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DVT Incidences in Indian Patients of Hip Arthroplasty

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Abstract

Background: Hip arthroplasty is common procedure performed to treat Hip Joint pain and dysfunction secondary to arthritis, femoral head avascular necrosis, fracture neck femur and many more.

Aim of the study: To assess the risk factor and to estimate incidence of Deep Vein Thrombosis (DVT) in patients of Hip arthroplasty.

Materials & Methods: A prospective, non-randomized, cross-sectional study was conducted in 80 patients undergoing Hip Arthroplasty. All the patients with > 18 years of age group undergoing Total Hip Arthroplasty, Hemi arthroplasty, cemented arthroplasty or uncemented arthroplasty. Patients with <18 years of age, unwilling to participate, previous history of DVT and major lower limb surgery, revision arthroplasty and with blood coagulopathy were excluded. All the patients were assessed clinically for signs of DVT and radiologically with Venous Doppler Ultrasonography pre-op and post-op on 3rd & 5th day and 3 months.

Results: The mean age was 51.93 ± 16.71 years with 61.3% male patients. Obesity was noted in 13.8%, trauma (46.3%) was common cause for surgery. Venous stasis was 12.5%, 11.3%, 8.8% in doppler study on 3rd & 5th day and 3 months respectively. Partial venous thrombosis was noted in 1.3% cases on 15th day and 1.3% had clinical signs of DVT after 3 months post operatively.

Conclusion: The incidence of DVT after hip arthroplasty is relatively low in Indian population compared to western. Pharmaceutical DVT prophylaxis in patients having low risk factors for DVT is not a cost-effective advise.

Keywords: Deep Vein Thrombosis, Arthroplasty.

Introduction

Total hip arthroplasty (THA), the most frequent surgical procedure in the field of Orthopaedics, is one of the efficacious treatments for end-stage hip joint diseases, especially observed elder population (1). THA is primarily used to treat joint pain and dysfunction caused by hip joint disease, including hip joint osteoarthritis, femoral head necrosis, bone neck fractures and many more (2). Currently, about more than 5,00,000 people globally receive artificial joint replacement annually on

account of fractures, osteoarthritis, bone tumours and other diseases (3). It is possible to alleviate joint pain, improve joint function, and correct deformity via artificial hip replacement and with proper postoperative functional exercise, the function of patient's hip joint may meet the requirements of daily life and improve the quality of life.

Deep vein thrombosis is one of the major surgical complications of THA. The triad of venous stasis, hypercoagulability, and endothelial injury is associated with thrombus formation. In Western populations, the overall incidence of DVT was documented to be as high as 70% without any form of prophylaxis (4). Despite varying rates of the incidence of venous thromboembolism among diverse racial/ethnic cohorts, it appears globally highest in Blacks, intermediate in Caucasians and lowest in Asians (5). As far as we know some studies investigating the incidence of DVT following THA comprising Korean (4), Chinese (6), Asian (7), and American (8) populations; but so far, only one study (9) investigating the incidence of DVT after hip arthroplasty in Indian population. With motive to provide additional data support, we conducted this study.

Distal DVT can range from being asymptomatic, causing long-term valvular damage leading to chronic venous insufficiency. More serious PEs can develop as a result of proximal propagation. The short-term clinical course following DVT can result in morbidity and mortality from PE. In the long-term, the condition can be further complicated by excess mortality, recurrent venous thromboembolism, and post-thrombotic syndrome (10, 11).

Predisposing factors for DVT in Western patients include age over 60 years, previous venous insufficiency, obesity, dehydration, one or more comorbidities, hyperlipidaemia, concomitant use of oral contraceptives, cancer, dietary factors, genetic factors and others (4, 12, 13). On the other hand, Asian patients have a remarkably low prevalence of DVT and virtually no postoperative PE following THA. (4, 14). It has been postulated that Asian populations have low clinical prothrombotic risk factors for DVT and the absence of some genetic factors involving DVT (4, 13).

Various diagnostic modality has been used to detect DVT such as a venogram, impedance plethysmography, computed tomography scan, or a D-dimer test. Among the stated ones, new non-invasive imaging techniques such as B-mode scanning and Doppler ultrasonography (duplex) are highly accurate in the diagnosis of DVT but are relatively expensive and time consuming (15). Doppler ultrasound is becoming increasingly accepted as an accurate, non-invasive means of imaging in suspected DVT. Numerous investigations performed abroad have reported (combined) sensitivity of 95% and specificity of 98% (12).

Materials & Method

A prospective, non-randomized, cross-sectional study of 2 years duration was conducted on a total of 80 patients who were undergoing hip arthroplasty in our institute with ethical clearance. With written informed consent patients with > 18 years of age undergoing Total Hip Arthroplasty, Hemi Arthroplasty, Cemented Arthroplasty and Uncemented arthroplasty were included whereas patients with <18 years of age, previous history of DVT, any previous history of major lower limb surgery, revision hip arthroplasty, blood coagulopathy and unwilling to participate were excluded. Detailed history, clinical examination, pre-operative blood and radiological investigation (X-rays and Colour Doppler study) was carried out. During postoperative period, mechanical prophylaxis (crepe bandaging in bilateral lower limbs) was given to every patient. Each

was encouraged to mobilise from bed as soon as post-operative pain subsides. Passive physiotherapy was given all patients. Each patient underwent a venous Doppler ultrasonography of the lower limbs on the 3rd & 15th day and 3 month postoperatively. Parameters assessed were Homan sign, Mose's sign, Neuhof's sign, Edema, Pain in limb, Discoloration of skin and Muscle wasting. Pharmacological prophylaxis was provided to the patients, only when there was an evidence of DVT on serial venous Doppler study. Patient's age, gender, body mass index (BMI), history of smoking, taking estrogens-progesterone containing contraceptives, hormone replacement therapy, pregnancy, past history of venous thromboembolism, past history of taking anticoagulants, active malignancy, diabetes, hyperlipidemia, hypertension were collected. Surgical data like diagnosis, type of the procedure, operative time, intraoperative blood loss, duration of postoperative recumbency, results of venous Doppler and clinical sign of DVT on 3rd, 15th and 3 month post-operative day were collected. All ultrasound procedures were done by a single radiologist to minimize inter-observer/subjective errors. Statistical analysis was done by SPSS version 20.

Results

A total of 80 patients were included in this study. The mean age of study population was 51.93 ± 16.71 years with a range of 18 to 89. Majority of the patients (43.8%) belong to age group 41-60 years. There were 49 (61.3%) male and 31 (38.8%) female patients. Obesity was noted in 11 (13.8%) patients. The patients underwent hip arthroplasty due to variety of reason, of which trauma (46.3%) being the most common.

Table 1: Distribution of patients according to age group

Age group (years)	Number of patients	Percent
<20	1	1.3
21−40	19	23.8
41−60	35	43.8
61−80	21	26.3
>80	4	5.0
Total	80	100

Table 2: Distribution of patients according to gender

Gender	Number of patients	Percentages
Male	49	61.3
Female	31	38.8
Total	80	100

Table 3: Distribution of patients according to body mass index

BMI (kg/m^2)	Number of patients	Percentages
18.5 to <25	69	86.3
25.0 to <30	11	13.8
Total	80	100

Table 4: Distribution of patients according to etiology

Types of patients	Number of patients	Percentages
Alcohol	10	12.5
Ankylosis spondylitis	2	2.5
Dysplastic hip	1	1.3
Idiopathic	14	17.5
Rheumatic arthritis	2	2.5
SCD	5	6.3
Steroid	8	10.0
TB hip	1	1.3
Trauma	37	46.3
Total	80	100

In our study, 17.5% had previous history of smoking, 36.3% has diabetes mellitus, and 48.8% had hypertension. Almost cases (40.0%) underwent hip arthroplasty due to neck of femur fracture, 31.3% due to hip arthritis, 26.3% due to AVN hip, 1.3% due to dysplastic hip, and 1.3% due to intertrochanteric femur

fracture. D-dimer test was positive in all patients with value between 1001-2000 ng/ml.

Table 5: Distribution of patients according to D-dimer test

D-dimer (ng/mL)	N (%)
<1000	41 (51.3%)
1001-2000	25 (31.3%)
2001-3000	10 (12.5%)
>3000	4 (5.0%)
<1000	1 (1.3%)

Table 6: Association of type of surgery with incidence of DVT

Types of surgery	N (%)	P-value
Bipolar	33 (41.3%)	0.852
Cemented total hip arthroplasty	1 (1.3%)	
Uncemented total hip arthroplasty	46 (57.5%)	

Table 7: Position, Intraoperative blood loss, and duration of surgery

Parameters	N (%)
Lateral decubitus (lateral) position	80 (100%)
Intraoperative blood loss	
≤ 200	45 (56.3%)
>200	35 (43.8%)
Duration of surgery	
< 100 min	19 (23.8%)
≥100 min	61 76.3%)

No abnormality was detected in preoperative Doppler findings. But Post-operative doppler findings were as per table 08. Post-operative immobilization and INR ratio were as per table 09.

Table 8: Pre and postoperative Doppler findings

Doppler finding	Preoperative	Postoperative (Total 80 patients)			
		3th day of hip arthroplasty	15th day of hip arthroplasty	After 3 months of hip arthroplasty	Clinical sign of DVT after 3 months
Venous stasis, n (%)	-	10 (12.5)	9 (11.3)	7 (8.8%)	1 (1.3)
Complete venous thrombosis, n (%)	-	1 (1.3)	-	-	
Partial venous thrombosis, n (%)	-	-	1 (1.3)	-	

Table 9: Post-surgery immobilization and INR ratio

Parameters	N (%)
Duration of postoperative immobilization (days)	
1	12 (15%)
2	51 (63.8%)
3	14 (17.5%)
4	3 (3.8%)
Postoperative INR ratio (hrs)	
1.0	6 (7.5%)
1.1	62 (77.5%)
1.2	10 (12.5%)
1.3	1 (1.3%)
1.4	1 (1.3%)

The incidence of venous stasis/DVT higher in patients in age group of 61−80 years (90.0%). Male (54.5%) were predominately affected with venous stasis/DVT. However, age group, gender & BMI were not

significantly associated with the incidence of venous stasis/DVT (Table 10).

Table 10: Association of age, gender, body mass index with incidence of venous stasis/ DVT

Parameters	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
Age group, years		
<20	0	0.471 (2.522)
21−40	4 (45.5%)	
41−60	6 (9.1%)	
61−80	1 (90.9%)	
Gender		
Male	6 (54.5%)	0.623 (0.242)
Female	5 (45.5%)	
BMI (kg/m^2)		
18.5- less than 25	9 (81.98%)	0.640 (0.218)
25.0-less than 30	2 (18.2%)	

Patients who are alcoholic were significantly associated with incidence of venous stasis/ DVT (chi-square=29.475; P=0.000) (Table 11). There wasn't statistical significant association of DVT with co-morbidities (Table 12).

Table 11: Association of etiology with incidence of venous stasis/ DVT

Etiology	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
Alcohol	4 (36.4%)	0.000
Ankylosis spondylitis	0	
Dysplastic hip	1 (9.1%)	
Idiopathic	0	
Rheumatic arthritis	1 (9.1%)	
SCD	3 (27.3%)	
Steroid	0	
TB hip	0	
Trauma	2 (18.2%)	

Table 12: Association of comorbidities with incidence of venous stasis/ DVT

Etiology	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
Smoking, n (%)		
Present	3 (27.3%)	0.358
Absent	8 (37.5%)	
Diabetes mellitus, n (%)		
Present	2 (18.2%)	0.180
Absent	9 (81.8%)	
Hypertension, n (%)		
Present	8 (37.5%)	0.261
Absent	3 (27.3%)	

Venous stasis/DVT was found statistically significant in patients with AVN hip (Chi-square=17.448; P-value=0.002) (Table 13), D-dimer value between 1001—3000ng/ml (Chi-square=24.56; P value=0.000) (Table 14), who underwent Bipolar surgery (Chi-square=8.693; P-value=0.034) (Table 15).

Table 13: Association of clinical diagnosis with incidence of venous stasis/ DVT

Diagnosis	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
AVN hip	5 (45.5%)	0.002
Dysplastic hip	1 (9.1%)	
Hip arthritis	3 (27.3%)	
Neck of femur fracture	1 (9.1%)	
Intertrochanteric femur fracture	1 (9.1%)	

Table 14: Association of D-dimer test with incidence of venous stasis/ DVT

D-dimer test values (ng/mL)	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
<1000	0	0.000
1001--3000	8 (72.7%)	
>3000	3 (27.3%)	

Table 15: Association of type of surgery with incidence of venous stasis/ DVT

Types of surgery	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
Bipolar	2 (18.2%)	0.034
Cemented total hip arthroplasty	0	
Uncemented total hip arthroplasty	9 (81.8%)	

Intraoperative blood loss (Chi-square=3.318; P-value=0.069) and duration of surgery were not statistically significantly associated with the incidence of venous stasis/ DVT (Chi-square=1.210; P-value=0.271) (Table 16).

Table 16: Association of intraoperative blood loss and duration of surgery with incidence of venous stasis/ DVT

Parameters	No of Doppler Positive (Venous stasis/DVT) (n=11)	P-value
lateral decubitus (lateral) position	80 (100%)	-
Intraoperative blood loss, mL		
≤ 200	6 (54.5%)	0.069
200	5 (45.5%)	
Duration of surgery		
< 100 min	3 (27.3%)	0.271
≥100 min	8 (72.7%)	

Duration of post-surgery immobilization was not significantly associated with incidence of stasis/DVT. Maximum number of patients with postoperative INR ratio (1.1) had venous stasis/ DVT, it was statistically significant with p value of 0.022 (chi-square=13.133) (Table 17).

Table 17: Association of Duration of post-surgery immobilization and Postoperative INR ratio with incidence of venous stasis/ DVT

D-dimer test values (ng/mL)	No of Doppler Positive (Venous stasis/DVT)(n=11)	P-value
Duration of post-surgery immobilization (days)		
1	0	0.311
2	7 (63.6%)	
3	3 (27.3%)	
4	1 (9.1%)	
Postoperative INR ratio		
1.0	1 (9.1%)	0.022
1.1	7 (63.6%)	
1.2	1 (9.1%)	
1.3	1 (9.1%)	
1.4	1 (9.1%)	

Discussion

Deep vein thrombosis and PE occur due to longer immobilisation period are potentially life-threatening medical complications after all major orthopaedic surgeries. Surgery of any kind is known to create prothrombotic state because of stress which may increase thrombotic complications post-operatively (7). The incidence of DVT varies among different racial/ethnic cohorts; however, it is generally highest in Blacks and lowest in Asians (5). This variability is mainly attributed to differences in epidemiological characteristics of the studied populations, lack of standard diagnostic, and treatment protocol for DVT (19, 20). To the best of our knowledge, only one study (9) in Indians and very few

studies in non-Indian populations (4, 6, 7) have attempted to investigate the incidence of DVT following hip arthroplasty. To add further evidence in support to the incidence of DVT in the Indian community after hip arthroplasty, we designed the present study.

Several studies found the incidence of DVT in various Indian and non-Indian populations ranged from 4.4% to 64.3%, as shown in Table 18. It might be due to the included patients' different health conditions, perioperative preventative anticoagulation regimens, and surgical techniques. In the current study, the incidence of DVT was 1.3%, which is remarkably low. Similarly, in one Indian study, DVT was found in two out of 45 patients (4.4%) who had undergone THA. Altogether, it is therefore not cost effective to advise prophylaxis in Indian patients undergoing THA who have no known risk factors for DVT.

Table 18: Incidence of DVT in different population

Studies	Incidence of DVT
Present study	1.3% of 80 Indian patients undergoing THA
Jain et al. (2004) (9)	4.4% of 45 Indian patients undergoing THA
Yu et al. (2003) (6)	18.2% of 22 Chinese patients undergoing THA
Kim et al. (1988) (16)	10% of 146 Korean patients undergoing cementless THA
Atichartakaran et al. (1988) (17)	No DVT case in 19 Thai patients undergoing THA
Fujita et al. (2000) (18)	22.6% of 164 Japanese patients undergoing THA
Sudo et al. (2003) (21)	9.1% of 33 Japanese patients undergoing THA
Dhillon et al. (1996) (22)	64.3% of 14 Malaysian patients undergoing THA

The three elements that cause DVT are endometrial damage, venous blood flow stasis, and blood hypercoagulability. The subjects of the current study are elderly patients 40 years and older, which is in accordance with findings of Yu et al and Jain et al. (18, 21) The following reasons attributed to the higher risk of DVT: 1) weak elasticity of blood artery, 2) physiological and organic complications of multiple organs in elder patients, and 3) decreased perioperative period of lower extremity joint mobility and activity levels (23). We suggest that early prevention and management for these DVT risk factors are clinically required to lower the likelihood of DVT.

Fifty percentages of all patients with DVT are simultaneously suffering from other diseases, which might contribute to thrombogenesis. In the other 50% no etiological factor can be detected. There are a number of factors predisposing to DVT, such as immobilisation, surgery, old age of the patient, and estrogen treatment. But these factors are risk factors but not etiological factors (24). We identified alcohol consumption, trauma, idiopathic cause and use of steroid as the most common but statistically insignificant aetiologies associated with DVT in our study population. Association of alcohol consumption and incidence of DVT is less elucidated in literature and still ongoing debate. Nielsen Jr S et al (25) confirmed that trauma patients are at an increased risk of developing venous thrombosis early in the hospital course due to comorbidities associated with trauma.

Approximately 10-15% of the tribal population of India resides in Gujarat, especially in South Gujarat. A high prevalence (13-31%) of sickle cell trait has been shown among the different tribes of Gujarat. Venous thromboembolism is often seen in adults with sickle cell disease (26). Patients with sickle cell disease have higher risks of vaso-occlusive crisis, acute chest syndrome.

Nitric oxide scavenging secondary to intravascular haemolysis in sickle cell disease cause hypercoagulable state that can result in complications like DVT (27). Among total patients, we found sickle cell disease in 6.3% patients who underwent hip arthroplasty.

In the current study, most of the patients underwent hip arthroplasty owing to neck of femur fracture (40%). On contrary, Jain et al observed that maximum proportion of patients underwent THA due to avascular necrosis (44.4%). Duration of THA surgery in the current study was ≥100 min in 61 (76.3) patients. Yu et al in non-Indian patients found the duration of THA surgery ≥ 120 min in DVT patients.

Doppler ultrasonography performed prior to surgery eliminates the possibility of false positive results and alerts the surgeon to the increased risk of DVT and the requirement for prophylaxis. In the current study, we have discovered that 1.3% of patients had DVT following 3 months of hip arthroplasty.

Aschwanden et al (28) concluded that regarding the frequency of PE, immobilization (for 4 days) was not superior to early mobilization, indicating that early mobilization (to ambulate for > or = 4 hours) was safe. We found no association between duration of immobilization and incidence of DVT. Further studies concerning the impact of very prolonged immobilization on the risk of DVT are recommended.

There are some limitations that need to be acknowledged. 1) This was a single-center prospective study with a small sample size; therefore, the data is not representative of the general population. 2) Patient risk stratification is a valid starting approach to better manage patients having hip arthroplasty and to identify those who may benefit from a pharmaceutical preventative strategy, however we did not perform individual thromboembolic risk assessment prior to surgery in the current study. 3) Further multi-center studies with large population size are warranted to offer solid evidence for the prevention of DVT.

Conclusion

The incidence of DVT after hip arthroplasty in Indian patients is relatively low compared to the Western populations. That clearly point out that it is not cost effective to advise prophylaxis in Indian patients undergoing hip arthroplasty who have no known risk factors for DVT. The prevalence of DVT varies according to ethnicity.

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