Prevalence and Economic Burden of Venous Thromboembolism After Total Hip Arthroplasty or Total Knee Arthroplasty

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Abstract

Venous thromboembolism (VTE) is a common complication following total hip arthroplasty or total knee arthroplasty and can lead to morbidity and mortality, as well as considerable healthcare costs. However, the incidence of VTE can be greatly minimized with effective thromboprophylaxis administered for the appropriate period of time. While guidelines exist to assist clinicians in determining what type of thromboprophylaxis should be prescribed and for how long, those guidelines are frequently not followed. Prevention of VTE would improve patient outcomes and result in substantial savings to payers and providers.

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For author information and disclosures, see end of text.

Due to an aging and increasingly obese population, it has been predicted that by 2030 the number of total hip arthroplasty (THA) operations in the United States will reach over half a million, a rise of approximately 100% compared with 2005 figures, and the number of total knee arthroplasty (TKA) operations will reach 3.5 million, an increase of over 560%.[1] As a consequence, the number of revision operations is expected to reach over 95,000 and 260,000 for THA and TKA, respectively, by 2030.[1]

After THA or TKA, patients are at increased risk of venous thromboembolism (VTE), a potentially fatal condition that comprises deep vein thrombosis (DVT) and pulmonary embolism (PE).[2] Without prophylaxis after THA and TKA, patients are at high risk for asymptomatic (venographic) DVT (incidence after THA: 40%-60%; after TKA: 40%-85%).[3] If routine thromboprophylaxis is used, fatal PE is uncommon, although symptomatic VTE continues to be reported in 1% to 10% of patients within 3 months after surgery.[3] DVT can result in considerable morbidity and mortality—without thromboprophylaxis, fatal PE occurs in approximately 1 patient per 300 undergoing THA.[3] Non-fatal PE can also have considerable consequences and may result in chronic thromboembolic pulmonary hypertension (CTPH), a serious disease associated with progressive disability and a high risk of mortality.[4,5]

Clinical Burden of VTE

Using a large US healthcare claims database, investigators estimated the burden of VTE after major orthopedic surgery.[6] In all, 2.2% of patients developed clinical VTE over a 90-day period following hospital admission (DVT: 1.7%, PE: 0.4%, DVT and PE: 0.01%). Over 60% of events occurred following hospital discharge. In a long-term follow-up study, patients with and without VTE were matched by age and procedure. Investigators found that patients who developed in-hospital VTE after major orthopedic surgery had a longer length of hospital stay compared with patients without VTE.[6]

Using data from discharge summaries for 105,562 patients from 220 acute care hospitals, Ollendorf et al[7] examined the incidence of VTE after major orthopedic surgery. They found that during the initial hospital stay, DVT occurred in 0.7% of patients and PE (with or

without DVT) in 0.4% of patients. Patients with VTE spent almost 10 times as long in the intensive care unit and more than twice as long in hospital as did those without VTE.[7]

Approximately one-third to one-half of all DVT patients will develop post-thrombotic syndrome (PTS).[8,9] PTS is a chronic condition characterized by persistent pain, or intermittent pain, swelling, itching, tingling, or cramping in the limb, that develops in 20% to 60% of patients within 1 to 2 years of DVT.[10,11] Severe PTS can lead to lipodermatosclerosis and intractable venous leg ulcers.[12,13] Due to its chronic nature, PTS is a cause of substantial patient morbidity.[10] Caprini et al[14] used a Markov model to simulate the natural history of DVT complications after THA, using published estimates of the incidence and prognosis of PTS and recurrent VTE. They projected that the cumulative proportion of patients who survived an initial acute, post-surgery DVT and subsequently developed mild-to-moderate PTS would be 21.5%, compared with 1.3% in the control group, who did not experience DVT after THA. The estimated cumulative proportions of post-surgery DVT patients who developed severe PTS and recurrent DVT and PE were 8.1%, 24.4%, and 6.5%, respectively. Corresponding figures for the control group were estimated at 0.4%, 2.4%, and 1.0%, respectively.[14]

Long-Term Consequences of VTE

Most VTEs are diagnosed in the 3 months after hospitalization.[15] As stated earlier, VTE is associated with a number of potentially serious complications, including recurrent VTE, PTS, and CTPH.[4,16] Most cases of PTS will occur within 1 to 2 years of acute DVT, with poor-quality initial anticoagulant therapy being an important risk factor.[17] A 10-year follow-up of patients who experienced an index VTE found an incidence of severe PTS of 6%, with 56.3% of patients having some sign of PTS during the follow-up period.[18]

CTPH is a relatively common and serious complication of PE and is associated with considerable morbidity and mortality.[4,19] It is notoriously underdiagnosed and its true prevalence remains unknown.[4] In a prospective, long-term follow-up study of 314 consecutive patients who presented with an initial acute PE, the cumulative incidence of symptomatic CTPH was 1% at 6 months, 3.1% at 1 year, and 3.8% at 2 years.[4]

Ollendorf et al[7] reported a mortality rate of 1.02% among those with no VTE, rising to 2.51% in those with DVT alone, and 19.49% in those with PE. In patients who had finished a course of anticoagulant therapy for a first episode of symptomatic VTE, the risk for fatal PE was reported to be 0.19 to 0.49 events per 100 person-years.[20]

Economic Impact of Venous Thromboembolism

VTE has a major clinical impact on US Medicare, other payers, and patients, and significantly increases the economic burden on the US healthcare system. Despite the costs of thromboprophylaxis, it has been noted that following major orthopedic surgery, any type of prophylaxis is cost-saving compared with no prophylaxis.[21]

Studies of the economic consequences of VTE after major orthopedic surgery have yielded a number of contrasting estimates. Caprini et al[14] reported annual projected costs (first year) of complications of $839 for mild-to-moderate PTS, $3817 for severe PTS, $3798 for recurrent DVT, and $6604 for recurrent PE. From discharge summaries, Ollendorf et al found mean costs of inpatient care were $17,114 for patients with DVT and $18,521 for patients with PE compared with $9345 for patients with no VTE.[7] A study using data from a large healthcare claims database calculated much higher in-hospital mean billed charges for the index admission after THA: $36,705 in patients with no VTE, $62,558 in patients with in-hospital VTE, and $34,970 for post-discharge VTE.[6] Similarly, costs after TKA were $35,601 in patients with no VTE, $44,898 in patients with in-hospital VTE, and $31,774 for post-discharge VTE.[6]

An older estimate of costs for treating VTE after major orthopedic surgery was $11,600.[22] Yet, despite changes in healthcare following surgery, such as reduced time in hospital,[23] more recent estimates remain high at $17,114 for treating DVT and $18,521 for treating PE after orthopedic surgery.[24]

While health economic modeling of cost-effectiveness of thromboprophylaxis has evolved over recent years,[25] cost estimates will still vary from one analysis to another, reflecting the range of healthcare services included, the proportion of patients who use them, and the unit costs applied.

Conclusions

Patients undergoing major orthopedic surgery are classified as being at high risk of developing VTE. Even when prophylaxis for VTE was given, studies indicated rates of VTE of 1.1% to 3.3% in patients who underwent major orthopedic surgery. VTE imposes significant clinical and economic consequences on patients and on the healthcare systems that support them—extending hospital stays and precipitating additional hospitalizations. The incremental inpatient costs of patients with major orthopedic surgery who developed VTE were substantially higher compared with patients with no VTE (approximately $12,000-$17,000 higher). Consequently, there is a need for more cost-effective and prolonged VTE

prophylaxis following THA and TKA. The development of cost-effective anticoagulants is of paramount importance in order to ensure that the most appropriate anticoagulant care can be provided for the largest number of patients at risk of VTE.[26] Preventing VTE could lead to substantial savings to healthcare systems, and to significant reductions in morbidity and mortality. After all, prevention of VTE is much easier and less expensive than diagnosis and treatment.[27]

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