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Population-based epidemiology of postoperative venous thromboembolism in Taiwanese patients receiving hip or knee arthroplasty without pharmacological thromboprophylaxis



Po-Kuei Wu^{a,b,c,d}, Cheng-Fong Chen^{b,c,d}, Lien-Hsiang Chung^{c,d,e}, Chien-Lin Liu^{b,d}, Wei-Ming Chen^{b,c,d,*}

^a Institute of Clinical Medicine, National Yang-Ming University, Taipei, Taiwan, ROC

^b Department of Orthopaedics and Traumatology, Taipei Veterans General Hospital, Taipei, Taiwan, ROC

^c Therapeutic and Research Center of Musculoskeletal Tumor, Taipei Veterans General Hospital, Taipei, Taiwan, ROC

^d Orthopaedic Department School of Medicine, National Yang-Ming University

^e Department of Orthopaedics and Traumatology, Chia-Yi Christian Hospital, Chia-Yi, Taiwan, ROC

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ABSTRACT

Introduction: Population-based evaluation on the incidence of postoperative venous thromboembolism (VTE) has not yet been reported for Asians receiving arthroplasty. In Taiwan, thromboprophylaxis was not commonly applied for patients. The population-based cohort study aimed to investigate the epidemiology, and to determine the risk factors VTE for patients receiving hip or knee replacement without pharmacological thromboprophylaxis in Taiwan.

Materials and Methods: We retrospectively acquired patients' data from National Health Insurance databases representing more than 99% of about 23 million Taiwanese citizens. The primary outcome was the incidence of composite symptomatic VTE within 28 days after receiving hip or knee replacement surgery.

Results: During 2002 to 2006, there were 114,026 patients undergoing hip ($n = 61,460$) or knee ($n = 52,566$) replacement surgery. The occurrence rate of overall postoperative VTE was 0.44%. The incidence of pulmonary embolism was four in 10,000 patients receiving hip replacement or seven in 10,000 individuals undergoing knee replacement. The weekly cumulative incidence of VTE was persistently rising up to 28 days after surgery. Dramatic increase in risk of post-surgical VTE was associated with prior disease history of PE ($p < 0.001$ for hip replacement, $p = 0.01$ for knee replacement) or DVT ($p = 0.004$ for hip replacement, $p < 0.001$ for knee replacement). Prior claim of congestive heart failure was an independent risk factor associated with patients receiving knee arthroplasty ($p = 0.01$).

Conclusion: Life-threatening PE occurred and increased cumulatively up to 28 days after hip or knee arthroplasty in Asians. Proper prophylaxis for patients with the exposure of high risks needs to be scrutinized.

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Introduction

Venous thromboembolism (VTE), consisting of pulmonary embolism (PE) and deep vein thrombosis (DVT), is a common postoperative complication for patients receiving hip or knee replacement surgery [1–3]. Standard pharmacological prophylaxis such as anticoagulants, mechanical devices such as calf pump or combined intervention have been practiced for decades. Guideline recommendations for appropriate prophylaxis based on strong evidence have been published by American College of Chest Physicians (ACCP) [4], American Academy of Orthopaedic Surgeons (AAOS) [5], or the consensus of the Asia-Pacific Thrombosis Advisory Board in the countries without their own guidelines [6]. In Taiwan, postoperative thrombosis prophylaxis has not yet

applied for patients receiving hip or knee arthroplasty that may be attributed the following reasons. Firstly, the assumption determined by previous studies indicated that occurrence of post-surgical VTE in Asian population was relatively uncommon [7,8]. Secondly, given the matters of unreliable diagnoses and silence in clinical signs, physicians may not be aware of the risk prior to manifesting severe thrombosis events such as PE [9]. In addition, due to the perception of increased post-surgical bleeding, orthopedic surgeons may concern about the use of prophylactic anticoagulant therapy [10,11].

Increasing studies reported that postoperative VTE struck Asian patients receiving hip or knee replacement surgery in a comparable rate with that in Western countries [12–14], suggesting that patients undergoing arthroplasty without VTE prophylaxis in Taiwan can be predisposed to the emerging risk of thrombosis or a higher mortality rate led by PE strikes. However, the incidences of total thrombosis events after major joint surgeries revealed great variation spanning the ranges of 0%–64% for THR, and 11%–77% for TKR [3,4,9]. A previous Asian study also showed an ethnicity-related difference in the incidence

* Corresponding author at: 18F, 201, Section 2, Shin-Pai Road, Taipei 112, Taiwan, ROC. Tel.: +886 2 28757557x117; fax: +886 2 28757559.

E-mail addresses: drwuvgh@gmail.com (P.-K. Wu), ciaoquess@gmail.com (W.-M. Chen).

of postoperative DVT. In which, a lower rate was found in Koreans (29.8%) than Chinese (45%) or other selected Asian population (46.3%) [14]. Meanwhile, validity of the prior Asian studies was concerned by the small size of population and heterogeneity of diagnoses. Taken together, reevaluating previous assumption about the rareness of VTE after major joint surgeries is warranted for Asians. A large population-based study is required prior to determining a prophylactic policy preferable to Taiwanese population receiving major joint surgeries.

A proper strategy preventing postoperative VTE needs to be determined by the balance between the costs and benefits. Considerations shall also be addressed on the patients vulnerable to adverse outcomes derived from prophylactic intervention such as bleeding, infection and joint stiffness [11]. In addition, results of population-based studies in US [15] and Europe [16,17] appeared no improvement in the rates of symptomatic or fatal PE despite anti-thrombotic prophylaxis has been introduced over a decade. Up to date, there is no study concerning about the prevalence of postoperative PE in Asians. Significant increase in cost for administering aggressive anticoagulant therapy such as low molecular weight heparin (LMWH) leads to financial difficulties of extending the benefit for reimbursement in general public [11,18]. Therefore, identification of independent risk factors associated with the occurrence of post-surgical VTE is a prerequisite to determine an adequate thromboprophylaxis guideline for clinical practice, which is not yet available in Taiwan.

In the present study, we aimed to identify the incidences and the risk factors associated with postoperative VTE for Taiwanese patients receiving hip or knee replacement surgery by retrospectively evaluating on the data acquired from the National Health Insurance (NHI) database representing more than 99% population in Taiwan. The cumulative rates as well as the difference in the incidences between inpatient and outpatient visits were also calculated and compared.

Subjects and Methods

Data Acquisition and Validity

This was a retrospective population-based cohort study exploring the authentic database of Bureau of National Health Insurance (BNHI), Taiwan. Since March 1995, a single-payer NHI program was launched nationwide and more than 99% of Taiwanese citizens were mandatory to be insured. The registration files and original claims for reimbursement were included in the computerized database that is being maintained by the government-funded National Health Research Institute (NHRI), Taiwan. The claim files comprise outpatient and inpatient medical records on diagnosis, treatment and all management incurring expenses. Accession to explore the database requires authenticated account exclusively registered for research purposes.

Data Mining

The eligible subjects were all NHI insured patients receiving hip or knee surgery during five consecutive years between January 1st, 2002 and December 3, 2006. The inclusion criteria were determined by the claimed ICD-9-CM procedure codes including total hip replacement (81.51), partial hip replacement (81.52), revision of hip replacement (81.53), total knee replacement (81.54), and revision of knee replacement (81.55). All claims required the approval of orthopedic surgeons. Meanwhile, claim records within one year prior to the date of surgery and available postoperative follow-up information for at least 28 days were required for the enrollment.

For each enrolled subject, the data including demographic variables, surgery year, and surgery type were extracted and categorized. To identify the diseases associated with the incidence of postoperative VTE, subject data with prior history of VTE, congested heart failure (CHF), stroke, transient ischemic attack (TIA), diabetes mellitus (DM) and

hypertension claimed within one year prior to the date of surgery were collected. All diseases were determined by the claimed ICD-9-CM codes.

Study Outcomes

The primary outcome of the present study was the incidence of VTE determined as PE (415.1) and DVT (415.xx), or other venous embolism and thrombosis (453.xx) such as acute venous embolism, thoracic vein thrombosis in outpatient or inpatient within 28 days after surgery. All claims of PE or DVT related were centrally reviewed and confirmed by independent committees in BNHI prior to registering the approval of reimbursement in the NHI databases.

Statistical Analysis

Descriptive statistics were used to describe the baseline characteristics. The subjects with postoperative VTE were further stratified to four groups by the days (1–7, 8–14, 15–21 and 22–28 days) of onset since the date of surgery. The χ^2 -test was performed to compare characteristics between the VTE and non-VTE groups.

Logistic regression model was used for assessing the risk factors associated postoperative VTE for subjects receiving knee and hip surgery. The covariate variables included age, gender, surgery type, hospital level, and prior disease history of VTE, CHF, stroke, TIA, DM, and hypertension. We compared the unadjusted and adjusted patient characteristics between these groups by using odds ratio (OR) and 95% confidence intervals (CI). A p value < 0.05 indicated statistical significance. Data management and logistic regression model was conducted by SAS Version 8.0 (Chicago, Illinois).

Results

Incidence of Postoperative VTE Following Hip Replacement Surgery

During the 5-year period, data from 61,460 subjects received hip replacement surgeries were analyzed (Table 1). The total incident cases of postoperative VTE accounted for 0.27% (163/61,460) during 2002–2006, showing a significant decreasing trend over these years ($p < 0.02$). There were significant differences in the distribution of incidence rates in age and gender groups. Our findings revealed that higher incidence rates were found in those aged over 60 years ($p < 0.01$). Females were more susceptible to postoperative VTE than males ($p < 0.02$). No significant difference was found in the incidence rates of postoperative VTE following different types of hip replacement surgeries ($p < 0.07$). Patients with prior history of PE ($p < 0.001$), DVT (or related venous embolism and thrombosis, $p < 0.001$), varicose veins of lower extremity ($p < 0.001$), and transient ischemic attack ($p < 0.01$) were associated with significantly higher postoperative VTE.

Incidence of Postoperative VTE Following Knee Replacement Surgery

As summarized in Table 1, a total of 52,556 patients had knee replacement surgeries during 2002–2006 in Taiwan. Of those, the number of incident cases with postoperative VTE was 335 (0.64%). A significant decreasing trend over the 5 years was observed ($p < 0.01$). No significant difference was found in the VTE incidences by age or by gender. Patients who received total knee replacement surgery had a significantly higher incidence of developing postoperative VTE than those receiving a revision of replacement ($p < 0.05$). Moreover, significantly higher incidences were found in the subjects with prior PE ($p < 0.001$), DVT ($p < 0.001$), varicose veins of lower extremity ($p < 0.05$), and congestive heart failure ($p < 0.001$) following knee replacement surgeries.

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