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Clinically manifest thromboembolic complications of femoral vein catheterization for continuous renal replacement therapy☆,☆☆,★

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ABSTRACT

Purpose: The safety of femoral vein (FV) catheterization for continuous renal replacement therapy is uncertain. We sought to determine the incidence of clinically manifest venous thromboembolism (VTE) in such patients.
Methods: We retrospectively studied patients with femoral high flow catheters (≥13F) (December 2005 to February 2011). Discharge diagnostic codes were independently screened for VTE. The incidence of VTE was also independently similarly assessed in a control cohort of patients ventilated for more than 2 days (January 2011 to December 2011) in the same intensive care unit (ICU).
Results: We studied 380 patients. Their mean age was 61 years, and 59% were male. The mean Acute Physiology and Chronic Health Evaluation III score was 84; average duration of continuous renal replacement therapy was 74 hours, and 232 patients (61%) survived to hospital discharge with an average length of hospital stay of 22 days. Only 5 patients (1.3%) had clinically manifest VTE after FV catheterization. In the control cohort of 514 ICU patients, the incidence of VTE was 4.4% ($P < .05$ compared with FV group).
Conclusion: The incidence of clinically manifest VTE after FV catheterization with high flow catheters is low and lower to that seen in general ICU patients.

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1. Introduction

Central venous catheterization is a prerequisite of blood purification techniques such as continuous renal replacement therapy (CRRT) [1,2]. The choice of vessel is influenced by several factors such as bleeding risk, body habitus, presence of other central venous catheters (CVCs), skin excoriation, intertrigo, and presence of a previous graft. In addition, the complication profile such as risk of catheter colonization, catheter-related bacteremia, and venous thromboembolism (VTE) is taken into consideration.

The femoral vein (FV) can be catheterized between the inguinal ligament and the confluence of the saphenous vein and the FV and is anatomically appealing. It has various potential advantages: proximity to the skin, lack of vital organs near the cannulation site, ability to compress the artery in case of inadvertent puncture, ease of repair of the artery in case of vessel injury, the fact that interruption to the arterial circulation would not threaten the brain, and ease of ultrasound-assisted cannulation [3,4]. Furthermore, the FV is easier to catheterize than jugular or subclavian veins in patients who cannot lie in the Trendelenburg position and/or are receiving noninvasive ventilation. Finally, the FV can be compressed externally in case of significant bleeding during removal of the double lumen catheter [5]. However, the risks of colonization and thromboembolic complications are of significant concern, and some observational studies have suggested the potential for a higher incidence of these complications at the FV compared with other sites [6]. The increased risk of line colonization was not confirmed by 2 recent randomized controlled studies; however, opinions remain conflicting with regard to the risk of thromboembolic events [6-8]. This is because studies investigating the risk of thromboembolic events after FV catheterization for CRRT have assessed small cohorts only. Because the risk of thromboembolic complications is likely to be less than 5% to 10%, a study of several hundred cases would be required to more accurately estimate the incidence of clinically manifest thromboembolic complications in critically ill patients [9]. Such data, in turn, would be valuable in assisting clinicians in their choice of cannulation site.

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Accordingly, we conducted a retrospective study using the vascular access database of a tertiary intensive care unit (ICU) and combining it with the administrative database containing discharge diagnostic codes including any diagnosis of clinically manifest VTE. We hypothesized that the incidence of clinically manifest VTE associated with FV catheterization for CRRT would be low even in comparison with control cohort of patients who received more than 48 hours of ventilation and ICU therapy.

2. Materials and methods

This study was approved by the Human Research Ethics Committee of the Austin Hospital, which waived the need for informed consent because of the retrospective, noninterventional nature of the study.

The ICU of Austin hospital, where the study was performed, serves a tertiary teaching hospital, has 20 beds, and provides care for more than 2100 patients per year. The ICU provides care for all aspects of neurosurgical, cardiac surgery, liver surgery, orthopedic, thoracic, and general surgery patients as well as wide a range of medical patients. All patients are given standard thrombosis prophylaxis with unfractionated heparin 5000 IU twice daily. Patients expected to stay for more than 3 days in the ICU were given enoxaparin 40 mg/day s.c. (except in patients with estimated GFR <30 ml/min where 20 mg/day was given). Calf compression was used in all patients where pharmacological thrombosis prophylaxis was contraindicated (such as platelet count < ce:hsp sp="0.10"/>20 0000 $\times$ 10^6/L or recent or active bleeding, recent neurotrauma, and recent neurosurgery).

During the study period, no routine screening for deep venous thrombosis was applied to patient care.

All catheters inserted for vascular access in the ICU, including catheters for CRRT, were registered in the vascular access database of the Austin Hospital ICU. All were inserted under ultrasound guidance. This service is exclusively for ICU patients. Standard catheters for CRRT via the FV in the unit were Niagara 13.5F, 24 cm (Bard, Murray Hill, NJ, USA) and Dolphin 13F, 24 cm (Gambro, Lund, Sweden) as of January 2011. At other sites, 15-cm catheters of similar brands were used.

Anticoagulation was managed according to clinical judgment. Heparin anticoagulation aiming for an activated partial thromboplastin time of 40 to 60 seconds was used when considered clinically safe. If there was clinical concern about the risk of bleeding, patients either received low-dose heparin (500 IU/h) prefilter or no anticoagulation. In patients with frequent filter clotting and a high risk of bleeding, regional anticoagulation (citrate based) was applied.

Two groups were assessed for the incidence of VTE. For femoral catheter study group, data were extracted from vascular access database of the Austin Hospital ICU on all patients who had a high flow catheter (HFC) for dialysis (>13F gauge) inserted through the FV from December 2005 to February 2011. Criteria for initiation of CRRT were the same as in the RENAL trial [10] (the clinician considered that initiation of CRRT was warranted and the patient had at least one of the following criteria: urine output <100 mL over 6 hours unresponsive to fluid resuscitation, a serum potassium concentration >6.5 mmol/L; a pH <7.25; a plasma urea level >25 mmol/L; a serum creatinine concentration >300 μmol/L or the presence of clinically significant organ edema). These criteria were initially chosen because the study unit was participating in the RENAL trial and, thereafter, because they were associated with the lowest mortality results so far for patients treated with renal replacement therapy (RRT) [10].

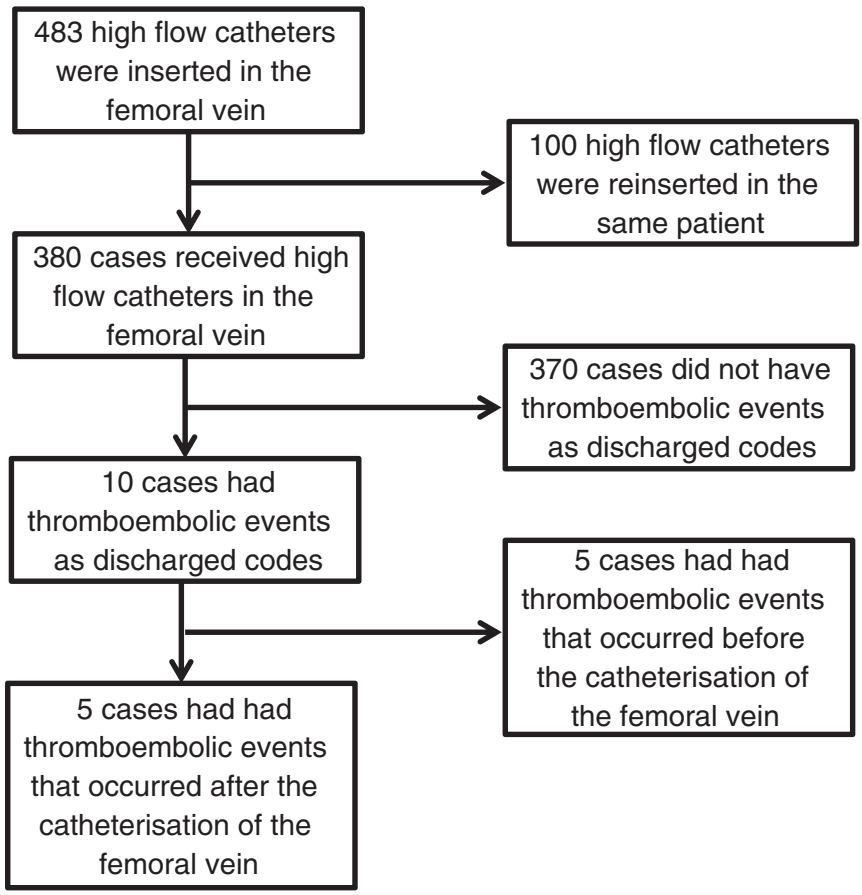

Fig. 1. Flowchart of patients with dialysis catheters inserted via the FV included in the study. Of the 100 cases of catheters reinsertions, some were performed in the same patients.

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