Preoperative Versus Postoperative Initiation of Warfarin Therapy in Patients Undergoing Total Hip and Knee Arthroplasty

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KEYWORDS

• Warfarin • Dosing regimen • Anticoagulation • Perioperative blood loss

KEY POINTS

- Initiation of warfarin therapy on the night before surgery versus the night after surgery was associated with significantly decreased drain output and earlier increases in postoperative International Normalized Ratio (INR).
- We did not observe a difference in perioperative change in hemoglobin.
- We were unable to detect any difference in complication rates between groups.

INTRODUCTION

The optimal strategy for postoperative deep venous thrombosis (DVT) prophylaxis remains a controversial topic in hip and knee arthroplasty. Although it has been widely accepted that some form is required, a consensus on the ideal modality has not been established.[1] The benefits of chemical DVT prophylaxis must be balanced against the risks of anticoagulation in the early postoperative period, because increased bleeding can necessitate transfusions as well as lead to hematomas and other wound healing complications.

Warfarin therapy is the most commonly used form of chemical DVT prophylaxis after hip and knee arthroplasty in the United States.[2] It is usually administered beginning the evening after surgery and titrated according to International Normalized Ratio (INR) with a target range of 1.6 to 3.0, depending on the institution and surgeon.[2] It acts by preventing the carboxylation of vitamin K–dependent clotting factors in the liver; however, it first affects anticoagulant protein C and S, leading to an interval of transient hypercoagulability. Although the risk of DVT formation may begin at the time of surgery or during the early postoperative period, patients are unprotected until their INRs reach appropriate levels[3]; thus, the optimal timing of warfarin treatment with respect to surgery remains unclear.

We evaluated the effects of preoperative versus postoperative initiation of warfarin therapy on postoperative INR, perioperative blood loss, and related complications.

PATIENTS AND METHODS

This quasirandomized controlled study included all primary, elective total hip and knee

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arthroplasties (THA, TKA) performed by the senior author (BC) at a single institution over a 12-month period (January 2012–January 2013). Patients were assigned to begin taking warfarin the night before surgery or the night after surgery based on day of the week evaluated in clinic; those seen on Mondays and Wednesdays were prescribed 5 mg warfarin the evening before surgery, whereas those seen on Friday began warfarin on the evening after surgery. An a priori power analysis was performed to ensure appropriate sample size to detect a difference of 0.5 g/dL in perioperative change in hemoglobin between groups, given an alpha level of 0.05 and beta of 0.80. The results indicated that 64 patients would be required in each group, or at least 140 total when allowing for an estimated 10% exclusion rate.

The demographic distribution of patients assigned to each group is shown in Table 1. Preoperative hemoglobin levels were measured on all patients within 2 weeks of surgery. Morphine spinal anesthesia was routinely used, and all TKAs were performed using a tourniquet, which was inflated at the time of incision and deflated before closure. A single medium HemoVac drain (10 French/0.125 in/0.32 cm diameter) was placed at the end of each case and discontinued on the morning of postoperative day (POD) 1. All patients received 5 mg of warfarin at 10 PM on the evening after surgery (6–12 hours postoperatively), and a standard nomogram was used to titrate warfarin dosing according to INR levels in both patient groups thereafter. The surgeon and other staff were blinded to the patient's anticoagulation protocols at the time of surgery and throughout their hospitalizations.

After receiving appropriate Institutional Review Board approval, the electronic medical records for patients in the study population were retrospectively reviewed for INR levels (on POD 1 and 2), drain outputs (on POD 1, when all drains were removed), and change between preoperative and postoperative hemoglobin levels (on PODs 1 and 2). Patients were monitored clinically, but no Doppler studies or other screening modalities were performed to detect asymptomatic DVTs. The number of adverse events related to anticoagulation (wound healing complications, hematomas [abnormal swelling and fluid accumulation within the knee], epidural complications, and transfusions) or thrombosis (symptomatic DVT, pulmonary embolus) was also noted. These outcomes were compared between patient populations using a χ^2 test for categorical variables (wound healing complications, hematomas, and transfusions) and the Student *t* test for continuous variables (postoperative INR, drain output, and change between preoperative and postoperative hemoglobin levels). Adverse events (transfusions, hematomas, epidural complications, symptomatic DVT, and pulmonary embolus) were compared using the 2-tailed Fischer's exact test.

Table 1
Demographic distribution of patients assigned to preoperative compared with postoperative initiation of warfarin treatment

	Study Group	Control Group	*P*
Total hip arthroplasty (n)	49	59	.7431
Total knee arthroplasty (n)	24	33	
Male (n)	29	45	.3429
Female (n)	43	47	
Age (y), mean	59.6	54.4	.0034

RESULTS

Of the 177 patients initially reviewed, 12 were excluded: 7 receiving chronic anticoagulation for treatment of another condition, 3 undergoing simultaneous procedures that would likely increase blood loss (2 significant hardware removals and 1 contralateral core decompression), and 2 with medical contraindications to warfarin (1 hemophiliac, 1 intolerance). Of the remaining 165 cases (108 THA, 57 TKA) available for study, 73 were prescribed warfarin preoperatively (49 THA, 24 TKA) and 92 postoperatively (59 THA, 33 TKA). Patients were evenly distributed between groups in terms of gender and hip versus knee arthroplasty ($P = .3429$ and $P = .7431$, respectively), although those who received postoperative warfarin were slightly older (mean 59.6 compared with 54.4 years; $P = .0034$; see Table 1). Five patients from the study group and 2 patients from the control group were discharged on POD 1 and therefore excluded from the analysis of INR and hemoglobin on POD 2. In addition, drain outputs were not reliably documented in 9 patients from the preoperative treatment group (6 not recorded, 3 fell out) and 6 patients from the postoperative treatment group (5 not recorded, 1 fell out), so these patients were excluded from the analysis of drain output.

No difference in perioperative change in hemoglobin was observed between groups on either POD 1 (mean, 3.279 vs 3.377; $P = .6824$) or POD 2 (mean, 4.0 vs 4.12; $P = .6831$). The study