The Role of the Use of Low Molecular Weight Heparin in the Prevention of Deep Venous Thrombosis after Total Knee Arthroplasty

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Abstract

Background A prospective clinical study was performed to compare the efficacy of the use of low-molecular-weight heparin group (enoxparin group) with control group in the prevention of deep-vein thrombosis after total knee arthroplasty.

Aim of the study: to assess the prevalence of DVT after total knee arthroplasty and evaluate the importance of the use of low molecular weight heparin in the prevention of this DVT.

Methods Thirty-three patients undergoing total knee arthroplasty were randomly divided into two groups. One group consisted of 12 patients who received no prophylaxis with an anticoagulant (the control group), other group consisted of 21 patients who received the low-molecular-weight heparin enoxparin (enoxparin group) 4000 I.U. S.C 6 hours after surgery for two weeks after the operation then aspirin 100 mg until 6th week after operation. Bilateral duplex ultrasonography was performed preoperatively and at (5-7) days postoperatively.

Results The prevalence of deep-vein thrombosis was 58% in the control group, 38% in the enoxparin group.

Conclusions Enoxaparin significantly lowered the prevalence of deep-vein thrombosis after total knee arthroplasty.

Keywords: (Deep-vein thrombosis, Enoxaparin, pulmonary embolism**)**

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Introduction

Several recent studies have demonstrated that the prevalence of deep-vein thrombosis after total knee arthroplasty in the eastern population is similar to that in the Western population [1, 2]. However, the locations of the thromboses in the patients have differed, with a predominance of distal clots (in the calf) and very few proximal clots (in the thigh or pelvis) or pulmonary emboli [2]. Therefore, the risks of deep-vein thrombosis after total knee arthroplasty have not been fully appreciated and the importance of prophylaxis against this complication has not been emphasized. In contrast to the situation in Western countries, where routine prophylaxis against deep-vein thrombosis is standard practice after total joint replacement [3,5], pharmaceutical prophylaxis against deep-vein thrombosis is not routine in most hospitals in the East [6,8]. Therefore, prophylactic strategies after major orthopaedic procedures remain controversial in the East [4, 7, and 10].

Low-molecular-weight heparin is the most commonly used pharmaceutical agent for prophylaxis against deep-vein thrombosis in North America and Europe [11]. However; its efficacy in our population has not been established, to our knowledge [9]. The purpose of this prospective clinical study was to compare the efficacy of a low-molecular-weight heparin group (enoxparin group) and that of control group for the prevention of deep-vein thrombosis after total knee arthroplasty.

DVT is also one of the most prevalent medical problems today, with an annual incidence of 117 cases per 100,000. Each year in the United States, more than 200,000 people develop venous thrombosis.

Methods

All patients provided informed consent to participate in it. The exclusion criteria included:

1. Recent thromboembolic disease (previous history of deep venous thrombosis).
2. History of a coagulopathy including thrombocytopenia.
3. A technical failure in the performance of duplex ultrasonography.
4. Bilateral total knee arthroplasty.

The period of the study extended from August 2008 to August 2009, 33 patients (11 women and 22 men) scheduled to undergo total knee replacement were recruited in the nursing home

hospital. The age of the patients range from (32-72 years), the body weight range from 65 to 120 kg, and the body height range from 139 to 179 cm. 16 of the total knee arthroplasties were performed on the right side and 17 on the left side.

Patients were randomly divided into two groups according to the admission schedules. One group consisted of 12 patients who received no prophylaxis with an anticoagulant (the control group), other group consisted of 21 patients who received enoxparin (the enoxparin group). The dosage of enoxparin was 4000 IU and was given subcutaneously once daily dose 6 hours after the surgery for 2 weeks after the operation.

Bilateral duplex ultrasonography was performed within one week preoperatively and (5-7days) postoperatively for both lower limbs.

Results

The prevalence and location of the deep-vein thromboses are summarized in table (1) .The prevalence of deep-vein thrombosis was 58% (seven of twelve) in the control group, 38% (eight of twenty one) in the enoxparin group.

Table (1): Prevalence and Location of Deep-Vein Thrombosis Seen on duplex ultrasonography at (5-7Days) postoperatively.

No. of Patients	Deep-vein thrombosis	No. (%) of the Patients	Location of deep-vein thrombosis				Symptomatic deep-vein thrombosis
			Calf vein	Popliteal vein	Femoral vein	Iliac vein	No. (%) of all thrombosis
Control	12	7 (58%)	7	0	0	0	3 (42.8%)
Enoxparin	21	8 (38%)	7	1	0	0	1 (12.5%)
Total	33	15 (45.4%)	14 (93.3%)	1 (6.7%)	0	0	4 (26.6%)

The total number of mail patients with DVT was 9 out of 21 (42.85%); in the age group (30-50 years) one patient (20%) from 5 patients in this age group develop DVT, while in the age group more than (50 years) 8 male patients (50%) from 16 patients in this age group develop DVT.

In the age group (30-50 years) 3 patients develop DVT, one in the control group (33%), and 2 in the enoxparin group (66%).

In the age group more than (50 years) 12 patients develop DVT, 6 in the control group (50%), and 6 in the enoxparin group (50%).

In the female group 6 patients had DVT, 3 in the control group (50%), and 3 in the enoxparin group (50%), while in the male group, 9 patients had DVT, 4 in the control group (44%) and 5 in the enoxparin group (56%).

There is significant correlation between increasing age and the incidence of DVT.

Table (2): Age and gender distribution of patients and incidence of DVT by ultrasonography in the first week postoperatively.

Age	Total no. of female and % to total No. of patient	No. of female patients with DVT and % to age group	Total no. of male and % to total no. of patient	No. of male patients with DVT, % to age group	No. of patient in both sex and % to total no	No. of DVT patient in both sex and %to age group
30-50	6 (18.18%)	2 (33%)	5 (15.15%)	1 (20%)	11 (33%)	3 (27.27%)
>50	6 (18.18%)	4 (67%)	16 (48.48 %)	8 (50%)	22 (67%)	12 (54.54%)
Total	12(36.36%)	6 (50%)	21 (63.63%)	9 (42.85%)	33	15
% of DVT in relation to total no.		(18.18%)		(27.27%)		(45.45%)

Six patients (18%) out of thirty-three patients in our study are normal BMI value is 20-25) and 1 patient (16.6%) of them developed DVT. One patient in the control group. 12 patients (36%) out of thirty -three patients in our study are over weight (BMI value is 25-27) and 5 patients (41.66%) of them developed DVT. Two patients of control group (40%) (Two of seven) and three patients in enoxparin group (60%) (Three of eight) Fifteen patients (45.5%) out of thirty-three patients in our study are

Obese (BMI value is above 27) and 9 of them (60%) developed DVT. Four patients of the control group (44%) (Four of seven) and 5 patients in enoxparin group (56%) (Five of eight)

Table (3): Weight of patients and incidence of DVT by duplex study in the 1st week post operatively.

	Total no. of patients sample and % to all patients.	No. of patient with DVT from sample	% of DVT patients in relation to weight group
Normal	6 (18%)	1	(16.6%)
Over weight	12 (36%)	6	(50%)
Obese	15 (45.5%)	9	(60%)

Twenty two patients (66%) had procedure that lasted less than 2 hours and 8 (36%) of those patients developed DVT. Four patients of the control group (50%) and four patients of the enoxparin group (50%)

Eleven patients had procedure lasted more than two hours 7 (63.63%) of them developed DVT. Three patients of the control group (43%) and four patients of the enoxparin group (57%).

Table (4): Duration of operation and incidence of DVT by duplex ultrasonography in 1st week post operatively.

Duration of the operation	Total no. of patients sample	No. Of patients with DVT from sample	% of DVT patients in relation to total no. of sample
<2 HOURS.	22	8	36%
>2 HOURS	11	7	63.63%
Total	33	15	45.4%

The period of hospitalization was more than one week in 10 patients while in 23 patients it was less than one week.

Six patients (60%) of 10 patients who hospitalized more than week developed DVT, 3 patients in the control group (50%) and 3 patients in the enoxparin group (50%), while 9 patients (39%) of 23 patients who hospitalized less than week developed DVT,4 patients in the control group(44.5%) and 5 patients in the enoxparin group(55.5%).

Table (5): Duration of hospitalization and incidence of DVT by duplex study in 1st week postoperatively

Duration of the hospitalization	Total no. of patients sample	No. Of patients with DVT from sample	% of DVT patients in relation to total no. of sample
<week	23	9	(39%)
> week	10	6	(60%)

Sixteen patients (48.48%) of those with total knee replacement had leg swelling and 11 patients (68.75%) of those 16 patients had DVT, while 17 patients (51.51%) of the patients did not have unilateral leg swelling and 4 of them (32.5%) had DVT.

Patients had DVT with positive unilateral leg swelling 5(45.45%) in the control group and 6(54.54%) in the enoxparin group. Patients had DVT with negative unilateral leg swelling 2(50%) in the control group and 2 (50%) in the enoxparin group. 19 patients (57.57%) of those with total knee replacement had calf pain and 14 patients (73.68%) of them had DVT, while 14 patients (42.42%) did not have calf pain and one patient (7.14 %) had DVT. Patients had DVT with positive calf pain 6 in the control group (42.85%) and 8 in the enoxparin group (57.14%).

Patients had DVT with negative calf pain 1 in the control group.

14 patients (42.42%) of those 33 patients with total knee replacement had calf tenderness, 10 patients (71.42%) of them had DVT, while 19 patients (57.58%) of those with total knee replacement did not have calf tenderness and 5 patients (26.31%) of them had DVT. Patients had DVT with calf tenderness 4 in the control group and 6 in the enoxparin group. Patients had DVT with negative calf tenderness 3 in the control group and 2 in the enoxparin group.

Table (6): Some clinical presentation of DVT and incidence of DVT by duplex study 1st week postoperatively

	+ve sign		-ve sign	
Clinical presentation	**No. of patients**	**No. of patients with DVT**	**No. of patients**	**No. of patients with DVT**
Unilateral. Leg swelling	16	11 (68.75%)	17	4 (32.5%)
Calf pain	19	14 (73.68%)	14	1 (7.14%)
Calf tenderness	14	10 (71.42%)	19	5 (26.31%)
Homon's sign	8	7 (87.5%)	25	8 (32%)
Warm limb + erythema	17	8 (47%)	16	7 (43.75%)

Discussion

• Deep vein thrombosis represents one of the most commonly occurring and serious medical condition following hospitalization for serious illness or major surgery.

• In this study of thromboprophylaxis after total knee arthroplasty, we found that enoxparin was more effective in preventing venous thrombosis and there were no pulmonary emboli or deaths in this study**,** we found that incidence of DVT in patient with enoxparin was 38% while in patient not take enoxparin the incidence increased to 58% in the 1st week postoperatively.

• This study shows that the incidence of DVT is increased in both male and female with increasing age, as it is about 2 times more in those older than 50 years than those younger than 50 years. It shows that there is significant correlation between age and incidence of DVT. We found that age more than 50 to age less than 50 ratios are 2:1. From about the age of 40 the risk increases significantly, it's much higher in people over 60 and over70. This higher risk may be because older people are likely to have other risk factors for thrombosis (e.g. restricted movement or cancer) and are more likely to require an operation. In this study the incidence of DVT increased in both age group in the control group and decreased in the enoxparin group so our result goes with other results done by Johnson BF, Manzo RA that found that the incidence of DVT decrease in enoxparin group in 120 patients with different age group with total knee replacement due to osteoarthritis and rheumatoid arthritis [(12)].

• Obesity increases risk of DVT because obesity may be associated with longer periods of immobility post operatively than non obese patients and the longer duration of operation in obese patients [(4,13)]. Our study agreed with this conclusion where the incidence of post operative DVT increase with increasing weight, in this study we found that the incidence of DVT decrease in the enoxparin group with normal weight and overweight and obese patients while increase in control group.

• Most DVT occur in patients with long duration operative procedure [(14)]. In our study the incidence is about 1.7 times more in patients

with surgical procedure lasted more than 120 minutes than those patients with surgical procedure lasted less than 120 minutes, our study show that incidence of DVT increase in the control group patients with operation less than 120 minutes while there is no significant difference between enoxparin and control groups patients with operation more than 120 minutes.

• In our study the incidence DVT in the group who had duration of hospitalization more than one week was (60%), whereas the incidence of DVT in patients whose hospitalization time less than one week was (39%), we found that the incidence of DVT decrease in the enoxparin group in patients with less than 1 week and more than 1 week hospitalization, so it agree with result of Hansson Po, Sorbo J, Eriksson H, that show that incidence of DVT decrease in the enoxparin group of 85 patients with hospitalization of less and more than 1 week [(15)].

• Most DVT occurred in the operated limbs, 12 of 15 DVT patients and 3 patients in the contralateral legs.

• Most DVT occurred in the calf veins and one DVT in the popliteal vein, no femoral and iliac veins involvement and no case of pulmonary embolism.

• Our study shows that unilateral leg swelling, calf pain, calf tenderness, Homon's sign are useful in diagnosis DVT in patients with total knee replacement, although absence of these symptoms and signs not exclude DVT.

Conclusions

• Enoxparin (low molecular weight heparin) is effective in prevention of DVT after total knee arthroplasty.

• Incidence of DVT increases with age in both male and female and no sex prevalence exists, DVT increases in obese patients, those with more than a week of hospitalization and Procedure lasted more than 120 minutes.

• The bed side diagnosis of venous thrombosis is insensitive and inaccurate
and absence of these symptoms and signs doesn't exclude DVT in patients
with total knee replacement.

Recommendations

• Patients with total knee replacement considered high risk patient for developing DVT.

• Use of low molecular weight heparin (enoxparin) 6 hours postoperatively subcutaneously for two weeks from the time of operation.

• Early ambulation after total knee replacements whenever possible.

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