Thromboembolic Prophylaxis in Patients Undergoing Arthroscopic Knee Surgery: A Cross-Sectional Study

Abstract

Background: Postoperative Deep Vein Thrombosis (DVT), a subtype of Venous Thromboembolism (VTE), is a significant preventable cause of morbidity and mortality worldwide. VTE is estimated to occur at a rate of one per 1,000 people per year, with DVT accounting for approximately two-thirds of these events. DVT continues to be a common complication of knee arthroscopy. The purpose of this study is to determine the prevalence of DVT in patients who have undergone arthroscopic knee surgery.

Methods: Patients over the age of 18 years who underwent arthroscopic knee surgery in a teaching hospital were evaluated for VTE clinically and via lower limb Doppler ultrasonography prior to, three days after, and four weeks after surgery. The incidence of DVT was determined and associated with risk factors such as age, sex, duration of immobility, and duration of surgery. Afterward, statistical analysis was performed on the data.

Results: The prevalence of DVT was 3.1% in 318 patients undergone knee arthroscopy with a mean age of 34.31 years. The mean duration of surgery was 96.30 minutes across all patients. In 96.9% of patients, there was no evidence of DVT. Additionally, there was no significant association between DVT prevalence and gender, age, surgery type, duration of surgery, or presence of edema in patients ($p = 0.551$). The patients' mean duration of absolute rest was 61.89 hours. Absolute rest time was significantly longer in patients with positive DVT than in patients with negative DVT ($p = 0.001$).

Conclusion: While knee arthroscopy can be performed as an outpatient procedure, the risk of postoperative DVT is unknown. The incidence of DVT following arthroscopic knee surgery was 3.1% in this study, a necessary precondition for perioperative thromboprophylaxis.

Keywords: Deep venous thrombosis, Pulmonary embolism, Venous Insufficiency, Knee, Arthroscopy

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Introduction

Deep vein thrombosis (DVT), a subtype of venous thromboembolism (VTE), is a significant preventable cause of morbidity, mortality, and health care costs in patients undergoing arthroplasty worldwide [1, 2]. VTE is estimated to occur at a rate of one per 1,000 people per year [2], with DVT accounting for approximately two-thirds of these events [3]. PE, a dreaded complication of DVT, occurs in up to one-third of cases and is the leading cause of death [4]. Much of the morbidity associated with DVT is caused by the development of post-thrombotic syndrome, which occurs in up to 50% of patients within two years of DVT and manifests itself in a variety of ways, including leg pain, swelling, and, in severe cases, venous ulcers [5, 6]. In a meta-analysis of 18 randomized control trials involving 1947 patients in an Asian population (Japan, Thailand, Hong Kong, India, Malaysia, Singapore, Korea, and Taiwan), Lee et al. [7] reported a 1.9% incidence of symptomatic DVTs associated with TKAs (total knee arthroplasties). As a result of the potentially dire consequences for patients, economic analyses have determined that venous thromboembolisms (VTEs) impose a significant economic burden on the healthcare system [8]. As a result, considerable efforts have been made worldwide to identify and implement effective strategies for preventing VTEs following TJA. To this end, identifying risk factors may aid in the prevention or early detection of VTE. Numerous risk factors for VTE have been identified in TJA, including comorbidities, advanced age, cancer, prolonged immobilization, bilateral procedures, and longer operative times [9, 10]. Although risk stratification models and scoring systems have been developed to help reduce VTE incidence, such as the Caprini score [11], their utility and implementation in TJA remain debatable [12]...

There are numerous guidelines available for VTE prophylaxis. The 2012 ACCP and American Academy of Orthopedic Surgeons guidelines are more consistent than previous iterations and create a balance between prophylaxis efficacy and bleeding risk. For example, according to the most recent ACCP guideline [13], aspirin is now considered an acceptable agent, and its use has increased. Nonetheless, a retrospective analysis conducted in the United States found that, while healthcare provider aspirin use has increased, there has been no apparent change in VTE risk [14]. Additionally, over the last five to ten years, early discharge and outpatient protocols, as well as a concomitant reduction in length of stay (LOS), have been implemented (LOS) [15, 16].

Recent studies have revealed that DVT incidence following knee arthroscopy ranged between 1.50% and 41.20% in the absence of anticoagulation during the perioperative period, raising concerns among orthopedic surgeons [17, 18]. According to a study conducted by Bohensky et al., DVT has become the most common complication following arthroscopic surgery [19]. In severe cases, DVT can progress to pulmonary embolism (PE) [20]. Because DVT continues to be a complication of knee arthroscopy despite universal routine DVT screening, we evaluated the incidence of DVT in patients undergoing arthroscopic knee surgery in this study, plus evaluated the incidence of DVT in patients undergoing arthroscopic knee surgery.

Methods

This descriptive-analytical and cross-sectional study included 318 patients who underwent arthroscopic knee surgery at Imam Khomeini Hospital in Ahvaz from 2018 to 2020.

The purpose of this study was to determine the prevalence of DVT in patients undergoing knee arthroscopy who were all treated by the same orthopedic surgeon.

Patients over the age of 18 years, male or female, with various indications for arthroscopy were included in the study. The exclusion criteria were patients with a history of deep vein thrombosis, coagulation disorders, previous knee surgery, or pregnancy.

Patients underwent Doppler ultrasonography twice, three days before and four weeks after surgery, to ascertain the presence or absence of lower limb DVT. An experienced radiologist performed a Doppler ultrasound. Gray-scale ultrasound of the bilateral iliac veins, common femoral veins, proximal femoral, superficial veins, distal femoral, superficial veins, and popliteal veins would be performed first, followed by color Doppler ultrasound. Doppler ultrasound was used to determine the presence or absence of DVT in patients based on specific criteria (vein density or absence, decreased vasoconstriction, presence of venous flow in the leg's deep veins, and flow velocity in the leg's deep veins). Then, risk factors such as age, gender, duration of bed rest, and surgery type and duration were evaluated and recorded. The data were described using frequency and percentages for qualitative variables and standard mean and standard deviation for quantitative variables. The data were analyzed using paired and independent t-tests.

Results

The study enrolled 318 patients with a mean age and standard deviation of 34.31±11.23 years. In total, 255 (80.2%) of the patients were male, while 63 (19.8%) were female. In 318 patients undergoing knee arthroscopy, the prevalence of DVT was 3.1% (seven males, three female), and 96.9% of patients had no DVT (Figure 1). The mean and standard deviation of patients with positive DVT were 42.30 ±15.88 years, while those with negative DVT were 34.05 ±10.99 years. Males constituted 70% of patients with a negative DVT, while females constituted 30%. The chi-square test revealed no statistically significant difference between male and female patients undergoing knee arthroscopy in terms of DVT prevalence ($p = 0.551$). The independent t-test revealed no significant difference in age between the two groups of positive and negative DVT patients ($p = 0.145$).

A total of 17.2% of patients studied underwent diagnostic surgery, while 82.8% underwent thromboembolic prophylaxis surgery. Arthroscopy was diagnostic 30% of the time and therapeutic 70% of the time in patients who tested positive for DVT. Arthroscopy was diagnostic in 17.2% of patients with negative DVT and therapeutic in 82.8%. The chi-square test revealed no statistically significant relationship between DVT prevalence and the type of surgery performed on patients undergoing knee arthroscopy (p = 0.401) (Figure 2).

The mean duration of surgery in all patients was 38.99 minutes. The mean duration of surgery was 98 minutes for patients with a positive DVT and 92.99 minutes for patients with a negative DVT. In order to compare the duration of surgery in the two groups of patients with positive and negative DVT, due to the normality of the variable distribution of surgery duration based on Kolmungrov-Smirnov test (P<85.8) and the same variance of variable duration of surgery between the two groups based on Levin test (P=815.8), independent t-test was used. The results of independent t-test showed that there was no significant difference between the two groups of positive and negative DVT patients based on the duration of surgery (P = 911.8) (Figure 3).

Overall, 41.2% studied lacked edema, while 58.8% confirmed edema. A total of 30% of patients with DVT lacked edema, and 70% confirmed edema. A total of 41.6% with DVT-negative status did not have edema, and 58.4% confirmed edema. The chi-square test revealed no statistically significant difference between DVT prevalence and edema in patients undergoing knee arthroscopy (p = 0.771)(Figure 4).

The mean and standard deviation of absolute rest time was 61.89 ±85.95 hours in all patients studied. The mean (and standard deviation) of absolute rest time in patients with positive DVT was 213.60 ±94.28 hours, while it was 56.96 ±81.19 hours in those with negative DVT. The independent t-test revealed that the absolute rest time was significantly longer in patients with positive DVT than in patients with negative DVT (p = 0.001) (Figure 5).

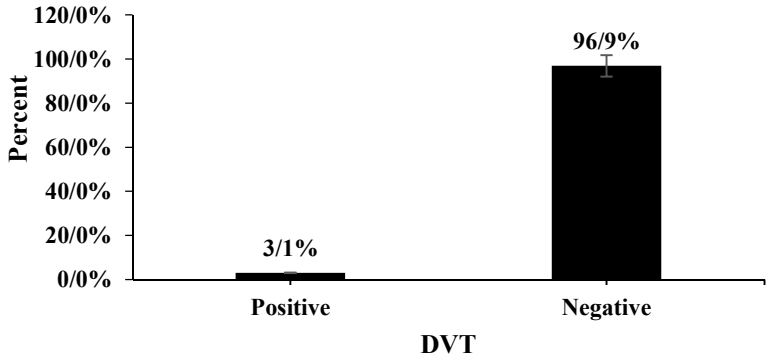

Figure 1. Prevalence of DVT in patients undergoing knee arthroscopy

Discussion

Deep vein thrombosis (DVT) is the formation of a blood clot in a deep vein in the body, usually in the lower leg or thigh. According to early research, DVT is a complex disorder influenced by environmental and genetic factors [21, 22]. Approximately half of DVT patients exhibit no symptoms. DVT is typically characterized by swelling, pain, redness, or warmth in the affected area [22]. Previous epidemiological studies have estimated the annual incidence of DVT to be 1 in 1000 [23], and approximately 5% of people will develop VTE at some point in their lives. VTE occurs in approximately 10% of people following total or partial knee replacement [24]. The Incidence of Deep Vein Thrombosis (DVT) in Patients Undergoing Arthroscopic Knee Surgery was evaluated in this study. The prevalence of DVT was 3.1 percent in 318 patients undergoing knee arthroscopy. In 96.9% of patients, there was no evidence of DVT. Additionally, there was no significant association between DVT prevalence and gender, age, surgery type, duration of surgery, or presence of inflammation in patients (p = 0.551).

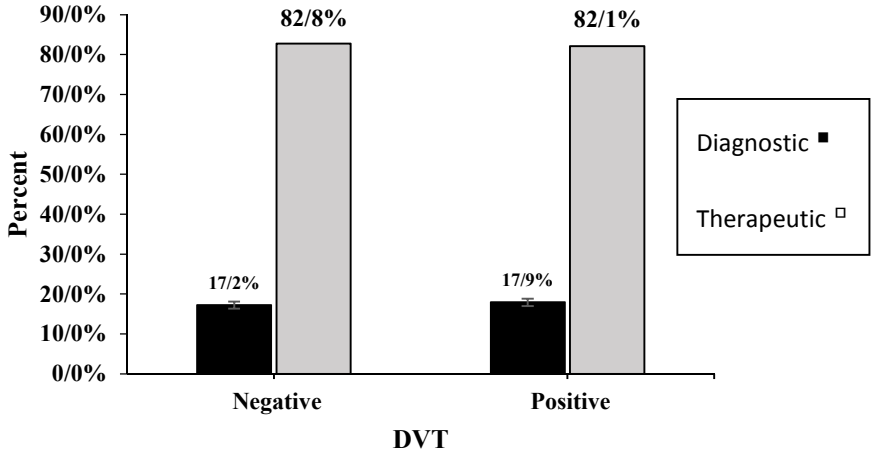

Figure 2. Frequency distribution of DVT by type of surgery in patients undergoing knee arthroscopy

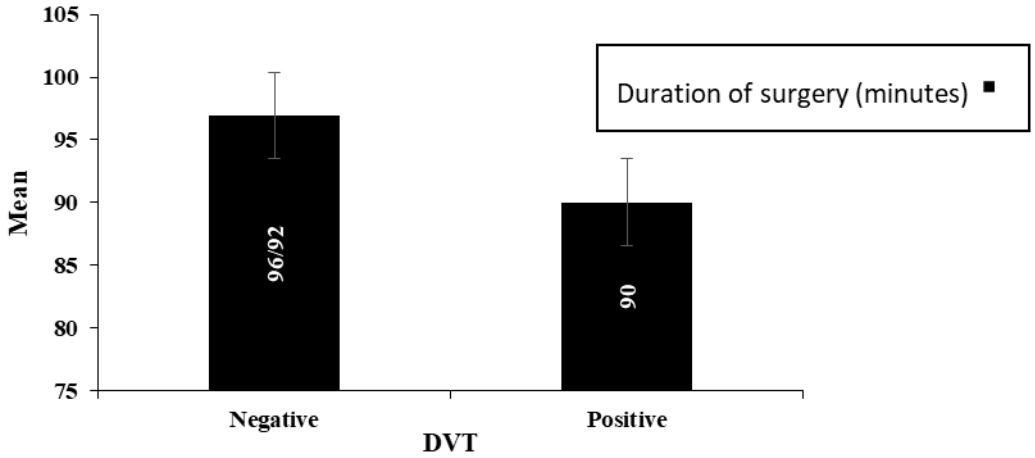

Figure 3. Distribution of DVT means according to the duration of surgery in patients undergoing knee arthroscopy

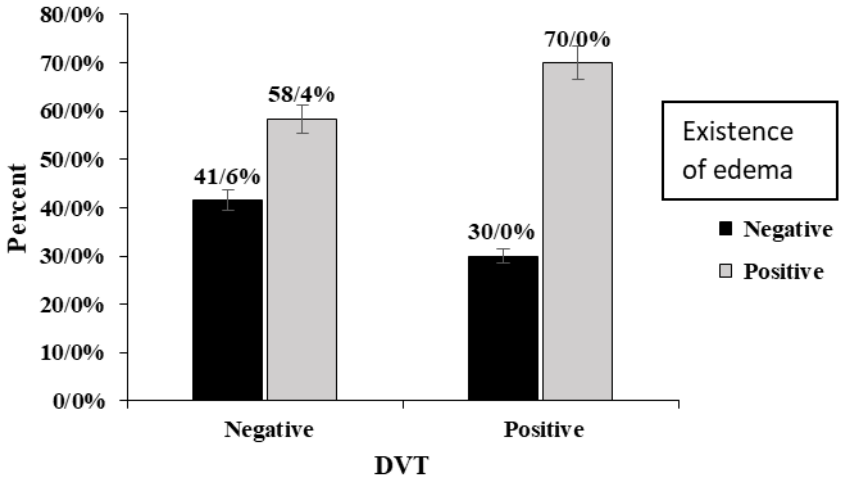

Figure 4. The frequency distribution of DVT in patients undergoing knee arthroscopy according to the presence of inflammation

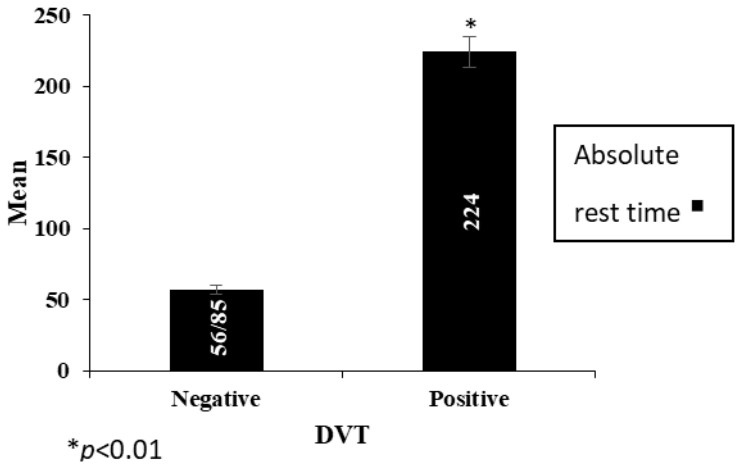

Figure 5. Distribution of DVT means by absolute rest time in patients undergoing knee arthroscopy

Absolute bed rest time was significantly longer in patients with positive DVT than in patients with negative DVT (p = 0.001). Ozcan et al. [25] conducted a study in 2019 on Symptomatic Deep Venous Thrombosis following elective knee arthroscopy. Over 40 years of age. They searched through the surgical database and outpatient clinic charts of patients who underwent knee arthroscopy. The odds of developing thrombosis, having a family history of clotting disorders, having diabetes mellitus (DM), using oral contraceptives, having a high body mass index, having a history of malignancy, and smoking were evaluated. DVT was significantly more common following arthroscopic knee surgery (AKS) in patients older than 40 with a prior medical history of VTE, diabetes mellitus, or smoking. In our study, the mean age of patients with positive DVT was 43.66 years, while patients with negative DVT were 34 years. Independent t-test results indicated no significant difference in age between positive and negative DVT patients (p = 0.145).

Moreover, Saied et al. investigated the incidence of deep vein thrombosis following knee arthroscopy (26). This study used ultrasonography to screen for DVT two weeks after knee arthroscopy to determine the DVT incidence following such procedure. This study enrolled 50 patients, 44 males, and six females, who underwent knee arthroscopy and met the following inclusion criteria: they were between the ages of 18 and 60 years, had isolated meniscal injury, and were not known to be at high risk for DVT. All patients underwent preoperative radiographs and MRI to diagnose knee injury.

Within two weeks postoperatively, all patients underwent complete DVT screening using lower limb venous ultrasonography. At the time of surgery, the mean age of patients was 27.8 years (range: 18–43 years). The mean length of stay in the hospital was 1.24 days (range: 1–3 days). Within the first two weeks following surgery, only one of the 50 patients developed asymptomatic silent DVT. The incidence of DVT was 2% following arthroscopic knee surgery in 50 patients in this study. We discovered a 3.1% DVT incidence following arthroscopy in the 318 patients studied. This raises whether routine DVT prophylaxis following AKS is necessary in cases where the patient is not classified as high-risk.

Li et al. [27] investigated the prevalence of Deep Vein Thrombosis (DVT) in Chinese patients undergoing knee arthroscopy surgery in routine clinical practice without thromboprophylaxis to identify risk factors. The study reviewed the medical records of 864 successive Chinese patients (≥ 18 years) who underwent various arthroscopic knee surgeries without prophylaxis in the high-risk category at Zhoushan Hospital in China between January 2012 to December 2014. Venography confirmed DVT in 564 (65.27%) patients. A total of 23% with DVT had proximal DVT, while 42% had distal DVT. Of the 70% of DVT cases, 25% had symptoms of deep vein thrombosis, while 45% were asymptomatic. DVT was strongly associated with increasing age

and complex surgical procedures performed via arthroscopy. DVT was significantly more common in patients who underwent complex arthroscopy surgery procedures than in simple surgical procedures ($p<0.01$). The study's findings indicated a high prevalence of DVT among Chinese patients undergoing knee arthroscopy surgery in routine clinical practice without thromboprophylaxis. They recommended that patients undergoing advanced knee arthroscopy surgery be closely monitored to develop DVT to avoid postoperative complications.

William et al. ([28]) reviewed published reports on prophylaxis guidelines, randomized controlled trials (RCTs), and current practice patterns in prophylaxis. They then considered the most appropriate model for assessing VTE risk in patients undergoing knee arthroscopy in this context. The existing body of literature on VTE and AKS reports a wide range of incidences, frequently relying on unreliable primary outcome measures in asymptomatic and distal deep vein thrombosis (DVT). Published prophylaxis guidelines provide limited practical guidance, and it is unclear how to translate RCT findings into clinical practice, as most VTE cases prevented by routine prophylaxis are asymptomatic or distal DVT. There is no consensus in the literature regarding the actual implementation of pharmacologic prophylaxis following AKS. Individual models of VTE risk assessment would be preferable for patients undergoing knee arthroscopy rather than the group models used for hip and knee arthroplasty patients.

Ying et al. ([17]) examined the risk factors for DVT following arthroscopic posterior cruciate ligament (PCL) reconstruction in patients with isolated PCL injury in 2021. In 172 patients, color Doppler ultrasound was used to assess bilateral lower-extremity deep veins three days after surgery. The potential associations between DVT risk and age, gender, body mass index (BMI), diabetes, hypertension, smoking, and other factors were analyzed in 108 males and 38 females with a mean age of 43.62 years. An advanced age, a high BMI, and increased postoperative D-dimer values were all associated with an increased risk of DVT following knee arthroscopic PCL reconstruction. While knee arthroscopy surgery can be performed as an outpatient procedure with minimal hospitalization, the risk of postoperative DVT is unknown. In this study, the prevalence of DVT following knee arthroscopy was 3.1% in 318 patients. As such, it is a necessary precondition for thromboprophylaxis in patients who are not at increased risk. Sound advice is to treat DVT seriously and consider prophylaxis, even in patients at low risk or who do not have a risk factor.

The study's limitations include the use of sonography rather than venography to diagnose DVT, the inclusion of patients under the age of 18 years, and a failure to evaluate the thromboembolic syndrome, which may manifest itself during long follow-ups.

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