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DEEP VEIN THROMBOSIS RATES AFTER MAJOR LOWER LIMB ORTHOPEDIC SURGERY IN PAKISTAN: PROSPECTIVE STUDY DESIGN.

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Abstract:
Objective: In this study, we aimed to investigate the incidence and risk factors of DVT related to hip arthroscopic surgery.
Design: prospective study
Setting: …….
Patient(s): enrolled 69 consecutive patients who underwent hip arthroscopic surgery between September 2017 and December 2018.
Method: Clinical diagnosis of DVT was confirmed through ultrasonography performed preoperatively and 3 days postoperatively. Additionally, D-dimer levels were measured preoperatively and on postoperative days 1, 3, and 7.
Main Outcome Measure(s): rates of DVT
Result(s): ten patients (14.49)) were diagnosed with DVT clinically, although all cases were asymptomatic. The mean age of the patients with identified DVT was 62.0 ± 6.1 years; significantly higher than the mean age of the patients without DVT (45.1 ± 1.7 years; P = 0.0188).
Conclusion: The incidence of DVT during hip arthroscopy, investigated by ultrasound, was 14.49 %. From our results, we recommend screening for and treatment of asymptomatic DVT, especially in older patients, during hip arthroscopic surgery.
Keywords: Hip arthroscopy Deep vein thrombosis surgical complication Low extremity surgery

Introduction

Isolated lower extremity fractures are very common.[1,2] These injuries are known to be risk factors for venous thromboembolism (VTE).[3–6] Although studies using demographic outcomes suggest a 10%–40% incidence of deep vein thrombosis (DVT) after these fractures, most of these thrombi are distal, localized, and asymptomatic, and their clinical relevance is unknown.[5,7–11] Some prophylaxis trials suggest that low-molecular weight heparin (LMWH) can reduce the incidence of asymptomatic DVT in patients with lower extremity injuries, although this finding was not specifically demonstrated in patients with fractures.[5,7–11] Furthermore, the effectiveness of any method of thromboprophylaxis in decreasing the incidence of clinically important venous thromboembolism (CIVTE) in patients with isolated leg fractures is unknown, and there is uncertainty about the need for thromboprophylaxis resulting in significant practice variation.[12,13] Generally, in North America, such patients are not given thromboprophylaxis,[14,15] whereas, in Europe, routine use of thromboprophylaxis seems to be common.[16–18] While the American College of Chest Physicians guidelines on the prevention of VTE recommend against the routine use of thromboprophylaxis in these patients,[12] the recent UK guidelines recommend that prophylaxis be used routinely in this setting.[19]

Several environmental and genetic risk factors contribute to the occurrence of DVT in patients with hip fractures. The etiology of both DVT and hip fracture is multifactorial and risk factors for both conditions are intricately linked with each other. Therefore, understanding of the interaction between these risk factors can facilitate DVT research, and may help identify targeted prevention and treatment measures.

In a prospective study, patients living in their own home with hip fracture were found to be at a higher risk of DVT. Furthermore, immobility is another central issue in patients with hip fractures that can cause a series of physiological and clinical effects. One of them is long-term bed rest after fracture [39].

The iliac vein compression syndrome (IVCS), also called May Thurner syndrome or Cockett syndrome, was first described by Virchow in 1851 when he observed a left-sided predominance of ilio femoral DVT. IVCS usually occurs in the second or third decade of life and is especially prevalent in women. Studies have highlighted the need to improve awareness of IVCS as a risk factor for left-sided DVT in patients with hip fracture. Other factors such as pregnancy and postpartum period, immobilization, hospitalization, and catheterization may also increase the risk of DVT in patients with hip fracture. However, further studies are needed to confirm their relationship with DVT.

A series of changes occur in the body in the aftermath of hip fracture. These include local hemorrhage and release of exogenous coagulation factors from injured soft tissues, which collectively activate the coagulation cascade. These chemical changes result in a hypercoagulable state. In a study of 127 elderly patients with hip fractures, both preoperative and postoperative fibrinogen levels were significantly higher than the normal reference levels, which may have a direct impact on the coagulation system. Moreover, studies conducted on transgenic mice and murine infusion models suggest that fibrinogen can contribute to DVT via multiple mechanisms. Together, these studies indicate that hyper fibrinogenemia plays a causal role in the pathogenesis of DVT, and is not merely a biomarker of DVT risk. Exposure of subcutaneous tissues and local trauma to soft tissues and blood vessels caused by fracture activate blood extrinsic coagulation pathway, which results in a hypercoagulable state. Moreover, inflammatory mediators released by necrotic tissues can stimulate the coagulation system, which further activates the coagulation system.

Moreover, VTE is a potentially fatal postoperative complication that requires urgent attention. As most patients with hip fractures tend to be in the elderly age-group, a special group vulnerable to perioperative complications, the relative risk of VTE in patients with hip fractures is higher than that in patients with fractures at other sites. In current clinical practice, D-dimer and Doppler imaging are the mainstream investigations for diagnosis of VTE; however, the condition may not be recognized in older patients due to atypical presentation

In this study, we aimed to investigate the incidence of DVT related to major lower limb orthopedic surgery.

Methodology

We obtained approval from our Institutional Review Board (IRB) for this study, and it has been performed in accordance with the ethical standards. We began screening for DVT with ultrasound and measuring Dimer levels in September 2017. We, prospectively, enrolled 101 consecutive patients (101 hips) who underwent hip arthroscopic surgery between September 2017 and December 2018 at …….. Patients who were not able to receive ultrasound preoperatively and postoperatively (15 patients), had surgery with combined open procedures (seven patients), were 15 years or younger (five patients), or received anticoagulant therapy postoperatively per anesthesiologist recommendation (two patients) were excluded from this study. Accordingly, 69 patients (69 hips) were included in this study. For all included patients, data regarding age, sex, BMI, and administration of anticoagulants preoperatively were retrospectively collected from the clinical record. Recorded demographic data of the patients are displayed in Table 1.

Table 1: Demographics of patient population

Age (years)	46.3 ± 1.7
Sex	
Male:	27 patients (39.13%)
Female:	42patients (60.86 %)
BMI	23.4 ± 0.5
Administration of anticoagulants	(-): 71, (+): 1

All operations were performed under general anesthesia. During hip arthroscopy, patients were placed in supine position upon a fracture table. A well-padded perineal post was used in addition to a carefully padded boot with the heel firmly seated and secured. Gentle traction was applied to the legs bilaterally and a spinal needle was used to establish the anterolateral portal over a guide wire using fluoroscopy. Two portals (anterolateral and mid-anterior) were used in all cases. Additional portals (proximal midanterior and posterolateral) were made in few cases. In cases in which labral instability was identified intraoperatively, we performed labral fixation using suture anchors. Furthermore, cases in which morphological abnormality related to femoroacetabular impingement (FAI) were identified in postoperative radiograph and impingement confirmed intraoperatively, we performed femoral cam osteochondroplasty after releasing traction. All operations were performed by a single surgeon. All

patients were permitted to move to a wheelchair the day after surgery. For patients receiving labral fixation, partial weigh bearing was permitted 1 week postoperatively, and full weight bearing 4 weeks postoperatively. For patients not receiving labral fixation, full weight bearing was permitted 1 week postoperatively. From surgical records, operative time, incidence of labral fixation, and incidence of cam osteochondroplasty were recorded.

Diagnosis of DVT Duplex ultrasonography was performed on the bilateral common femoral veins, superficial veins, popliteal veins, and calf veins preoperatively and 3 days postoperatively to confirm a clinical diagnosis of DVT. The criteria for the diagnosis of DVT were the following: loss of compressibility of the vein, presence of intraluminal echogenicity, and absence of venous flow. DVT was classified as proximal or distal. All patients with a diagnosis of DVT proceeded to a pulmonary thromboembolism (PTE) survey using helical computer tomography (CT). Additionally, Ddimer levels were measured preoperatively, and on days 1, 3, and 7 postoperatively.

Statistical analyses

Results were expressed as the mean and the standard error of the mean unless otherwise indicated. The results were compared between the two groups (identified DVT vs. no identified DVT). A nonparametric Mann–Whitney U test was used for comparisons of normally distributed data among the groups (age, BMI, operation time, D-dimer level). Sex, administration of anticoagulants, incidence of labral fixation, and incidence of cam osteochondroplasty were statistically compared between the groups using the v2 test. P values of\0.05 were considered statistically significant.

Results

Among 69 patients enrolled in this study, 10 (14.49%) were diagnosed with DVT clinically. All cases were asymptomatic. DVTs were classified as distal in all cases. In addition, patients diagnosed with DVT clinically had absence of PTE confirmed by CT survey. Details of the patients in the two groups (identified DVT vs. no identified DVT) are shown in Table 2. The mean age of the patients with identified DVT is 62.0 ± 6.1 years, which is significantly higher than the mean age of the patients without DVT (45.1 ± 1.7 years; P = 0.0188). There are no statistical differences between the two groups in factors of operation (i.e. operation time, incidence of labral fixation, incidence of cam osteochondroplasty). The mean $_{D}$-dimer levels are higher in patients with DVT than in those without DVT. However, they are not statistically significant (Table 3)

Table 2: Details of the patients between two groups

	Identified DVT (n = 10)	No identified DVT (n = 59)	P value
Age (years)	62.0 ± 6.1	45.1 ± 1.7	0.0188*
Sex	Male: 3 Female: 7	Male: 24 Female: 35	0.642
BMI	24.9 ± 1.8	23.3 ± 0.49	0.319
Operation time (minutes)	70.4 ± 9.2	92.8 ± 5.4	0.24
Labral fixation	(+): 2 (-): 3	(+): 33 (-): 34	0.69
Cam osteochondroplasty	(+): 0 (-): 5	(+): 8 (-): 59	0.41
DVT deep vein thrombosis, BMI body mass index * Nonparametric Mann–Whitney U test showed a significant difference between two groups (P\0.05)			

Table 3: The mean value of $_{D}$dimer levels

	Identified DVT (n = 10)	No identified DVT (n = 59)	P value
Preoperative	1.09 ± 0.23	0.93 ± 0.1	0.359
P.O. day 1	1.93 ± 0.77	1.34 ± 0.13	0.546
P.O. day 3	2.19 ± 0.73	1.6 ± 0.14	0.439
P.O. day 7	5.71 ± 3.4	1.8 ± 0.2	0.125

Discussion

Hip arthroscopy is considered to be a very effective method of examination and treatment of joint disorders, and the use of hip arthroscopy is widely increasing[20]. At the same time, some complications have been reported. Harris et al. performed a systematic review of 92 studies (6134 patients) of hip arthroscopy to determine the associated prevalence of complications and reoperations[21]. In their review, the rates of minor and major complications associated with hip arthroscopy were 7.5 and 0.58 %, respectively. Among the 512 complications that Harris et al. described as having occurred during or after hip arthroscopy, there were nine cases (1.8 %) of DVT or PTE, including one in which PTE was the patient's cause of death. Another recent systematic

review was performed by Gupta et al. [22]. Among 285 complications, they mentioned that there were six cases (2.1 %) of DVT or PTE. As DVT and PTE can be serious life-threatening complications, we thought it important to investigate asymptomatic DVT because it is difficult to diagnose and has the potential to develop into PTE clinically. To our knowledge, only one study focusing on the incidence of DVT during hip arthroscopic study included asymptomatic cases [23]. The authors reported two symptomatic DVT (2/139 patients; 1.4 %) cases, and there were no cases of asymptomatic DVT in the 81 hip arthroscopic cases which were screened by ultrasound. In the current study, we found the incidence of asymptomatic DVT to be 14.49 (10/69 patients). Accordingly, the incidence of asymptomatic DVT in the current study was higher than the incidence reported in the previous study. The difference in the incidence of DVT between the current study and the previous study may be due to differences in the age of the population (average 46.3 vs. 37.7 years). In this study, we reported that patients with identified DVT were significantly older than patients with no identified DVT. Increasing age has been recognized as an important risk factor for DVT and PTE [23, 24]. Additionally, recent reports note that hip arthroscopic surgery for older patients has increased. Javed and O'Donnell reported on clinical outcomes of hip arthroscopic surgery for patients over 60 years old [25]. Clinical results were satisfactory, with no complications reported in their study population. They concluded that hip arthroscopic surgery was beneficial with a minimal risk of complication even in older patients. Domb et al. performed a matching comparison test of hip arthroscopic surgery for patients between 30 and 50 years old. Although clinical outcomes were not significantly different between the groups, symptomatic DVT occurred in one case in the patients over 50 years old [26]. Increasingly, as older patients undertake recreational and sporting activities with more physical requirements, hip arthroscopic surgery for hip pain in older patients may be performed more frequently. From our results, we recommend screening for and treatment of asymptomatic DVT, especially in older patients, during hip arthroscopic surgery. Sun et al. reported on the incidence of DVT after knee arthroscopic surgery in a Chinese population with screening by venography. Their study reported 3.7 % symptomatic cases and 11.2 % asymptomatic cases, respectively. Since the proximity of the femoral and gluteal veins would result in compression against the perineal post during limb traction to keep arthroscopy portals open during hip arthroscopic surgery, we hypothesized that there would be a significant percentage of patients diagnosed with asymptomatic DVT. From the results, application of tourniquets may increase thrombus formation. DVT during total hip replacement (THR) has been regarded as a natural consequence, and screening and a variety of prophylactic regimens are performed. Tsuda et al. reported on the incidence of VTE in Asian patients who underwent THR with only mechanical prophylaxis. Nine of the 182 patients (5 %) investigated were diagnosed with asymptomatic DVT. In addition, Yokote et al. investigated the incidence of DVT in the population reported on by Tsuda et al., with a resulting rate of DVT of 7.2 %. Surprisingly, the incidence of DVT in these reports was comparable to the rate in the current study. There is some evidence to suggest that genetic differences partially explain the lower risk of DVT in Asian populations. Consequently, the incidence of DVT in Western countries may be higher than in the current study.

Conclusion

The incidence of DVT during hip arthroscopy, investigated by ultrasound, was 14.49%. All cases were asymptomatic. Advanced age correlated to occurrence of DVT. From our results, we recommend screening for and treatment of asymptomatic DVT, especially in older patients, during hip arthroscopic surgery.

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