

Use of Low Molecular Weight Heparin for Prevention of Deep Vein Thrombosis in Total Knee Arthroplasty—A Study of its Efficacy in an Asian Population

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Abstract

Introduction: The aims of this paper were to study the incidence of deep vein thrombosis following total knee replacement in an Asian population and to evaluate the role of low molecular weight heparin for deep vein thrombosis in this setting. **Materials and Methods:** We prospectively studied two groups of 100 consecutive patients undergoing total knee replacement separately. Group 1 did not receive any low molecular weight heparin and group 2 received low molecular heparin, nadroparin calcium (Fraxiparine™) according to body weight. The sex distribution, age group, weight, preoperative knee and function scores, and postoperative rehabilitation were similar for both groups. A single ultrasound technician performed ultrasound duplex scan of both lower limbs on the seventh postoperative day. **Results:** The incidence of deep vein thrombosis in group 1 was 14% (14 patients, 5 proximal vein thromboses and 9 distal vein thromboses) while in group 2, no patients developed deep vein thrombosis. There was no increased incidence, either local or systemic, of major bleeding complications with the use of low molecular weight heparin. **Conclusion:** While the incidence of deep vein thrombosis following total knee replacement in an Asian population appears lower compared to Western populations, the use of low molecular weight heparin for thromboprophylaxis appears to further reduce the incidence without major bleeding complications.

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Key words: Asian population, Bleeding, Deep vein thrombosis, Prophylaxis, Ultrasound duplex scan

Introduction

The role of thromboprophylaxis in total knee replacement (TKR) remains controversial. In several reports,¹⁻⁷ the incidence of deep vein thrombosis (DVT) has been significant. Pharmacological prophylaxis, particularly warfarin, has been used to reduce this high incidence of DVT and the more serious complication of pulmonary embolism (PE). However, its efficacy is offset by the added cost of medications and laboratory monitoring as well as bleeding complications. More recently, the introduction of low molecular weight heparin (LMWH) has revived some interest in the role of thromboprophylaxis in TKR.

We performed a prospective study to determine the incidence of DVT following TKR in Asian patients and to evaluate the efficacy and role of LMWH in DVT prophylaxis in TKR.

Patients and Methods

In this prospective study, two groups of 100 consecutive

patients each who underwent elective TKR were studied separately from 1996 to 1997. Group 1 was studied first followed by group 2. The age, weight and preoperative knee and function scores based on the Knee Society Clinical System of all patients were evaluated.

All patients with a history of gastric ulceration, bleeding disorders, thromboembolic disease, recent cerebral vascular accidents and non-ambulation were excluded. The patients were admitted one day before surgery. Relevant preoperative investigations were carried out, including blood haemoglobin level. Elective TKR was performed the following morning. All the operations were done by several experienced surgeons from our institution who regularly perform these procedures using a similar standard surgical technique which included insertion of drains in all cases.

The postoperative management of all patients followed a standard protocol, which includes a blood haemoglobin level on the first postoperative day, commencement of continuous passive motion on the second day and

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ambulation by the fourth day. Routine ultrasound duplex scans of both lower limbs were done on the seventh postoperative day. A duplex scan was also done if there was clinical suspicion of DVT or PE. The same vascular technician performed all scans.

The first group of 100 patients (group 1) did not receive any pharmacological thromboprophylaxis. In the second group of 100 patients (group 2), subcutaneous LMWH, nadroparin calcium ^{*}(FraxiparineTM) was administered according to body weight for thromboprophylaxis. The first dose was given 12 hours preoperatively. After surgery the standard dose was administered once a day till the seventh postoperative day when an ultrasound duplex scan was done. The patients were assessed clinically on a daily basis for pain, swelling, bruising and haematoma of the operated limb. Any other complications were also noted, particularly signs of deep infection. Total postoperative drainage, range of motion of the operated knee, time to ambulation and duration of hospital stay were also noted.

** Statistical analysis was performed using a paired 2-tailed Student's t-test to compare the 2 groups.*

Results

The patient characteristics such as age, weight, male to female ratio, knee scores and operating time were similarly matched for both groups (Table I).

In group 1, 14 patients developed asymptomatic DVT, which was detected on the duplex scan. In all, there were 5 patients with proximal vein thrombosis and 9 with distal vein thrombosis (Table II). One patient developed suspected

PE as shown by the ventilation perfusion scan on the fifth postoperative day. However, ultrasound duplex scan did not reveal any vein thrombosis.

In group 2, no cases of DVT, proximal or distal were detected (Table II). This difference was statistically significant ($P = 5.5 \times 10^{-5}$). No cases of PE occurred in this group.

No major bleeding complications such as gastrointestinal bleeding, haematoma or intracranial bleeding occurred in either group. More cases of bruising and wound haematoma were noted in group 2 but the difference was not statistically significant and none required intervention or cessation of thromboprophylaxis. No significant haemarthrosis occurred in either group. There was no significant difference in postoperative haemoglobin levels or drainage when comparing both groups (Table III).

Postoperative recovery was similar in both groups. The time to ambulation was shorter in group 2 but there was no significant difference in range of motion and hospital stay between the groups. One patient who did not receive thromboprophylaxis developed a deep infection three weeks after recovery. No major medical complications occurred in either group of patients (Table IV).

Discussion

The incidence of thromboembolic disease following TKR is reported to be between 40% and 84%.¹⁻⁷ As a result, pharmacological thromboprophylaxis is often routinely used. It has traditionally been believed that thromboembolic disease is less common in Asian population. This is possibly

TABLE I: PATIENT CHARACTERISTICS IN THE TWO GROUPS

	Group 1 (n = 100)	Group 2 (n = 100)	P value of difference
Mean age (range 48 to 85 y)	65.2	66.5	0.17
Mean weight (range 38 to 95 kg)	62.1	64.4	0.16
Female:Male ratio	6.1:1	4.9:1	0.39
Unilateral:Bilateral ratio	10.1:1	13.3:1	0.48
Knee score (range 10 to 90)	62.9	59.1	0.11
Function score (range 0 to 90)	47.0	42.7	0.12
Operating time (range 45 to 205 min)	95.7	90.6	0.11

TABLE II: INCIDENCE OF DEEP VEIN THROMBOSIS (DVT) IN BOTH GROUPS

	Group 1 (n = 100)	Group 2 (n = 100)
Proximal DVT	5	0
Distal DVT	9	0
Total	14	0

TABLE III: BLEEDING COMPLICATIONS IN BOTH GROUPS

	Group 1 (n = 100)	Group 2 (n = 100)	P value of difference
Major bleeding	0	0	—
Wound haematoma/bruises	8	10	0.46
Volume of postoperative drain (ml)	473	392	0.07
Mean drop in haemoglobin postoperatively (g/dL)	2.85	2.86	0.94

TABLE IV: OTHER RESULTS OF BOTH GROUPS

	Group 1 (n = 100)	Group 2 (n = 100)	P value of difference
Range of motion of knee (degree)	74.4	76.5	0.15
Time to ambulation (days)	5.5	4.4	0.6
Hospital stay (days)	14.6	14.1	0.78
Deep infection	1	0	—
Other complications	0	0	—

due to a slower and smaller rise in anti-thrombin III level in Chinese compared to Caucasians.⁸ Several relevant studies on DVT incidence following limb surgery in Asian patients report an incidence that is variable, from 4% to 62.5%.⁹⁻¹² A recent study suggests that the incidence in this population may be higher than previously found.¹² To our knowledge, no other study has been published on the incidence of DVT and PE in an Asian population after TKR. LMWH are fragments of commercial heparin produced either by chemical or enzymatic depolymerisation. Depolymerisation causes it to inhibit factor Xa more than thrombin. It also binds less to plasma and matrix proteins, thus having greater bioavailability and more predictable anticoagulant response. Patients do not need repeated laboratory monitoring and the dose can be administered once a day. Results from Lerclerc et al,¹³ Colwell et al¹⁴ and the RD Arthroplasty Group¹⁵ have found LMWH to be effective in reducing the incidence of DVT in TKR. One concern with the use of LMWH has been the potential for bleeding complications. Our results revealed a DVT incidence of 14% in 100 consecutive patients who had TKR. This incidence was reduced to 0% with LMWH prophylaxis. Although some increased bruising was noted, no major bleeding complications occurred.

Though this is not a randomised study, the two groups were compatible in terms of demographic characteristics and the operations were performed by the same group of experienced surgeons with similar operating technique and time. Group 1 thus served as a useful historical control in this study.

Conclusion

Although the incidence of DVT in Asian patients following TKR is relatively low, the use of LMWH prophylactically can further reduce this incidence. A significantly larger, randomised study in the form of a multicentre trial will be required to assess its effectiveness in preventing PE.

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