



Incidence and Risk Factors for Venous Thromboembolic Disease in Podiatric Surgery*

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Background: The Agency for Healthcare Research and Quality ranks prevention of venous thromboembolism (VTE) as a top priority for patient safety; however, no guidelines or population-based research exist to guide management for podiatric surgery patients. The objective of our study was to determine the incidence and risk factors for postprocedure VTE in podiatric surgery.

Methods: A 5-year retrospective analysis of patients undergoing podiatric surgery in a large not-for-profit health maintenance organization serving > 485,000 members in the Pacific Northwest from 1999 to 2004.

Results: We identified 16,804 surgical procedures in 7,264 patients and detected 22 symptomatic postprocedure VTEs. The overall incidence of postprocedure VTE was 0.30%. Three risk factors were significantly and independently associated with VTE in podiatric surgery: prior VTE (incidence, 4.6%; relative risk, 23.0; $p < 0.001$), use of hormone replacement therapy or oral contraceptives (incidence, 0.55%; relative risk, 4.2; $p = 0.01$), and obesity (incidence, 0.48%; relative risk, 3.0; $p = 0.02$).

Conclusions: We identified a low overall risk of VTE in podiatric surgery, suggesting that routine prophylaxis is not warranted. However, for patients with a history of VTE, periprocedure prophylaxis is suggested based on the level of risk. For podiatry surgery patients with two or more risk factors for VTE, periprocedure prophylaxis should be considered. Until a prospective study is completed testing recommendations, guidelines and care decisions for podiatric surgery patients will continue to be based on retrospective data, expert consensus, and clinical judgment. (CHEST 2009; 135:917-922)

Key words: podiatric surgery; podiatry; prophylaxis; pulmonary embolism; thrombosis; venous thrombosis

Abbreviations: BMI = body mass index; CI = confidence interval; DVT = deep vein thrombosis; HMO = health maintenance organization; HRT = hormone replacement therapy; ICD-9 = *International Classification of Diseases*, ninth revision; OCP = oral contraceptive pill; OR = odds ratio; PE = pulmonary embolism; VTE = venous thromboembolism

Prophylaxis for preventing deep vein thrombosis (DVT) and pulmonary embolism (PE) has been receiving increasing attention in recent years.¹⁻² The Agency for Healthcare Research and Quality, for example, ranks prevention of venous thromboembolism (VTE) as one of the top preventive initiatives that can improve patient safety in health-care set-

tings.³ Medical specialties are increasingly involved in cross-disciplinary work to create guidelines, including guidelines on VTE prophylaxis.

While there are decades of research and guidelines for VTE prophylaxis in diverse patient populations, certain patient populations remain understud-

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ied. Little is known about VTE risk in podiatry patients. Only one study⁴ calculated VTE incidence

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rates in podiatric surgery. In addition to this single podiatric study, we were able to identify only six studies^{5–10} conducted in patients undergoing ankle/foot surgery. The results of these prior studies are conflicting and do not provide sufficient evidence to recommend an approach to VTE prophylaxis in podiatry patients.

This article presents data from the largest study to date on the incidence of symptomatic VTE in podiatry patients from a large health maintenance organization (HMO) during a 5-year period. We also review available studies in the podiatric and orthopedic literature on VTE prophylaxis in ankle/foot surgery. Finally, we describe identified risk factors for VTE in podiatric patients and propose an approach to prophylactic treatment in this population.

MATERIALS AND METHODS

We analyzed a large not-for-profit HMO database serving > 485,000 members using an integrated, group-model health delivery system to identify patients who had undergone podiatric procedures during the period from December 1999 to November 2004. A robust computerized electronic medical record system of all patient care activity is accessible. This study was approved by the Kaiser Permanente Northwest institutional review board; patient data were deidentified according to institutional review board regulations.

Podiatric Procedures and Patient Cohort

Patients undergoing podiatric procedures were identified in a stepwise fashion searching the HMO administrative database for patients undergoing podiatric-specific procedures performed by a podiatrist. For outpatient procedures, we used a list of podiatric-specific current procedural terminology codes¹¹ to locate outpatient podiatric procedures. For inpatient procedures, we used a list of podiatric-specific International Classification of Diseases, Ninth Revision (ICD-9) codes¹² to locate inpatient podiatric procedures. Cases were limited to podiatrists using specialty-specific provider codes.

Venothrombotic Events

We screened inpatient and outpatient records of patients undergoing podiatric procedures during this time period to identify patients with a history of DVT or PE using VTE-specific ICD-9 codes (Table 1).¹³ We defined a postprocedure VTE event as any definitive and symptomatic DVT and/or PE occurring within 6 months of the procedure. A positive compression Duplex ultrasound result was required for a diagnosis of a DVT. Either a high-probability ventilation/perfusion scan or positive CT angiogram were required for PE. Patients with both symptomatic DVT and PE were classified as having PE. Two clinician researchers (A.F. and R.M.) independently reviewed the medical records for all postprocedure VTEs to verify event classification. Cases were anatomically grouped using the method described by Wukich and Waters.¹⁰

Table 1—ICD-9 Codes for VTE

Variables	Codes
DVT specific	451.1, 451.11, 451.19, 451.19, 451.2, 451.81, 451.9, 453.2, 453.4, 453.40, 453.41, 453.42, 453.8, 453.9
PE specific	415.1, 415.11, 415.19
Pregnancy-related VTE	639.6, 671.31, 671.32, 671.33, 671.34, 671.35, 671.4, 671.40, 671.42, 671.44, 673.2, 673.20, 673.21, 673.22, 673.23, 673.24, 673.25, 673.26, 673.27, 673.28, 623.29

Risk Factors

All patient records were analyzed for the presence or absence of the following VTE risk factors: (1) active cancer; (2) prior VTE; (3) known hypercoagulable state; (4) advanced age; (5) obesity; (6) use of hormone replacement therapy (HRT) or oral contraceptive pills (OCP) medication within 3 months of surgery. Active cancer was defined as the presence of cancer during the 6 months prior to podiatric surgery determined using the HMO internal cancer registry. Prior VTE was defined as a known history of VTE any time before the index procedure using the same ICD-9 VTE event coding (Table 1). Hypercoagulable states were defined as the presence of any of the following ICD-9 codes anytime before the index procedure: 289.81 and 289.82. Advanced age was defined as ≥ 70 years at the time of the index procedure. Obesity was defined as a body mass index (BMI) ≥ 30 kg/m² any time during the 12 months before the index procedure. HRT/OCP use was determined by searching medication profiles for use of these medications within 3 months of surgery.

Index Case Definition

In patients undergoing a single procedure, this procedure was considered the index date for determining all risk factors. In patients who had multiple procedures, the date of the last procedure was considered the index date for assessing all risk factors except in patients who had a VTE during the study period. In the case of a patient having undergone multiple procedures and having a VTE, the podiatric procedure immediately preceding the VTE was used to determine all risk factors.

Statistical Analysis

We analyzed risk factors with univariate and logistic regression models. Dichotomous variables were tested for association with χ^2 . We performed logistic regression of risk factors using statistical software (SAS version 8.2; SAS Institute; Cary, NC) and conducted sensitivity analyses using a stratified model for estrogen-associated risk including only female patients in regression. Due to nonconvergence with small cell numbers, we constructed truncated exploratory models with variables found in univariate analysis to have association at the $\alpha < 0.05$ level.

RESULTS

A total of 7,264 patients underwent 16,804 podiatric surgical procedures from December 1999 to November 2004 (Table 2); 5,128 patients underwent a single procedure, and 2,136 patients underwent

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