

Should venous Doppler ultrasonography be routinely applied before lower extremity major orthopedic surgery?

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ABSTRACT

Background: Hip-knee arthroplasty and knee arthroscopy (KA) is frequently applied in the orthopaedic surgery. The approach does not exist related with the preoperative asymptomatic deep venous thrombosis (DVT). In this study, the patients who would undergo surgery lower extremity were screened for asymptomatic DVT, using the venous Doppler ultrasonography (USG). **Patients and Methods:** DVT was screened by venous Doppler USG in the patients who would undergo hip-knee arthroplasty and KA between the dates of November 2013 and September 2015. The patients were investigated regarding the age, gender, and the planned operation. The cases were separated to the following three groups: group I (<49 years), Group II (49–69 years), and Group III (≥70 years). **Results:** The study included 222 patients; of these, 174 were female and 48 were male. Group I, Group II, and Group III included 45, 115, and 62 patients, respectively. Of the six patients determined to exist with DVT, 2 (1.73%) were in Group II, and 4 (6.45%) were in Group III. **Conclusion:** Although the differences were not found to be statistically significant, it may be useful to screen asymptomatic DVT by Doppler USG in the preoperative period in the 70-year-old male patients, and in those over 70.

Key words: Deep venous thrombosis, Doppler ultrasonography, preoperative screening

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INTRODUCTION

Hip-knee arthroplasty and knee arthroscopy (KA) are frequently performed orthopedic operations in the lower extremity. The success rates of these elective operations are generally dependent on the proper determination of preoperative pathologies such as deep venous thrombosis (DVT), and other risk factors. DVT of the lower extremity occurs in the deep venous system of the lower limbs, and it may lead to wound healing problems, amputation, pulmonary embolism, and even death if not managed properly.^{1,2} DVT can be easily diagnosed by the noninvasive method of Doppler ultrasonography (USG).³ There are many clinical studies investigating the diagnosis and treatment of pre- or post-operative DVT in symptomatic patients.⁴⁻⁶ However, there is no consensus on the need for

the diagnosis of preoperative asymptomatic-chronic DVT, and for its management after being diagnosed. To the best of our knowledge, no study has been conducted in our country related to this subject. In this study, we aimed to investigate the frequency of preoperative asymptomatic DVT of the lower extremity using Doppler USG.

PATIENTS AND METHODS

Consent of the Local Ethical Committee was received before the study. All investigations with Doppler USG were performed in the same center and by the same radiologist, using a 6–11 MHz linear vascular probe, and a Xario XG (Toshiba Medical Systems Corporation, Otawara,

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Japan) Doppler USG device. This retrospective study included the patients who were planned to undergo total knee arthroplasty (TKA), total hip arthroplasty (THA), and KA between November 2013 and September 2015, and who underwent Doppler USG preoperatively. All patients were evaluated preoperatively by a single specialist in orthopedics and traumatology, dealing with surgery for the lower extremity and were operated afterward.

Considering studies that investigated the frequency of postoperative DVT with regard to age groups^{7,8} the patients were separated into the following three groups: Group I, below 49 years; group II 49 to 69 years and group III above 70 years. The patients were evaluated for gender, history of diabetes mellitus (DM), hypertension (HT), or a previous anamnesis of DVT, and their records of the venous Doppler USG for lower extremity were investigated. Fisher's exact test was used in statistical analysis.

RESULTS

The study included 222 patients; of these, 174 were female and 48 were male, and the mean age was 59.9 years (22–81 years). Table 1 shows distributions of patients with regard to the age groups and the planned operations. Of the patients, 28 (12.6%) existed with the addiction of smoking, 24 (10.8%) had HT, and 32 (14.4%) had DM. Table 2 shows the gender of the patients and the frequencies of DVT.

Preoperative Doppler USG performed picked up 6 patients (2.7%) chronic DVT. The rate was determined to be higher in males than in the females; however, gender did not significantly correlate with the existence of DVT ($P > 0.05$). Of the six patients with DVT, two were hypertensive, one was diabetic, one had a previous history of DVT, and one had a history smoking.

Distribution of the patients with DVT according to groups was found to be as follows: No patients in Group I, two patients (1.73%) in Group II and four patients (6.45%) in Group III. These percentages need to be in relation to the number of patients with DVT, which is six and not total number of subjects in the study. In other words, 66.6% of those with preoperative DVT belonged to Group III. The Fisher's exact test revealed that the existence of DVT did not significantly correlate with the patient age groups ($P = 0.053$). Distribution of the patients with DVT according to the age groups is illustrated in Table 3.

The general characteristics of the patients with DVT are illustrated in Table 4. Of the patients found to have DVT preoperatively, four underwent surgery with the essential precautions, while two had their surgeries canceled.

Table 1: Distribution of the planned surgical approaches with regard to age groups

	Group I (<49)	Group II (49-69)	Group III (>70)	Total	Age
TKA	9	77	42	128	64.8 (48-79)
THA	6	25	20	51	66.2 (46-81)
KA	30	13	-	43	39.4 (22-58)
Total	45	115	62	222	59.9 (22-79)

KA – Knee arthroscopy; THA – Total hip arthroplasty; TKA – Total knee arthroplasty

Table 2: Distribution of the patients with regard to gender and existence of deep venous thrombosis

	Case	DVT (+)	Percentage
Female	174	3	1.72
Male	48	3	6.25
Total	222	6	2.70

DVT – Deep venous thrombosis

Table 3: Distribution of the patients with deep venous thrombosis with regard to age groups

Group	Patient distribution	DVT (+)	Percentage
Group I	45	-	
Group II	115	2	1.73
Group III	62	4	6.45

DVT – Deep venous thrombosis

Table 4: General characteristics of the patients with deep venous thrombosis

	Age	Gender	DM	HT	DVT history	Smoking
Case I	64	Female	-	+	-	-
Case II	72	Male	+	-	-	+
Case III	71	Male	-	-	-	-
Case IV	55	Male	-	-	-	+
Case V	74	Female	+	-	+	-
Case VI	70	Female	-	+	-	-

HT – Hypertension; DM – Diabetes mellitus; DVT – Deep venous thrombosis

DISCUSSION

Increase in the mean life expectancy and the expected increase in the quality of life have led to the increases in the frequency of the hip-knee arthroplasty and KA.^{9,10} Recovery generally occurs rapidly after the operation, and the quality of life increases. However, in some of these patients, DVT or unexplained deaths may ensue after the surgery.¹⁰ DVT generally develops in the postoperative period; however, it may exist also preoperatively. It is almost impossible to detect whether these postoperative existing complications have developed in the preoperative or the postoperative period. It is, in fact, easier and cheaper in some of these patients to make a diagnosis with Doppler USG and to take the essential precautions in the preoperative period. Doppler USG is a noninvasive, cheap, and easily applicable method that does not emit ionizing radiation. When it is

performed using the proper technique, it has sensitivity of 90% and specificity of 100% in the diagnosis of DVT.^{1,11,12} Studies related to postoperative symptomatic DVT are still going on, and the essential precautions are taken using pharmacological or mechanical methods.¹³

Preoperative asymptomatic DVT and vascular pathologies are generally not considered, or they are excluded. Although there are a limited number of studies when the outcomes are compared, considerably variable results are reported that change between 4% and 12%.^{14,15} The reason for this may be expressed as the nonstandard patients attending the hospitals, and patient groups included in the studies. Some of the mentioned studies recommend preoperative screening of DVT, however, some report that it does not have an additional advantage and therefore it is not essential.¹² Of the investigated 986 patients who underwent TKA and THA; application of TKA, advanced age, and a high body mass index were found to be the risk factors in the patients diagnosed with DVT.¹⁶

Our study involved 174 female and 48 male patients. The mean age of the 128 patients, who were planned to undergo TKA, was found to be 64.8 years; the mean age was 66.2 years in the 51 patients who were planned to undergo THA. The mean ages in both groups were lower than those reported in the literature.^{4,5} The mean age of the 43 patients planned to go KA, was found to be 39.4 years. A total of only six patients were found to have asymptomatic chronic DVT, three cases in each of the TKA-and THA-planned groups. The number of cases with DVT was found to be lower than that in the literature, which may be the result of lower mean age in our study. Of these cases with DVT, three were female and three were male, and no difference existed between both genders. Of the patients who were to undergo KA, 27 were female and 16 were male, and the mean age was 39.4 years; none of these patients had DVT. This may be due to the young age of patients in the KA group.

Lee *et al.* have screened DVT following major orthopedic surgery, and they have reported the frequency of DVT, by separating the cases into 3 groups according to their ages.⁷ In this study, DVT was found to occur 5.12-fold more in Group II and 10.68-fold more in Group III. We also evaluated our patients according to these age groups; none of the patients in Group I had DVT, and the frequency was found to be 2 (1.73%) and 4 (6.45%), respectively in the Groups II and III. Conflicting with the results in literature, we determined higher rates in the males than in the females. When the three age groups were compared, the rate of asymptomatic chronic DVT was found to be higher in the cases over 70 years.

Esmarch bandage and pneumatic tourniquet are used frequently especially in the KA and TKA; however,

these devices increase the risk of DVT or trigger the embolization of an existing thrombus.¹⁷ Chiu *et al.* have shown that Esmarch bandage decreases the venous flow in the postoperative period.¹⁸ All patients with DVT were reviewed by physicians in cardiac and vascular surgery, and their risk analyses were performed. Of the patients who were recommended for anticoagulant treatment, four underwent the planned surgical treatment, and two cases were canceled. Preoperative anticoagulant treatment was started in the patients undergoing surgical intervention. Esmarch bandage was not used during the operation, and tourniquet was used only during the application of bone cement. With these precautions, the surgical treatment was successfully carried out in these patients.

Venous HT, edema, tissue hypoxia, subcutaneous fibrosis, and skin ulceration occur in the early stages of DVT.¹⁹ If the presence of thrombosis, atherosclerosis, varicose veins, and vascular malformations are determined especially in the lower extremity preoperatively, and if a proper surgical approach is planned, the extremity can be protected from amputation, and the performed procedures become life-saving. The venous Doppler USG of the lower extremity is not routinely recommended; however, when it is performed, life-saving results may be revealed.²⁰ DVT is the third most common cardiac pathology, and fatal pulmonary embolism is its most important complication. Diagnosis and treatment are considerably difficult after the development of pulmonary embolism. In contrast, preventing its development and even demonstrating its preoperative existence are cheap and life-saving approaches.

The number of patients found to have DVT in this study was limited, and the common risk factors such as the cardiac problems, smoking, and history of DVT did not exist in all of them (the last part of the statement is not factually correct as some of the patients with DVT in the study had some of these risk factors. Statement should be recast to bring out intended message!!). However, the mean age of these patients was 67.6 years, and we considered that age might be the most important factor. The patients with cardiac problems and history of DVT have been receiving anticoagulant treatment, and this fact might prevent the existence of higher frequencies of DVT.

Dietch *et al.* have demonstrated that venous USG of the lower extremity following trauma, was expensive, was not an indicator for therapeutic considerations, and was ineffective in preventing the venous, pulmonary embolism.²¹

Complications related to DVT have been substantially decreased by the mechanical and pharmacological prophylaxes of DVT in the postoperative period. Schwarcz

et al. have claimed that the routine USG evaluation for DVT was not essential in patients receiving proper anticoagulants following a total joint arthroplasty.²² Taking the diagnosis and treatment of preoperative asymptomatic DVT into consideration rather than focusing only on postoperative DVT may be life-saving for the patient.

In a study with the highest number of patients screened for DVT preoperatively (2678 patients), 120 cases (4.5%) were found to have DVT by the Doppler USG. The surgical intervention in these patients with DVT was postponed, and the patients were treated for DVT and the authors have reported that routine screening in the preoperative period was a life-saving procedure.¹⁴ In a series of 505 patients undergoing THA, Wakabayashi *et al.* found 62 cases (12.3%) with DVT, and they reported that DVT developed more frequently in patients with advanced age, major surgeries, RA, revision THA, and treatment for cancer.¹⁶ A lower rate of preoperative DVT was found in our study may be due to the inclusion of only the cases planned to undergo primary THA, TKA, and KA, and exclusion of the data related to revision operations and cancer patients.

The rate of asymptomatic DVT differed between the groups arranged regarding the ages or genders; however, no statistically significant correlations could be detected. The nonhomogeneous groups and small number of cases may be the reasons for these results. Further studies are needed on this subject conducted with greater number of cases, and comparing certain age groups.

CONCLUSION

Although we could not determine statistically significant differences, screening for asymptomatic DVT with Doppler USG in the preoperative period may be prevented from death in patients aged 70 years and above.

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Conflicts of interest

There are no conflicts of interest.

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