Perioperative Bridging Anticoagulation Therapy in At-Risk Patients Undergoing Elective Arthroplasty Surgery

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Abstract

We investigated the efficacy and safety of a standardized periprocedural anticoagulation bridging regimen that was instituted for patients who were on long-term oral anticoagulation therapy and were admitted for elective lower limb arthroplasty.

Over a 3-month period, from March to June 2007, 15 inpatients who required temporary interruption of oral anticoagulation therapy in order to undergo elective orthopedic surgery were included in the study. All patients had bridging anticoagulation therapy instituted as per a standardized hospital protocol adapted from a British Orthopaedic Association publication. Patients were followed up prospectively during their inpatient stay.

One operation was canceled, and 1 operating theatre list was rescheduled to delay a procedure because of nonadherence to the protocol. There were 2 cases of excessive surgical wound bruising, which caused additional morbidity and delayed discharge. One patient died from a cause unrelated to anticoagulation.

Lack of proper knowledge of the bridging therapy protocol and improper communication between the medication prescribing and dispensing staff were the most important areas of concern. Given our study results, we believe that patient information and staff education are the key elements in successful implementation of a perioperative bridging anticoagulation protocol in elective arthroplasty.

Any significant risk for systemic thromboembolism—such as atrial fibrillation, presence of prosthetic heart valves, or recent or recurrent venous thromboembolism—warrants long-term oral anticoagulation (OAC) therapy. Oral anticoagulation use, however, poses a special challenge in elective surgical procedures. Temporary interruption of OAC therapy often is needed in the perioperative period. During this phase, heparin, a bridging anticoagulation therapy, is commonly used. However, such perioperative management is not without its risks. Interrupting anticoagulation enhances the risk for thromboembolism, whereas maintaining anticoagulation status increases the risk for a major bleeding complication. During this perioperative period, strict monitoring of anticoagulation is essential. Improved anticoagulation control could decrease the likelihood of almost half of all anticoagulant-associated adverse events.[1] Although much has been written about perioperative bridging therapy for long-term anticoagulation patients undergoing cardiac surgery,[2] urology,[3] and general surgery,[4] similar studies cannot be found for patients undergoing orthopedic procedures.

We conducted a prospective audit study to assess the efficacy and safety of a standardized perioperative bridging therapy protocol for elective arthroplasty procedures in patients who receive long-term OAC therapy. In this article, we describe this study, highlight the problems or complications encountered in implementing the protocol, and discuss general principles of perioperative bridging anticoagulation for elective arthroplasty.

Methods

In this prospective study, conducted over a 3-month period, from March to June 2007, patients on long-term OAC therapy were admitted to a tertiary-care specialist orthopedic center for elective lower limb arthroplasty procedures. There were 16 admission episodes involving 15 patients during this period. One primary knee arthroplasty was canceled because the patient was admitted on day of surgery. All other patients underwent temporary interruption of OAC therapy and initiation of a bridging anticoagulation therapy per a standardized hospital protocol adopted from "Blood Conservation in Elective Orthopaedic Surgery," an article published by the British Orthopaedic Association (BOA) (Figure).[5]

Patients on long-term OAC therapy were assigned to 1 of 2 study groups—those with atrial fibrillation or recent or recurrent thromboembolism (group 1) and those with a prosthetic heart valve (group 2). All patients were asked to start skipping their OAC medication 4 days before their scheduled surgery date.

Group 1 patients were admitted 1 day before their surgery date and had their clotting status checked. When the international normalized ratio (INR) was found to be lower than 2, bridging therapy was initi-

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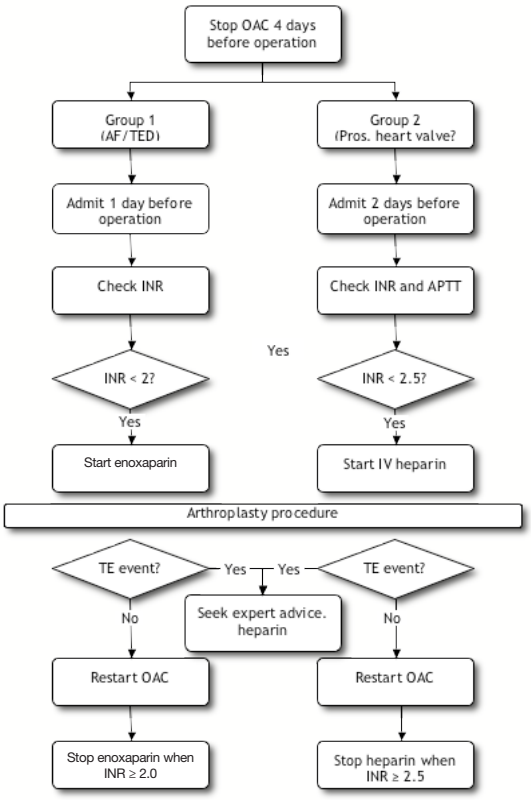

Figure. Protocol for bridging anticoagulation therapy. Abbreviations: AF, atrial fibrillation; APTT, activated partial thromboplastin time; INR, international normalized ratio; IV, intravenous; OAC, oral anticoagulation; Pros, prosthetic; TE, thromboembolic; TED, thromboembolic disease.

ated with subcutaneous enoxaparin 40 mg (0.4 mL; anti-Xa, 4000 IU) administered at least 12 hours before surgery. Then, OAC therapy was to be restarted 6 hours after surgery, provided there was no major perioperative bleeding incident. Bridging therapy was to be continued until the INR was 2 or higher.

Group 2 patients, considered clinically more challenging, were admitted 2 days before surgery and, when the INR was found to be lower than 2.5, were initiated on intravenous unfractionated heparin. As with group 1, OAC therapy was to be restarted 6 hours after surgery, provided there was no major perioperative bleeding incident. Bridging therapy was to be continued until the INR was 2.5 or higher.

These regimens ensured that adequate anticoagulation status was maintained during the perioperative period and until regular OAC therapy could be resumed. Patients were followed up during their hospital stay, beginning with day of admission. Any discrepancies in adhering to the protocol and any resulting complications were noted. Ways to minimize the problems and complications also were examined.

Results

Over the 3-month study period, there were 16 elective admission episodes for lower limb arthroplasty procedures involving 15 patients (9 men, 6 women) who were prescribed the bridging anticoagulation regimen. Mean age was 70 years (range, 57 to 86 years). Fourteen patients were taking long-term warfarin, and 1 patient was taking phenindione. Indications for long-term OAC therapy were atrial fibrillation (11 patients), presence of mechanical heart valves (2), and recurrent venous thromboembolism (2). The orthopedic procedures performed are listed in the Table.

There were many discrepancies in adhering to the preoperative and postoperative protocol pathways. In only 1 case was the protocol followed to the letter. In 6 of the 16 admissions, OAC therapy was not stopped 4 days before the surgery date. One surgery was canceled because the patient was admitted on day of surgery, and, therefore, was not medically fit to proceed. Contrary to the protocol, in 10 of the 16 admissions, preoperative bridging therapy was not initiated even though the INR was lower than 2 (1 surgery was delayed as a result). After surgery, restarting regular OAC therapy was delayed in 7 of the 16 cases.

There were 2 cases of excessive surgical wound bruising that resulted in additional morbidity and delayed discharge. An 86-year-old patient underwent aseptic revision of a total hip arthroplasty but died from cardiorespiratory failure 33 days after surgery.

Discussion

Major orthopedic surgery is in itself a high-risk factor with asymptomatic venous thromboembolism, and, in the absence of prophylaxis, venous thromboembolism affects at least half of these patients.[6] The evidence regarding perioperative management of orthopedic patients who take long-term OAC therapy is mainly anecdotal and not well defined. Most published evidence on bridging therapy addresses surgical interventions in general and mentions the effectiveness of this therapy in managing these patients. In the present study, we examined bridging therapy for orthopedic patients on long-term OAC therapy. We now discuss general principles of perioperative management for such patients.

Ideally, bridging anticoagulation therapy should be initiated in consultation with the relevant experts, as this phase is not without its own risks. In addition to hemorrhagic and thromboembolic complications, there are issues in relation to canceled and postponed surgery, delayed recovery and discharge, and readmission for treatment of these complications. The necessity of bridging therapy depends on the risk for a thromboembolic event in the absence of any anticoagulation therapy. Patients for whom an anticoagulation-requiring index event occurred more than 3 months earlier and many patients who undergo same-day surgery can be managed safely without bridging anticoagulation.[7] These patients are at relatively low risk for thromboembolism. Patients with prosthetic heart valves are at higher risk in terms of balanced anticoagulation control and warrant closer monitoring to avoid complications. Therefore, combined medical and surgical input is necessary when deciding on a bridging therapy.

Table. Surgical Procedures by Study Group[a]

Procedure (n = 15)	Group 1	Group 2
Total knee arthroplasty		
Primary	8	0
Revision	0	2
Total hip arthroplasty		
Primary	3	0
Revision	2	0

[a]Group 1, atrial fibrillation and recurrent venous thromboembolism; group 2, mechanical heart valve.

The bridging therapy protocol used in this study, though existing only as an appendix in a BOA article,[5] does provide a guideline for managing this unique set of orthopedic patients, especially in the absence of any other evidence. This regimen is advocated to ensure a balance in anticoagulation status in the perioperative period. All patients on long-term OAC therapy need to be assessed in the preoperative assessment clinic before undergoing any elective surgery. This assessment not only addresses medication status but also provides an opportunity for the patient to become educated and informed. Patients are admitted before their surgery date and have their anticoagulation status tested. Ideally, warfarin is skipped 4 or 5 days before the surgery. The INR usually drops lower than 1.5, making surgery safe in terms of operative bleeding. Bridging therapy with subcutaneous enoxaparin should be initiated at least 12 hours before a regional spinal anesthesia procedure to decrease intrathecal bleed. In the postoperative period, OAC therapy is restarted provided that no major bleeding events occur. Studies have shown that there are no advantages to starting warfarin at a loading dose and that a dose closer to the maintenance dose is appropriate.[8,9]

Checking the INR within 24 or 48 hours of changing a dose may not reveal the true steady-state response, as warfarin takes several days to influence the INR to the dose adjustment. Therefore, frequently drawing blood to test the INR is an unnecessary exercise.

The most common complication with OAC therapy is bleeding. INR levels accurately predict anticoagulation status. For most conditions, the target maintenance INR would be between 2 and 3. Numerous studies have shown that complication rates are higher when patients' INRs are outside the therapeutic range.[10,11] In this study, 2 patients had excessive wound bruising. All these bleeding complications can be at least partly explained by anticoagulation status.

Results of this study highlight the difficulties in implementing such a protocol even at a tertiary-care orthopedic center. Major discrepancies were found in adhering to the preoperative and postoperative pathways of the protocol. In the preoperative pathway, the main areas of concern were lack of proper patient information and the staff's education. A deficiency in knowledge about prescribing and administering the anticoagulant therapy as per the protocol was identified. The preoperative INR check and initiation of the correct bridging therapy were not uniformly followed.

Advice given to patients—about when to stop OAC therapy and the significance of doing so—was inadequate. In 1 case, the result was that the patient was admitted on day of surgery, and the surgery had to be canceled. Although there were no major complications related to hematologic events in our inpatients, such complications could not be assessed after discharge back into the community.

Given the results of this study, we recommend that all patients on OAC therapy be assessed in the preoperative assessment clinic before being admitted. Written instructions or patient leaflets highlighting the risks associated with bridging anticoagulant therapy should be dispensed. Staff education and information regarding the pharmacology of OAC therapy and the clinicopathology of systemic thromboembolism are essential in improving adherence to the bridging regimen.

Conclusions

Patients who must temporarily interrupt long-term OAC therapy in order to undergo invasive orthopedic surgery pose a special challenge. The bridging protocol for perioperative anticoagulation appears to be relatively efficacious and safe for these patients. Combined medical and surgical input is ideal when deciding on a bridging therapy. Important issues are patient information and staff education regarding anticoagulation therapy. Large, multicenter, randomized controlled trials are necessary to fully assess the efficacy and safety of a bridging anticoagulation therapy in arthroplasty patients.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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