

Clinical Significance of Muscular Deep-vein Thrombosis after Total Knee Arthroplasty

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Background: The definition of gastrocnemius and soleus deep-vein thrombosis (DVT) remains controversial. The purpose of this study was to evaluate the clinical significance of muscular deep-vein thrombosis after total knee arthroplasty (TKA).

Methods: This study consisted of 359 consecutive patients undergoing TKA evaluated for DVT by ascending venography. Venographies were performed 5 to 7 days after surgery. Those patients showing positive DVT underwent a follow-up venographic study at 3 months. The evaluation parameters included clinical symptoms, late DVT, thrombus propagation and pulmonary embolism. The data from patients with isolated muscular DVT were compared statistically with those patients with DVT of the leg veins and combined DVT.

Results: Of 359 patients, 175 (49%) developed venographic DVT including 160 with distal and 15 with proximal DVT. Of the 160 cases with distal DVT, 83 (52%) involved the gastrocnemius and soleus muscular veins. Of these 83 cases, 38 (46%) were isolated muscular DVT and 45 (54%) involved muscular branches and major leg veins including the anterior and posterior tibial and peroneal veins. Patients with isolated muscular DVT showed comparable rates of clinical symptoms, late DVT, thrombus propagation and no pulmonary embolism compared with patients with DVT in the major leg veins ($p = 0.874, 0.398$ and 1.000) and patients with combined DVT ($p = 0.155, 0.592$ and 1.000).

Conclusion: The clinical significance of isolated muscular DVT is comparable to that of the major leg veins and combined DVT. Muscular DVT in the calf is considered a significant clinical entity and should be treated accordingly.
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Key words: muscular DVT, clinical significance and TKA.

In contrast to Western countries where routine prophylaxis for deep-vein thrombosis (DVT) is considered standard patient care after total joint replace-

ment,⁽¹⁻³⁾ in most Asian hospitals, the risks of DVT after total knee arthroplasty (TKA) are not fully appreciated, and the importance of DVT prophylaxis

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has not been seriously emphasized, so pharmaceutical prophylaxis against DVT is not routinely used.^(4,5) The incidence of DVT after TKA was believed to be low in the Asian population. However, several recent studies using ascending venography reported that the incidence of DVT after TKA in Asian patients was similar to that in the Western population.^(5,6) However, the locations of DVT differed, with a predominance of distal DVT in the calf, few cases of proximal DVT in the thigh and pelvis, and no pulmonary embolism.⁽⁵⁾

The significance of DVT in the calf remains controversial and the debate on the need for routine prophylaxis continues.⁽⁷⁻¹⁵⁾ Approximately half of the reported cases of calf DVT involved the muscular branches in the gastrocnemius and soleus muscles.^(5,16-22) Muscular DVT has received very little attention and there is no consensus of opinion on its clinical significance. In Western reports, some authors regarded muscular DVT as a clinically significant entity with the potential risks of thrombus propagation and pulmonary embolism,^(19,21-23) whereas others considered it a benign finding with spontaneous remodeling and lysis.^(17,18) The purpose of this study was to evaluate the clinical significance of muscular DVT after TKA.

METHODS

Between July 1998 and June 2002, 359 consecutive patients undergoing TKA were included in this study. There were 228 women and 131 men with an average age of 66.6 years (range 55 to 82). The right knee was affected in 183 cases and the left knee in 176. Patients were randomly assigned to receive either DVT prophylaxis or no prophylaxis according to the treating surgeons. Overall, 239 patients received no prophylaxis, and 120 patients received low molecular weight heparin for DVT prophylaxis.

Ascending venography was performed 5 to 7 days after surgery. Patients with positive DVT findings in the initial venography underwent a follow-up venographic study at 3 months. The development of late DVT and the propagation of thrombus were investigated based on the results of the follow-up venographic studies. Two radiologists who were blinded to the nature of the study interpreted the venographic studies.

Clinical symptoms of DVT included pain and

swelling in the leg, calf tenderness, skin discoloration, venous engorgement, calf and thigh girth enlargement, positive Homans' sign and temperature elevation. Similar symptoms were also observed after surgery in some patients, however, the predominant symptoms from surgery were around the knee rather than in the leg. Symptomatic DVT was defined when patients with a positive venographic DVT developed symptoms that required treatment. Symptoms were clinically graded as mild, moderate or severe according to the intensity of the pain and the degree of swelling. The intensity of pain was based on a visual analogue scale from 0 to 10 with 0 for no pain and 10 for severe pain. The degree of swelling was based on thigh and calf girth measurements. In patients with chest symptoms such as chest pain, tight sensation or difficulty breathing, additional studies including chest radiograph, electrocardiogram, arterial blood gases and perfusion lung scan were performed to exclude pulmonary embolism.

The evaluation parameters included the occurrence of clinical symptoms, the development of late DVT, the propagation of thrombus and the incidence of pulmonary embolism. The results from patients with isolated muscular DVT were compared statistically with those patients with DVT in the major leg veins and patients with combined DVT using a chi square test with statistical significance at $p < 0.05$.

RESULTS

Deep-vein thrombosis was diagnosed in 175 of 359 patients resulting in a 49% incidence of DVT. There were 160 (91%) cases of distal DVT in the calf, 15 (9%) cases of proximal DVT in the popliteal and femoral veins, and no cases in the iliac vein. There were no cases of pulmonary embolism. Distal DVT involved the muscular branches in 83 cases (52%) and the major leg veins in 77 cases (48%). Of the 83 patients with DVT involving the muscular branches, 38 (46%) had isolated muscular DVT, and 45 (54%) had combined DVT including the muscular branches and the major leg veins.

The incidence of DVT was 51% (122 of 239) in patients receiving no prophylaxis and 44% (53 of 120) in patients with DVT prophylaxis ($p < 0.01$). Ninety percent (110 of 122) of patients who did not receive prophylaxis had distal DVT and 10% (12 of 122) had proximal DVT. Of patients who received

prophylaxis, 94% (50 of 53) had distal and 6% (3 of 53) had proximal DVT. Fifty of 160 patients with distal DVT received DVT prophylaxis with low molecular weight heparin, while the remaining 110 patients received no prophylaxis.

A comparison between patients with muscular DVT and DVT in the major leg veins is shown in Table 1. No statistically significant differences were noted in the occurrence of clinical symptoms ($p = 0.874$), the development of late DVT ($p = 0.398$) or thrombus propagation ($p = 1.000$) between the two groups. No pulmonary embolism was noted in either group. Therefore, patients with muscular DVT showed clinical manifestations comparable to those in patients with DVT in the major leg veins.

A comparison between patients with isolated muscular DVT and combined DVT is shown in Table 2. No statistically significant differences were noted in the occurrence of clinical symptoms ($p = 0.155$), the development of late DVT ($p = 0.592$) or

thrombus propagation ($p = 1.000$) between the two groups. No pulmonary embolism was noted in either group. Only one patient with isolated muscular DVT showed propagation of the thrombus from the muscular branch into the peroneal vein. Therefore, patients with isolated muscular DVT showed clinical manifestations comparable to those in patients with combined DVT.

The results of DVT prophylaxis with low molecular weight heparin in the patients with DVT are summarized in Table 3. Prophylaxis significantly lowered the overall incidence of DVT in all three groups of patients ($p < 0.01$). The effects were similar in patients with isolated muscular, major leg vein, and combined DVT. Low molecular weight heparin significantly decreased the occurrence of clinical symptoms. However, the effects on late DVT and thrombus propagation were less prevailing due to the small case numbers. No pulmonary embolism was noted in this series.

Table 1. Comparison between Patients with Muscular DVT and DVT in the Major Leg Veins

	Clinical symptoms	Late DVT	DVT propagation	Pul. embolism
Muscular DVT (N = 83)	42 (51%)	4 (4.8%)	1 (1.2%)	0
Major vein DVT (N = 77)	38 (49%)	3 (3.9%)	0	0
<i>p</i> value	0.874	0.398	1.000	N/A

Abbreviations: DVT: deep vein thrombosis; Pul. embolism: Pulmonary embolism; *p* values: Chi Square test.

Table 2. Comparison between Patients with Isolated Muscular DVT and Combined DVT

	Clinical symptoms	Late DVT	DVT propagation	Pul. embolism
Isolated DVT (N = 38)	16 (42%)	2 (5.3%)	1 (2.6%)	0
Combined DVT (N = 45)	26 (58%)	2 (4.5%)	0	0
<i>p</i> value	0.155	0.592	1.000	N/A

Abbreviations: DVT: deep vein thrombosis; Pul. embolism: pulmonary embolism; *p* values: Chi Square test.

Table 3. The Effects of Low Molecular Weight Heparin Prophylaxis in Patients with Muscular, Combined, and Major Leg Vein DVT

	Clinical symptoms	Late DVT	DVT propagation	Pul. embolism
Muscular DVT (N = 38)				
With prophylaxis (N = 16)	3 (19%)	0	0	0
Without prophylaxis (N = 22)	13 (59%)	1	1	0
<i>p</i> value	0.013	1.000	1.000	N/A
Combined DVT (N = 45)				
With prophylaxis (N = 16)	4 (25%)	1	0	0
Without prophylaxis (N = 29)	18 (62%)	1	0	0
<i>p</i> value	0.017	1.000	N/A	N/A
Major vein DVT (N = 77)				
With prophylaxis (N = 28)	7 (25%)	0	1	0
Without prophylaxis (N = 49)	31 (63%)	3	0	0
<i>p</i> value	0.001	0.475	1.000	N/A

Abbreviations: DVT: deep vein thrombosis; Pul. embolism: pulmonary embolism; *p* values: Chi Square test.

DISCUSSION

In Asian patients, most DVT after TKA occurred in the calf with 52% of patients sustaining isolated muscular DVT in the gastrocnemius and soleus muscles.⁽⁵⁾ Most studies reported that patients with proximal DVT are at a higher risk of pulmonary embolism,^(2,10,12) but the clinical significance of calf DVT remains controversial and the fate of deep vein thrombosis is unclear.^(7-9,11,12) It was reported that TKA surgery creates an environment conducive to acute DVT formation and thromboses propagation, especially those larger than 5 mm.^(7,8,10,11,24) Some reports stated that the veins of the calf muscles are a common site of acute DVT with risks of propagation and pulmonary embolism.^(17,19-22) However, other studies reported 46% of patients with calf DVT showed spontaneous lysis and complete dissolution with a low incidence of pulmonary embolism.^(4,17,18) The results of the current study showed that patients with muscular DVT demonstrated clinical manifestations comparable to those of patients with DVT in the major leg veins and patients with combined DVT.

Many studies reported that prophylaxis with low molecular weight heparin is effective in reducing the incidence of DVT, but none showed a total effect in the prevention of deep-vein thrombosis.^(15,23-26) The results of the current study showed that prophylaxis with low molecular weight heparin significantly lowered the incidence of DVT and the occurrence of clinical symptoms. However, the effects on the development of late DVT and thrombus propagation were less prevailing due to the small numbers of cases. Propagation of thrombus from the muscular branch into the peroneal vein was observed in only one case without DVT prophylaxis, and no pulmonary embolism was found. Both isolated muscular DVT and combined DVT showed a tendency to spontaneous dissolution with time.

In conclusion, the results of the current study showed that muscular DVT produced significant clinical manifestations comparable to DVT of the major leg veins. Muscular DVT in the calf should be regarded as a clinical entity that warrants the same precautions and management, including prophylaxis. Treatment of muscular DVT should be individualized according to the severity of clinical symptoms during the immediate postoperative period.

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全人工膝關節置換術後下肢肌內血栓的臨床意義

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背景：腓腸肌和比目魚肌靜脈血栓之意義仍然未知。本篇目的在評估全人工膝關節置換術後肌靜脈血栓的臨床意義。

方法：本實驗共收案 359 位接受全人工膝關節置換的病人，術後 5-7 天內以上行性靜脈血管攝影評估，證實有深部靜脈栓塞者三個月後再實行第二次靜脈血管攝影。評估項目包括臨床症狀，晚期深部靜脈栓塞及血栓傳播及肺栓塞。利用統計方法比較單獨腓肌靜脈血栓與主要靜脈血栓及合併血栓之異同。

結果：在 359 位病人中，有 175 位 (49%) 為陽性深部靜脈栓塞，包括 160 位遠端血栓及 15 位近端血栓。在 160 位遠端血栓病人中有 83 位 (52%) 包含有腓腸肌及比目魚肌靜脈血栓；83 位病人中 38 位 (46%) 是單獨肌靜脈血栓，45 位 (54%) 是肌靜脈合併前脛靜脈，後脛靜脈或腓靜脈。單獨肌靜脈血栓的病患臨床症狀，後期血栓，血栓傳播和肺栓塞和主要靜脈血栓病患或合併血栓病患的發生率並無統計上的差異。

結論：單獨肌靜脈血栓的臨床意義應等同於主要靜脈血栓及合併血栓，小腿肌靜脈血栓應視為有意義的臨床診斷並做適當治療。
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關鍵詞：肌靜脈血栓，臨床意義，全人工膝關節置換術。

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