of DVT, this may be an important source of morbidity in the critically ill population and should be taken into account when choosing a site for venous catheterization.

b. Literature Review

An association between femoral catheters and DVT was first described in 1958 when Bansmer et al reported a 46% frequency of iliofemoral DVT in the catheterized vein at autopsy.⁸ Since that time the catheter materials have changed, insertion technique has changed and the medications infused have changed. More recent studies have reached varying conclusions regarding an increased risk of with femoral DVT associated with femoral catheterization.

- Meredith et al⁹ studied 76 trauma patients who had femoral vein catheters in for 24 hours and found a 12% incidence of DVT associated with femoral catheterization, compared to 4% in the control limb using duplex ultrasound to detect DVT.
- Friedman et al¹⁰ used impedance plethysmography to evaluate 23 ICU patients with femoral catheters for lower extremity DVT. 2/23 (8.6%) developed evidence of DVT.
- Trottier et al¹¹ randomized 45 ICU patients to either upper (subclavian or internal jugular) or femoral central venous catheterization. 25% (6/24) of patients randomized to femoral catheterization developed DVT, whereas 0% (0/21) of the patients with subclavian/internal jugular catheters developed lower extremity DVT.
- Durbec et al¹² used venography to evaluate 80 patients with femoral catheters and found an 8.5% rate of DVT in the catheterized vein compared to 3% in the control leg.
- Most recently Joynt et al¹³ evaluated 124 patients with serial duplex ultrasound, and found a 1.6% incidence of line related DVT versus a 1.6% incidence in the control leg.
- In all of these studies the incidence of DVT in the control group was lower than expected given previous estimates of the incidence of DVT in hospitalized patients.

B. Hypothesis

Catheterization of the femoral vein is associated with an increased risk of deep venous thrombosis in that vein in critically ill patients in the medical intensive care unit.

C. Methods

a. Study Design

This is a prospective observational study of patients undergoing femoral venous catheterization in the medical intensive care unit of Columbia Presbyterian Medical Center. The incidence of DVT in the catheterized vein will be compared to the incidence of DVT in the uncatheterized vein. All patients Over 18 years of age receiving femoral venous catheters will be recruited for the study. Informed consent will be obtained from the patient when capable, otherwise the next of kin will be asked to give surrogate consent.

b. Exclusion criteria

Patients with existing or previous history of DVT, documented hypercoaguable state, full dose anticoagulation, prior femoral catheterization within the previous four weeks, pelvic trauma, infection or inflammation at site of insertion, duration of catheterization less than 24 hours, and lower extremity ischemia will be excluded from the study, Hypercoaguable state will be defined as protein C or protein S deficiency, Factor V Leiden, anti-thrombin III or lupus anticoagulant.

c. Demographic data

Patient age, gender, diagnosis, duration of catheterization, complications during catheter insertion, and type of DVT prophylaxis, if any, will be recorded.

d. Assessment

The presence or absence of DVT will be assessed with duplex ultrasound (estimated 95% sensitivity, 99% specificity for detection of proximal DVT)¹⁴. Ultrasonography will be performed prior to catheterization, at 24 hours, at 3 days and at 7 days, regardless of duration of catheterization.

D. Statistical Analysis

The number of DVTs observed in the catheterized vein will be compared to the number of DVTs observed in the uncatheterized vein using the Sign test to evaluate for a statistically significant ($p < 0.05$) difference. Based on the previously reviewed literature, the rate of DVT development in the catheterized vein is expected to be about 15%, compared to about 4% in the uncatheterized vein. Given these expected rates, 250 patients will be enrolled in the study. Approximately 40-50 patients undergo femoral catheterization each month in the medical intensive care unit; assuming a 70% participation rate, the study will need to run for 7-8 months to enroll the necessary number of patients.

E. Future Directions

An increased risk of deep venous thrombosis due to femoral venous catheterization has important implications for the care of critically ill patients. The femoral vein is an attractive site for central venous access as it is easily accessible, directly compressible, and access can be established very quickly in an emergency setting. 15 As discussed previously, DVT is a disease associated with significant morbidity and mortality (largely due to the risk of pulmonary embolism). Any increased risk of DVT associated with femoral catheterization will need to be taken into account when selecting a site to establish central venous access in the critically ill patient.

F. References

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