Postorthopedic Surgery Joint Replacement Surgery Venous Thromboembolism Prophylaxis

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KEYWORDS

• Thrombophrophylaxis • Rivaroxaban • Apixaban • Total hip arthroplasty
• Total knee arthroplasty • NOAC • Venous thromboembolism (VTE)

KEY POINTS

- Total hip and total knee arthroplasty put patients at high risk for venous thromboembolism.
- Significant research and development has been done in the search for the ideal postoperative thromboprophylactic agent.
- Direct factor Xa inhibitors like rivaroxaban and apixaban are novel oral anticoagulants with improved effectiveness and good safety profiles.
- Inconsistency across clinical trials with regard to the definition of trial safety endpoints has made it impossible to compare these agents with regard to bleeding.

INTRODUCTION

The performance of elective total hip arthroplasty (THA) or total knee arthroplasty (TKA) places patients at high risk for venous thromboembolism (VTE; **Tables 1** and **2**). These major orthopedic procedures contribute to all 3 components of Virchow's triad—vascular injury, stasis, and hypercoagulability. This places patients at high risk for the development of thrombosis. The subluxation of the tibia anteriorly during knee replacement surgery or the dislocation of the hip anteriorly or posteriorly in the course of hip replacement surgery imparts traction and torsional forces on blood

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Table 1
Incidence of VTE in hip and knee arthroplasty patients in the absence of thromboprophylaxis

Type of Surgery	Total DVT (%)	Proximal DVT (%)	Total PE (%)	Fatal PE (%)
Hip arthroplasty	42–57	18–36	0.9–28.0	0.1–2.0
Knee arthroplasty	41–85	5–22	1.5–10	0.1–1.7

Abbreviations: DVT, deep-vein thrombosis; PE, pulmonary embolism; VTE, venous thromboembolism.
Adapted from Geerts WH, Pineo GF, Heit JA, et al. Prevention of venous thromboembolism. Chest 126;2004:351.

vessels. This can cause direct vascular endothelial damage that can initiate the process of thrombosis intraoperatively. The period of time spent immobile on the operating room table, exacerbated by use of anesthetic paralytic agents or the use of a tourniquet during knee replacement surgery, further contributes to vascular stasis. As a consequence of the patient's biologic response to tissue injury, the patient's circulatory system is showered with tissue thromboplastins, which induces a state of hypercoagulability.

As our understanding of the pathophysiology of VTE after joint arthroplasty has increased, various pharmacologic strategies have been developed to directly or indirectly target different aspects of the coagulation cascade. It has been estimated that the postoperative risk of deep vein thrombosis (DVT) without systemic anticoagulation

Table 2
Comparative efficacy of pharmacologic agents in risk reduction of deep-vein thrombosis in patients after total hip and knee arthroplasty

Pharmacologic Agent	Relative Risk Reduction (%) Compared with Placebo
Total hip arthroplasty	
Low-molecular-weight heparin	70–71
Aspirin	0–26
Warfarin	59–61
Fondaparinux[a]	45
Apixaban[b]	36
Rivaroxaban[c]	48–76
Total knee arthroplasty	
Low-molecular-weight heparin	51–52
Aspirin	0–13
Warfarin	23–27
Fondaparinux[a]	63
Apixaban[b]	38
Rivaroxaban[35]	31

[a] Odds reduction for venous thromboembolism for fondaparinux versus enoxaparinparin.[15,18,19]
[b] Cite studies for ADVANCE-1-2-3 (Apixaban Dose Orally vs ANTiCoagulation with Enoxaparin-1-2-3).
[c] Cite studies for RECORD1-3 (REgulation of Coagulation in ORthopedic surgery to prevent Deep vein thrombosis and pulmonary embolism1-3).
Data from Geerts WH, Heit JA, Clagett GP, et al. Prevention of venous thromboembolism. Chest 2001;119(1 Suppl):132S–75S; and Gallus AS. Applying risk assessment models in orthopaedic surgery: overview of our clinical experience. Blood Coagul Fibrinolysis 1999;10(Suppl 2):S53–61.