Original Article

The Role of Thrombectomy in the Management of Deep Vein Thrombosis

Ilyas Sadiq, Muhammad Nasir and Farhan Iftikhar

ABSTRACT

Objective: To investigate the long-term effects of surgical thrombectomy of iliofemoral deep vein thrombosis (DVT) with regards to the occurrence of post-thrombotic syndrome (PTS) and post-surgery venous hemodynamics concerning venous insufficiency and venous obstruction.

Study Design: A retrospective observational study

Place and Duration of Study: This study was conducted at the surgical department of Doctors Hospital & Medical Centre Lahore from May 2019 to May 2021 for a period of 02 years.

Materials and Methods: A total of 50 patients who underwent surgical thrombectomy were included in the study. Among these patients, 35 patients were diagnosed with iliofemoral DVT. 20 patients were evaluated after an average follow-up of 2 years by a comprehensive duplex mapping. CEAP and Villalta scale was used to assess and test the severity of PTS. Digital photoplethysmography (PPG) and venous occlusion plethysmography (VOP) were used to calculate venous hemodynamics.

Results: After the 2-year follow-up, the primary patency rate of the iliofemoral venous segment was 85%. Venous reflux was observed in 45% of patients in the study. 55% of patients were diagnosed with mild or moderate post-thrombotic syndrome. However, no patient developed severe PTS or active ulceration. The average venous flow volume in the operated femoral was 63.2ml/100ml per minute which was notably less than controlled contralateral legs without surgery ($p<0.05$). The average venous refilling time (VRT) was 15.5 seconds which was significantly more than that of non-operative legs ($p<0.05$).

Conclusion: The results of the study indicate good long-term results and excellent patency rates after surgical thrombectomy of iliofemoral veins.

Key Words: Thrombectomy, deep venous thrombectomy, iliofemoral veins

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INTRODUCTION

Deep vein thrombosis (DVT) is a common complication affecting every 300 in 100000 patient's annually[1]. The affected patients report pulmonary embolism as the earliest critical complication whereas post-thrombotic syndrome (PTS) or chronic thromboembolic pulmonary hypertension (CTEPH) is among the serious long-term consequences [2]. Venous claudication and venous ulcers are the most noticeable symptoms of extreme PTS which significantly affects the quality of life [3]. Iliofemoral DVT is the major cause behind the development of severe levels of PTS[4,5].

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Therefore, it is recommended to remove the thrombus as early as possible. Currently, the thrombus is either removed through endovenous methods or surgical interventions[6]. Particularly, the younger patients diagnosed with acute, symptomatic iliofemoral DVT and having a thrombus of age <14 days are suggested to immediately undergo thrombus removal treatment[7]. As first-line therapy, endovascular and pharmacological treatment is suggestive for the patients[6]. However, according to a study, at a certain point, physicomechanical catheter-directed thrombolysis becomes non-beneficial and no significant results are produced when contrasted with anticoagulation alone for the prevention of PTS [8]. This could be due to the inclusion of femoropopliteal along with iliofemoral DVT patients in this trial. In this regard, another related study confirmed that pharmacological catheter-directed thrombolysis benefits only the population with an iliofemoral DVT [9]. However, surgical thrombectomy of iliofemoral DVT has widely been demonstrated as a successful management strategy for PTS [9]. Different imaging technologies duplex ultrasound mapping, air plethysmography, occlusion plethysmography, and photoplethysmography are available for venous disease diagnosis and for determining the outcomes of surgery[11]. However, despite these wide-ranging techniques, only limited data is available regarding

post-surgery hemodynamic effects. Therefore, the following study was designed to investigate the long-term effects of surgical thrombectomy of iliofemoral deep vein thrombosis (DVT) with regards to the occurrence of post-thrombotic syndrome (PTS) and post-surgery venous hemodynamics concerning venous insufficiency and venous obstruction.

MATERIALS AND METHODS

A retrospective observational study was conducted from 15th May 2019 to 15th May 2021 at the surgical department of Doctors Hospital & Medical Centre Lahore. Patients aged over 18 years, diagnosed with iliofemoral DVT, and treated through venous thrombectomy were included in the study. Whereas, patients with septic thrombosis, pregnancy-related DVT, phlegmasia cerulae dolens, atresia of deep veins, or patients in whom mechanical injury such as catheter-related DVT results in iliofemoral DVT was excluded from the study. Although 35 patients, data obtained from the hospital registry of last 3 years, complied with the criteria but the follow-up data of only 20 patients was evaluated as the remaining were either lost or died during the study or had missing data. These 20 patients had iliofemoral DVT, diagnosed through duplex ultrasound. Among them, 11 had had ascending DVT extending from the lower leg to the region surrounding the iliofemoral vein. 5 patients had inferior caval vein involvement while 7 had descending DVT of the iliofemoral vein. However, femoral veins in all these cases were free of thrombus. All patients underwent venous thrombectomy through a standardized procedure. Before the conduction of follow-up, all patients were informed of the purpose of the study, and their consent was sought. Similarly, ethical approval was taken from the ethical committee of the hospital. Included patients were followed for a mean period of 18 months (minimum 16 months, maximum 22 months). PTS was evaluated by the CEAP (Clinical-Etiological-Anatomical-Pathophysiological) score and Villalta score. Moreover, duplex sonography of fibular veins, posterior and anterior tibial veins, popliteal veins, femoral vein, deep femoral vein, external iliac vein, and inferior caval vein was also performed. In addition, small and large saphenous veins were also investigated. The scan was performed by an independent investigator. Duplex scans of femoral vein, external iliac, and inferior caval vein were conducted while patients were placed in a supine position where all other scans were performed in a standing position. Moreover, air plethysmography and photoplethysmography were conducted as already explained [11]. The most significant character of photoplethysmography is the "venous refilling time", an indicator of venous reflux. A value of less than 25s is considered pathological. Similarly, venous occlusion plethysmography measures venous outflow volume which indicates iliofemoral obstruction in which the outflow is less than 40-80ml/min[4].

SPSS (version 18) is used for statistical analysis. Data were expressed as frequency and percentages. The student's t-test was used for assessing the statistical significance of the treatment. A p-value of <0.05 was considered statistically significant.

RESULTS

Among the study population, 12 (60%) were male while 8 (40%) were female. The mean age at follow-up was 53 years 3.5 years. 7 right and 13 left legs were treated. At the time of surgery, the average thrombus age was 4.1 days. The patients' data showed that the mean surgery time was 120 minutes. Post-operatively no patient had reported bleeding while only 2% had postoperative seroma and 5% had postsurgical wound infection.

On post-operational evaluation, 3 patients were found to have "incomplete" venous recanalization thus had residual thrombus. 3 patients had post-surgical occlusion of the iliac or femoral vein during the follow-up of 2 years. Thus patency rate was 85%. 5 (25%) patients had postthrombotic alteration such as structural or septum irregularities in vein walls. In terms of reflux, 1 (5%) patients had iliac vein reflux and 6 (30%) had reflux in the deep femoral veins. The majority of patients reported reflux in the popliteal vein. Whereas, regarding superficial veins, 3 (15%) patients demonstrated reflux in large saphenous veins and 1 with incomplete insufficiency of the large saphenous veins was found. Lastly, only 1(5%) patient was found to have reflux in the lesser saphenous vein.

No patient had an active ulcer at the end of the follow-up. 1 (5%) was found to have healed ulcer on the treated leg (C5). According to CEAP classification, 8 patients were classified under C0, 5 with C1, and 1 with apparent varicose veins (C2). Similarly, 2 patients were having pretibial edema (C3), and 3 demonstrated skin changes (C4) (Table I).

Table II presents the categorization of patients according to the Villalta score. It was seen that the majority of patients (55%) had mild or moderate PTS and no case with severe PTS was found.

Photoplethysmography and venous occlusion plethysmography were performed on all patients on both legs. As per the results of the former imaging studies, the average venous refilling time (VRT) was 15.5 - 10.2 sec of the treated legs. 5 patients had severe reflux with VRT less than 10 s. A significant difference was found in VRTs when compared treated legs were compared with untreated legs. Whereas, according to venous occlusion plethysmography, the average venous outflow volume of all treated legs was 63.2ml/100ml per minute - 25.2. Among the evaluated patients, 4 patients had abnormal venous outflow values of <40 ml/100ml/min. In comparison, the average outflow

volume of the untreated legs was 78 ml/100ml per min 30.6 ($p<0.05$) (Table 3).

Table No.1: CEAP Classification

C0	C1	C2	C3	C4	C5	C6
8 (40%)	5 (25%)	1 (5%)	2 (10%)	3 (15%)	1 (5%)	0 (0%)

Table No.2: Villata score

Villalta < 5 (no PTS)	Villalta 5–9 (mild PTS)	Villalta 10–14 (less severe PTS)	Villalta > 15 (critical PTS)
9 (45%)	10 (50%)	1 (5%)	0(0%)

Table No.3: Hemodynamic outcomes

	treated legs	untreated legs	P-value
Average venous outflow (ml/100ml/min)	63.2-25.2	78 - 30.6	<0.05
Average venous refilling time (seconds)	15.5 - 10.2	26.2 - 8.5	<0.05

DISCUSSION

The above study found a patency rate of 85% which is comparable to already established literature. However, the follow-up time of our study is shorter when compared with the related studies. Plate et al conducted a 10-year long study on patients who underwent surgical thrombectomy and reported a patency rate of 83% [12]. Similarly, Hopler et al concluded 74% and 84% as primary and secondary patency rates, respectively, following a follow-up time of around 64 months [13]. Wagenhauster conducted a study of almost similar periods and reported a patency rate of 89% [14]. Despite such a good patency rate, 3 patients were found to have occlusion iliac or femoral vein which shows an occlusion rate of 15% and indicates that even after successful treatment, the veins still have the potential to remain patent. A similar study, however, reported a lesser occlusion rate of 8.3% [14].

Our study found that almost 50% suffered reflux in deep veins. Plate et al concluded 78% and 33% reflux rate in popliteal and femoral veins following surgical thrombectomy [12]. Our study found a significant difference in terms of VRT between formerly treated and untreated legs. However, it is generally expected that venous reflex should be significantly decreased after surgical thrombectomy when compared with anticoagulation treatment alone [15]. The venous outflow was expected higher in untreated legs compared to treated legs. However, the average venous outflow of 63ml/100ml/min found of treated legs is a physiological value. Similar results were reported by Plate et al [12].

According to CEAP classification, 1 patient had a C5 grade. The same results were reported by Wagenhauser et al who conducted a cohort study on 26 patients [13]. In our study it was found that 45% of patients had no PTS, the majority of patients (55%) had mild or moderate PTS and no case with severe PTS was found. This is with previously reported results where 80% of patients had no PTS [14]. 55% of patients in our study had PTS, considering Villalta score >5. The majority of the patients had mild PTS. It is predicted that early treatments strategies to remove PTS reduce the severe PTS forms [3].

According to the American venous forum guidelines, endovenous techniques are suggested as 1st line therapy [7]. However, they are contradicted in pregnancy, any scenario of internal bleeding, intracranial surgery, or any other cardiovascular events, and trauma. Given that, surgical thrombectomy is favorable in these situations.

The study is limited in terms of limited sample size, shorter follow-up period, and the lack of comparison with the endovenous group.

CONCLUSION

The results of the study indicate good long-term results and excellent patency rates after surgical thrombectomy of iliofemoral veins.

Author's Contribution:

Concept & Design of Study:	Ilyas Sadiq
Drafting:	Muhammad Nasir, Farhan Iftikhar
Data Analysis:	Farhan Iftikhar Muhammad Nasir
Revisiting Critically:	Ilyas Sadiq, Muhammad Nasir
Final Approval of version:	Ilyas Sadiq

Conflict of Interest: The study has no conflict of interest to declare by any author.

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