

# The incidence of deep vein thrombosis after hip and knee arthroplasties in Japanese patients: A prospective study

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## ABSTRACT

**Purpose.** To document the incidence of proximal deep vein thrombosis and pulmonary embolism in 58 consecutive Japanese patients undergoing total hip arthroplasty or total knee arthroplasty.

**Methods.** Patients were routinely examined for proximal deep vein thrombosis by B-mode ultrasonography before and after surgery. Those patients who had ultrasonographic findings of deep vein thrombosis were also investigated for pulmonary embolism by ventilation-perfusion lung scan.

**Results.** The incidence of deep vein thrombosis after total hip arthroplasty and total knee arthroplasty were 9.1% and 4.0% respectively, and the incidence of pulmonary embolism were 3.0% and 0%, respectively. There were no cases of fatal pulmonary embolism.

**Conclusion.** The incidence of deep vein thrombosis and pulmonary embolism in Japanese patients may have increased over the last few decades.

**Key words:** deep vein thrombosis; hip replacement arthroplasty; knee replacement arthroplasty

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## INTRODUCTION

The reported incidence of deep vein thrombosis (DVT) in Europe and North America ranges from 12% to 23% following total hip arthroplasty (THA), and from 17% to 57% following total knee arthroplasty (TKA) when using an accepted form of prophylaxis,<sup>1-3</sup> and without prophylaxis ranges from 48% to 70% after THA, and from 58% to 84% after TKA.<sup>2-4</sup> As the incidence of subsequent fatal pulmonary embolism (PE) is high (1.7%–3.4%), some form of prophylaxis is commonly used after THA and TKA in those countries.<sup>3,5,6</sup> In contrast, as the incidence of post-operative DVT in Japan has always been considerably lower, there has not been a clear indication for prophylaxis. A report written in 1964 revealed that the incidence of DVT found in an autopsy study in Japan was 3.9%.<sup>7</sup> However, more recently the number of cases of DVT and PE reported in Japan has increased, and there have been some fatalities.

In order to clarify the incidence of DVT and PE in Japan, we prospectively studied consecutive patients before and after THA and TKA. B-mode ultrasonography was used for detecting major proximal thrombi, for which there was a risk of detachment from the venous wall, proximal migration and subsequent fatal PE.

**Table 1**  
Preoperative diagnosis of patients undergoing total hip arthroplasty or total knee arthroplasty (n=58)

Diagnosis	Total hip arthroplasty (n=33)	Total knee arthroplasty (n=25)
<b>Primary surgery</b>		
Osteoarthritis	21	5
Rheumatoid arthritis	0	14
Avascular necrosis	3	0
Bone tumour	0	2
Alkaptonuria	0	1
<b>Revision surgery</b>		
Osteoarthritis	5	0
Rheumatoid arthritis	2	1
Infection	1	1
Trauma	1	0
Bone tumour	0	1

## MATERIALS AND METHODS

Between October 1996 and May 1998, we performed THA for 33 patients and TKA for 25 patients at Mie University Hospital. All patients were included in this study. Preoperative diagnoses for primary and revision surgeries at each site are shown in Table 1. Postoperatively, the lower extremity involved was compressed by an elastic bandage as the only form of prophylaxis. No antiplatelet or anticoagulant medication were used. Patients were advised to move both ankle joints immediately after operation. After bed rest for 2 to 3 weeks, wheelchair use and partial weightbearing were allowed for 6 weeks. After 6 weeks, activities progressed towards full weight-bearing. If bone grafting had been performed, more prolonged support with crutches was advised.

Preoperatively, ultrasound scanning to detect deep vein thrombi was completed for all patients, and was repeated between day 8 and day 14 after surgery.

Contrast venography to confirm the diagnosis was performed in all patients in whom DVT was suspected. All patients with evidence of DVT had ventilation-perfusion scintigraphy to detect pulmonary emboli. Ultrasonography involved imaging from the common femoral vein to the popliteal veins by axial B-mode sensing, using a 7.5 MHz ultrasonography probe (EUB-165A; Hitachi Medical Corporation, Tokyo, Japan). Veins below the knee were not surveyed, because it was unlikely that these sites contained large thrombi that could cause pulmonary artery obstruction. DVT was diagnosed by decreased compressibility of veins during ultrasonography. Normal veins collapse when compressed by probing whereas veins containing thrombi do not. PE was diagnosed on identification of a discrepancy between the ventilation scintigram and the perfusion scintigram.

The frequency of DVT, PE, and fatal PE were calculated, and risk factors including age, sex, body mass index (BMI), and number of days of bed rest were compared between patients with and without evidence of DVT. Results were analysed using the Chi squared test or Student's *t* test, with  $p < 0.05$  considered statistically significant.

## RESULTS

None of the patients had DVT prior to surgery. Four patients had a postoperative DVT detected by ultrasonography, and confirmed by venography (Table 2). There was one case of non-fatal PE among these 4 cases. The incidence of DVT was 9.1% in patients following THA and 4.0% following TKA, while that of PE was 3.0% following THA and 0% following TKA. The incidence was 6.4% in patients undergoing primary surgery, and 9.1% in those having revision surgery. All cases with DVT were females. For the patients with DVT, age at surgery

**Table 2**  
Details of cases with DVT

Case No.	Age (years)	Sex	Joint	Diagnosis	Surgery	BMI* (kg/m <sup>2</sup> )	Bed rest (days)	Side	PE <sup>†</sup>	Fatal PE
1	66	F	Left knee	Infection	Revision	25	15	Right	Negative	Negative
2	54	F	Right hip	Osteoarthritis	Primary	21	21	Left	Negative	Negative
3	74	F	Right hip	Osteoarthritis	Primary	29	21	Left	Positive	Negative
4	75	F	Right hip	Osteoarthritis	Primary	24	42	Bilateral	Negative	Negative

\* BMI body mass index

† PE pulmonary embolism

**Table 3**  
**Comparison of clinical factors in DVT positive and DVT negative cases\***

	DVT positive (n=4)	DVT negative (n=54)	p value
Age (years)	67.3 ± 9.7	60.2 ± 13.7	0.185
Body mass index	24.7 ± 3.1	22.0 ± 3.9	0.221
Number of days of bed rest	24.5 ± 12.1	16.6 ± 9.7	0.116

\* Data reported as mean±standard deviation

was slightly older, BMI was slightly higher, and the number of days of bed rest was slightly longer, but none of these differences were shown to be statistically significant (Table 3).

## DISCUSSION

DVT and PE are major complications after hip and knee arthroplasties in Europe and North America. In Japan, there have been sporadic case reports of DVT in the past. Due to the presumed low incidence of DVT in Japan, there has been a low level of clinical suspicion and poor recognition of postoperative DVT and PE, and lack of systematic approach to diagnosis, treatment, or prevention. In order to investigate whether a different therapeutic paradigm should be considered, we assessed the frequency of DVT and PE in our group of surgical patients, and compared our findings with reports from Europe and the North America, where prophylactic regimens have been in use for at least 2 decades.

Although venography is generally accepted as the gold standard for the detection of DVT, it has many problems including the difficulty of repeat examinations, exposure to radiation, allergy to the contrast agent, and potential induction of DVT. In recent years, ultrasonography has been utilised widely throughout the world. While it is less effective in detecting DVT below the knee (these are not critical clinically), it has a number of advantages. These include effective detection of DVT above the knee, ease of examination at the bedside allowing repeat examinations, and the absence of radiation exposure and allergic response. In addition to higher sensitivity (88–100%) and specificity (96–100%) compared with venography,<sup>8–10</sup> ultrasonography also often conveys additional information about the size and other properties of the thrombus.

In this study, the incidences of postoperative proximal DVT after THA and TKA were 9.1% and 4.0% respectively. The incidences of postoperative proximal DVT after THA and TKA in the US have

been reported as 20% and 10–15% respectively<sup>2</sup> i.e. twice as high as seen in the current study. This suggests that the incidences of DVT and PE in Japan are still lower than that in Europe and North America. An autopsy study in Japan in 1964 indicated the incidence of DVT to be 3.9%.<sup>7</sup> Of note, at that time the number of days of bed rest, a risk factor for DVT, was much longer in Japan than in Europe and North America. Although postoperative rehabilitation is now more rapid than previously, our results suggest that the incidence of DVT may be increasing in Japan although the reason is not obvious. However, the Japanese lifestyle has become more westernised in the last 4 decades, and disease patterns have tended to become more similar to those seen in western countries simultaneously.

In standard medical textbooks on the topic, it is usually stated that the risk factors for DVT are surgery of the lower extremity, advanced age, female sex, obesity, and bed rest. Our study found that these factors did not differ significantly between those patients with DVT and those without, although patient numbers were small. Recently, Factor V Leiden (FV Leiden) has been postulated as a risk factor for thrombosis. The relative risk of thrombosis in patients with FV Leiden has been shown to be more than 10 times greater than for those with a deficiency of protein C, protein S, or antithrombin III.<sup>11</sup> FV Leiden was noted in 5.27% of Caucasians compared with only 0.45% of Asians in a study which screened 4047 people in the US.<sup>12</sup> The discrepancy in rates of thrombosis seen between different ethnic groups may be due to the differences in the frequencies of occurrence of FV Leiden. The previously mentioned comparison between the incidence of DVT found in autopsies in Japan of 3.9% compared to a reported incidence of 11.3% in the US,<sup>7</sup> supports the possibility of ethnic differences. Similarly, the incidence of postoperative DVT in Thai has been reported to be 1.7% compared to 12.0% in people living in the UK, in a study using the iodine-125 fibrinogen uptake test.<sup>13</sup> Cystic fibrosis is thought to be a gene abnormality pre-

dominantly of Caucasians,<sup>14</sup> and the same may be shown to be the case for FV Leiden.

## CONCLUSION

We determined the rates of proximal DVT after THA or TKA in Japanese patients using ultrasonography, and the rates of PE in the patients identified with DVT, using ventilation-perfusion lung scanning. The incidence of DVT was 9.1% following THA and

4.0% following TKA, while that of PE was 3.0% after THA and 0% after TKA. There were no cases of fatal PE observed in this study. Although the incidence of DVT and PE in these patients was lower than that reported in Europe and North America, the rate appears to have increased over the last 4 decades. This suggests that we need to consider the possibility of DVT and PE following THA and TKA surgeries in Japan, and therefore carefully examine patients postsurgery for DVT and PE.

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