Clin Orthop Relat Res (2011) 469:3423–3428
DOI 10.1007/s11999-011-1979-7

CLINICAL RESEARCH

Deep Venous Thrombosis and Pulmonary Embolism are Uncommon in East Asian Patients after Total Hip Arthroplasty

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Received: 7 January 2011 / Accepted: 30 June 2011 / Published online: 12 July 2011

Abstract

Background In Western countries, deep vein thrombosis (DVT) and pulmonary embolism (PE), are relatively common after THA and many surgeons recommend routine pharmacologic thromboprophylaxis. There is some suggestion in the literature that the incidences of DVT and PE may be lower in East Asian patients. Therefore, it would be important to establish the incidences in a large number of East Asian patients who did not receive pharmacologic thromboprophylaxis.

Purpose We therefore determined the incidence of DVT and PE and evaluated the associated risk factors in a series of East Asian patients who underwent primary THA without pharmacologic prophylaxis.

Methods We retrospectively evaluated all 861 patients who underwent 992 elective primary THAs from May 2003 to December 2009. We identified patients with symptomatic DVT, symptomatic PE, and fatal PE. For potential risk factors we considered age, gender, body mass index (BMI), administration of aspirin, type of anesthesia, operation time, approach, simultaneous bilateral THAs, and duration of immobilization between symptomatic and asymptomatic patients.

Results We identified eight patients with symptomatic DVT, one of whom also had a symptomatic PE; there were no cases of fatal PE. The incidences of fatal PE, symptomatic PE, and symptomatic DVT were 0 %, 0.1 %, and 0.8 %, respectively. Longer duration of immobilization predicted symptomatic DVT or PE.

Conclusions East Asian patients have a low incidence of symptomatic DVT and PE and virtually no fatal PEs after primary THA. The incidences and risk factors should be taken into consideration when deciding whether to prophylactically treat these patients with pharmacologic agents.

Level of Evidence Level IV, prognostic study. See the Guidelines for Authors for a complete description of levels of evidence.

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was waived by the institutional review board of their hospital.
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Introduction

DVT is relatively common, and PE, although uncommon, is a serious and potentially life-threatening complication after THA. In Western countries, approximately 3% of

patients have symptomatic DVT or PE after THA without thromboprophylaxis [32, 33]. Moreover, the incidence of imaging-confirmed asymptomatic DVT and PE after THA without thromboprophylaxis reportedly ranges from 40% to 79% and from 7% to 30%, respectively [6, 8, 10, 20]. Owing to such high incidences in western countries, the American Academy of Orthopaedic Surgeons (AAOS) [11], the American College of Chest Physicians (ACCP) [10], and the National Institute for Health and Clinical Excellence (NICE) [12], recommended routine use of thromboprophylactic agents including aspirin, low-molecular-weight heparin, and warfarin for patients undergoing THA. However, these agents expose patients to an 1.5-fold to threefold increased risk of bleeding complications including substantial bleeding or hematomas at the operative site and fatal bleeding at a nonoperative site such as the intestine [4, 29].

For East Asian patients, the reported rates of imaging-confirmed asymptomatic DVT and PE after THA range from 10% to 16% and from 2% to 6%, respectively, and routine use of pharmacologic prophylaxis is controversial [13, 14, 36]. However, we are not aware of such a study on symptomatic DVT and PE after THA with East Asian patients, although the objectives of prophylaxis are to prevent fatal PE and reduce the symptomatic morbidity associated with PE and DVT [12]. To determine whether to use a thromboprophylactic agent, a study of symptomatic DVT and PE in a large number of patients not receiving any pharmacologic thromboprophylaxis is necessary.

We therefore determined the incidence of symptomatic DVT, PE, and fatal PE in East Asian patients and evaluated the risk factors associated with DVT and PE in patients undergoing primary cementless THA.

Patients and Methods

We retrospectively reviewed the medical records of all 869 patients who underwent 1025 elective primary THAs from May 2003 to December 2009. Eight patients were treated with heparin and warfarin for thromboprophylaxis and were excluded from the study: two patients (two hips) with a history of a thromboembolic event and six patients (six hips) with cardiac disease before surgery. This left 861 patients (1017 hips) for the study. Simultaneous bilateral THAs were performed in 25 patients, who were considered to have had one procedure. Therefore, the total number of procedures was 992 in 861 patients. Of the 861 patients, 65 (74 hips) took aspirin-containing compounds or other antiplatelet agents before surgery. Because their medications were discontinued 5 to 7 days before surgery, these patients were not excluded [7, 26]. There were 414 women and 447 men with a mean age of 51.1 years (range, 18–83 years) at the time of the operation. Their mean BMI was 24.2 kg/m^2 (range, 14.6–38.8 kg/m^2), and the most common diagnosis for THA was osteonecrosis of the femoral head (564 hips, 55.5 %) (Table 1). In 857 patients who survived longer than 6 months postoperatively, the mean followup was 42.8 months (range, 6–91 months).

Cementless fixation was used for the acetabular cup and femoral stem in all patients. Regional anesthesia was used in 876 procedures, and general anesthesia in 116 procedures. All procedures were performed with the patients in a lateral position. The posterolateral approach was used in 723 procedures, and the anterolateral approach was used in 269 procedures. In 93 procedures, wider exposure was necessary and the approach was extended to a triradiate approach, combined anterior and posterior approach, or transtrochanteric approach during the operation. The median operating time was 125 minutes (range, 50–535 minutes).

No pharmacologic or mechanical prophylaxis was used postoperatively in any of the 861 patients. However, thigh-length antiembolic stockings were applied and the patients were encouraged to use an ankle pump while in bed during the hospitalization. On postoperative Days 1 to 3, closed suction drainage was removed and patients were mobilized to a wheelchair. On postoperative Days 3 to 10, patients walked with restricted weightbearing and use of assistive devices (wheelchair, walker, crutches, or cane). As the walking ability improved, the assistive devices were changed as determined appropriate by a physical therapist. The mean length of hospital stay was 15.0 days (range, 6–28 days).

After the operation, we routinely monitored patients for clinical signs of DVT including pain and tenderness in the calf or thigh, swelling or erythema of the surgically treated limb, and a positive Homans' sign. We suspected DVT or PE in 32 patients and consulted the cardiovascular physicians. A diagnosis of DVT was confirmed by duplex ultrasonography or lower extremity CT angiography. A PE was confirmed by a ventilation/perfusion scan or pulmonary CT angiography. Patients who were diagnosed as having a DVT or PE were treated with warfarin. Patients were monitored for 1 to 3 weeks in the ward.

Most deaths attributable to PE related to surgery reportedly occur within 3 months and any death of

Table 1. Diagnoses

Diagnosis	Number of hips (N = 1017)
Femoral head osteonecrosis	564
Osteoarthritis	187
Sequelae of hip infection	87
Sequelae of Legg-Calve-Perthes disease	62
Miscellaneous condition	117

unknown cause that occurs within 3 months of surgery is considered to be the result of PE [5, 11, 33, 35]. We confirmed the fatal PE, if present, from the death certificate.

After discharge, patients were followed routinely at 6 weeks, 3 months, and 6 months postoperatively with specific attention given to the development of DVT or PE, although no patients were recalled specifically for this study.

Four patients died of causes unrelated to the operation within 6 months after surgery. Eight hundred thirty-eight patients visited the outpatient clinic for followups once or more after 6 months postoperative. Nineteen patients, who were unable to return, were visited or contacted by telephone by two nurses and one private locator.

We determined the incidence of symptomatic DVT, PE, and fatal PE. To determine confounding factors, univariate comparisons between the VTE group and the non-VTE group were made based on the demographic data and operative parameters, including age, gender, BMI, administration of aspirin, type of anesthesia, operation time, approach, simultaneous bilateral THAs, and duration of postoperative immobilization in bed. We used Fisher's exact test for categorized data and the Mann-Whitney U test for continuous data. For the variables with a p value less than 0.1 in the univariate analyses, multivariate logistic regression analyses using the enter method were performed. The independent variables tested for the multivariate logistic regression analyses included age, gender, anesthesia, and duration of immobilization, as confounding factors; the dependent variable was whether the DVT occurred postoperatively. From the multivariate regression analyses, it was assessed which variables were the risk factors for occurrence of DVT. Statistical analyses were conducted using SPSS for Windows statistical package (version 12.0; SPSS, Chicago, IL, USA).

The design and protocol of this study were approved by the institutional review board in our hospital, who waived informed consent.

Results

No patient had a fatal PE within 6 months after the operation. Symptomatic DVT occurred in eight patients and one of these eight had a symptomatic PE (Table 2). Incidences of fatal PE, symptomatic PE, and symptomatic DVT in our patients were 0%, 0.1%, and 0.8%, respectively. Seven of the eight patients were females and their mean age was 62.7 years. Symptomatic DVT developed 10 to 47 days after the operation (mean, 21 days). One of these patients had May-Thurner syndrome, a rare condition in which DVT occurs in the iliofemoral vein owing to compression of the left common iliac vein by the overlying right common iliac artery (Fig. 1) (Table 2) [18]. The eight patients

Table 2. Patients with DVT and PE after THA

Patient	Gender/ Age (years)	Diagnosis	Type of anesthesia	Approach	Operation time (minutes)	Interval between operation and DVT or PE	Location	Predisposing factors
1	F/71	Osteoarthritis	Spinal	PL	110	38 days	Bilateral DVT, PE	Delayed ambulation owing to pneumonia
2	M/69	Osteoarthritis	Spinal	PL	105	13 days	Bilateral DVT	Delayed ambulation owing to severe osteoarthritis of the knee
3	F/66	Osteoarthritis	Spinal	PL	100	25 days	Bilateral DVT	May-Thurner syndrome
4	F/59	Sequelae of infection	Spinal	Combined	160	16 days	Bilateral DVT	Delayed ambulation owing to tingling sensation associated with limb lengthening
5	F/62	Sequelae of LCP	Spinal	AL	123	10 days	Ipsilateral DVT	Delayed ambulation owing to sciatic and femoral nerve palsy
6	F/51	Sequelae of infection	General	AL	285	47 days	Ipsilateral DVT	Prolonged bed rest attributable to periprosthetic acetabular fracture and sciatic nerve palsy
7	F/69	Osteonecrosis	General	AL	127	22 days	Ipsilateral DVT	Prolonged bed rest attributable to periprosthetic femoral fracture
8	F/57	Osteoarthritis	General	AL	310	18 days	Unilateral DVT	Simultaneous bilateral THAs

PL = posterolateral approach; AL = anterolateral approach; DVT = deep vein thrombosis; PE = pulmonary embolism; LCP = Legg-Calve-Perthes disease; THA = total hip arthroplasty.

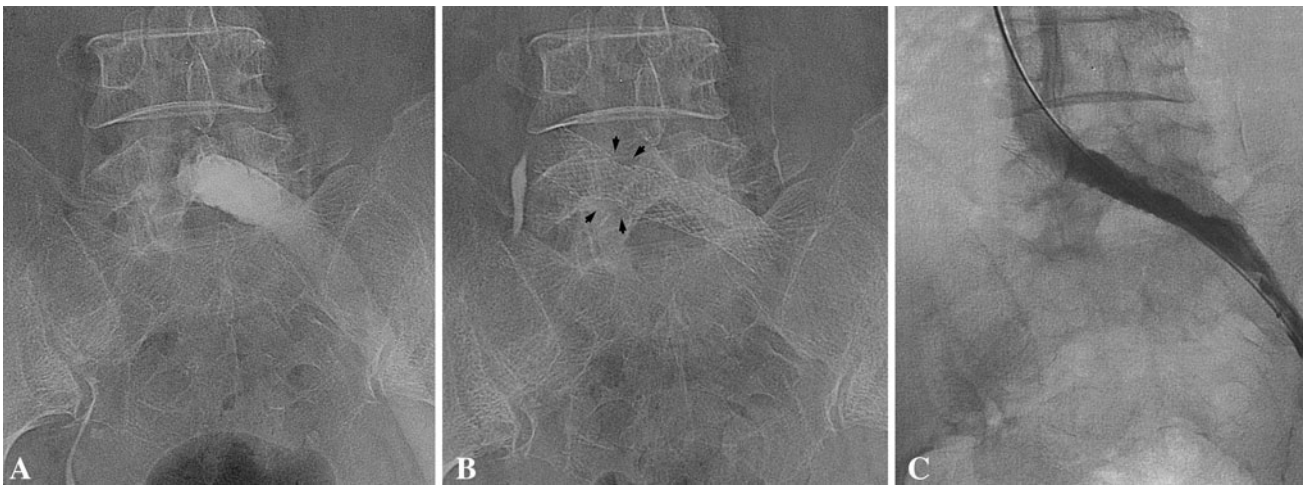

Fig. 1A–C (**A**) The left common iliac vein is occluded at the level of the overlying right common iliac artery. (**B**) After balloon angioplasty and stent insertion, the compressed portion of left common iliac is seen (black arrows). (**C**) The postangioplasty angiogram shows a patent left iliac vein

were treated with intravenous heparin followed by oral warfarin for 2 to 12 months.

In the univariate comparisons, age (p = 0.017), gender (p = 0.032), anesthesia (p = 0.056), and duration of immobilization (p = 0.016) had p values less than 0.1 (Table 3). However, the multivariate logistic regression analyses showed that only duration of immobilization was associated with the DVT (OR = 2.327; 95% CI, 1.030–5.262; p = 0.042). The value of R2 coefficient for this multivariate regression model was 0.352, suggesting that this multivariate model would explain the variation of the outcome variable to the extent of 35.2%.

After multivariate logistic regression analyses, longer duration of immobilization after THA was a risk factor.

Table 3. Potential risk factors for DVT and PE

Factor	DVT	Without DVT	p Value
Age (years)	62.7 ± 6.8	51.0 ± 14.8	0.017
Gender			0.032
Male	1	446	
Female	7	407	
BMI (kg/m^2)	25.8 ± 2.1	24.2 ± 3.4	0.1
Aspirin or antiplatelet medication			0.463
No	7	911	
Yes	1	73	
Anesthesia			0.056
Regional (spinal/epidural)	5	871	
General	3	113	
Operation time (minutes)	165.0 ± 84.1	138.7 ± 53.6	0.569
Approach			0.223
Posterolateral	4	719	
Anterolateral	4	265	
Simultaneous bilateral THAs	1	24	0.185
Unilateral THA	7	960	
Duration of postoperative immobilization (days)	16.9 ± 23.0	3.0 ± 1.0	0.016

DVT = deep vein thrombosis; BMI = body mass index; THA = total hip arthroplasty.

Discussion

Unlike in Western populations in whom the high incidence of DVT and PE require establishing guidelines for routine thromboprophylaxis after THA, baseline data were necessary before developing guidelines for East Asian patients undergoing THA. We questioned (1) the incidence of symptomatic DVT, PE, and fatal PE, in East Asian patients and (2) the risk factors associated with DVT and PE in patients undergoing primary cementless THA.

Our study has some limitations. First, our study was retrospective, not prospective. However, we recognized DVT as one of the most serious complications after THA, and being concerned about the incidence and risk factors of DVT, during the study period we routinely monitored our patients for clinical signs of DVT after surgery. In addition, the validity of medical records can influence reliability of a retrospective study. Because our institute has used a fully integrated electronic medical record system (EMR) since May 2003, there was little possibility of loss of the medical records. Second, we had a low number of patients with DVT or PE and no patients with a fatal PE, so we can draw few definitive conclusions regarding risk factors. Third, we did not perform confirmatory studies in asymptomatic patients and could not determine the incidence of asymptomatic

DVT or PE. However, considering the objectives of prophylaxis in DVT are to prevent fatal PE and to reduce the symptomatic morbidity associated with DVT, we believe studies of symptomatic DVT are most relevant. Further, imaging studies to confirm asymptomatic DVT are associated with procedure-related complications and high medical costs [1, 3], and routine use of these studies in asymptomatic East Asian patients is difficult to justify.

We found low incidences of fatal PE, symptomatic PE, and symptomatic DVT even without routine thromboprophylaxis after primary cementless THA. The incidences were much lower than those after THA in Western patients who received thromboprophylaxis [4, 23, 28]. In previous epidemiologic studies of Asian populations without thromboprophylaxis, the rate of DVT varied considerably, ranging from 1.0% to 64.3%, higher than our rate (Table 4) [2, 9, 16, 17, 25]. However, these studies have several limits. Most of them used data collected from various areas of Asia and included multiple ethnicities other than just East Asian patients. The majority of these studies included other procedures such as total knee arthroplasty and included a small number of patients having THA. The outcome variable included asymptomatic DVT. In the SMART study [16], which evaluated symptomatic DVT and PE in 2420 Asian patients undergoing orthopaedic surgery in 39 centers in 11 Asian countries, the rate of symptomatic DVT in 408 THAs was 1.0%, which was similar to our rate (Table 4). One explanation for the low incidences of fatal PE, symptomatic PE, and symptomatic DVT in our patients might be the low prothrombotic risk factors and absence of some genetic factors involved with DVT in East Asian patients [13, 15, 34]. Previous studies showed that several genetic polymorphisms are associated with lower incidences of DVT and PE in East Asian patients than in Western populations [13, 24, 27, 31]. Unlike Western populations who undergo THA mainly for primary osteoarthritis, the most common diagnosis of osteonecrosis, younger age with a mean of 51.1 years, and lower mean BMI of 24.2 (kg/m^2) might be reasons for the lower incidence.

Older age, female gender, obesity, underlying disease, type of anesthesia, simultaneous bilateral THAs, surgical approach, and prolonged immobilization in bed are known risk factors for DVT and PE in studies of patients from Western countries [2, 19, 21, 30]. After multivariate analysis in this study, prolonged immobilization was identified as a risk factor for DVT. The fact that the other factors studied did not predict DVT could be related to ethnic differences between our patients and Western patients or to relatively small numbers of patients with inadequate power to discern differences.

In Western countries, routine use of pharmacologic prophylaxis has been recommended to reduce the incidence of asymptomatic DVT, on the assumption it will reduce the incidence of symptomatic PE and the overall rate of mortality [22]. However, the objectives of prophylaxis are to prevent fatal PE and reduce the symptomatic morbidity associated with PE and DVT [12]. Furthermore, pharmacologic prophylaxis is associated with a potential risk of a bleeding complication at the operative or nonoperative site [4]. We found that East Asian patients who have undergone THAs have a low incidence of symptomatic DVT and PE, and prolonged immobilization was identified as a risk factor of DVT or PE.

Table 4. Published studies of the incidence of DVT and PE after THA

Study	Number of THAs	Number of DVTs (%)	Number of PEs (%)
Dhillon et al. [9]	14	9 (64.3)*	0
Leizorovicz et al. [17]	408	4 (1.0)	0 (0)
Piovella et al. [25]	121	31 (25.6)*	UI
Bagaria et al. [2]	23	2 (8.6)*	UI
Leizorovicz [16]	134	1 (0.7)/22 (16.4)*	0 (0)
Current study	992	8 (0.8)	1 (0.1)

* Including asymptomatic DVT; THA = total hip arthroplasty; DVT = deep vein thrombosis; PE = pulmonary embolism; UI = unidentified.

Acknowledgement We thank Chong Bum Chang MD for statistical advice.

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