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# COMPARATIVE EVALUATION OF VASCULAR CONDUITS FOR HEMODIALYSIS ACCESS: LONG SAPHENOUS VEIN VERSUS SUPERFICIAL FEMORAL VEIN

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**Abstract**

***Background:*** *Hemodialysis of end-stage renal disease (ESRD) requires reliable vascular access. Long saphenous vein (LSV) is used universally, although the superficial femoral vein (SFV) is also being used as an alternative to LSV when LSV is not appropriate. There is limited data available on the comparative data on patency, complications, and functional outcomes of these conduits.*

***Objectives:*** *To compare the efficacy of the long saphenous vein and superficial femoral vein with respect to primary and assisted primary patency, secondary patency, and complications.*

***Methodology:*** *It was a retrospective single-center study with a sample size of 25 ESRD patients who were in Department of Vascular Surgery, Combined Military Hospital Rawalpindi 6 months lower-limb venous conduits. The patients were separated into two groups (LSV-n=12 and SFV-n=13) in accordance with their preoperative suitability of the vein evaluated using duplex ultrasonography. Vein harvesting and arteriovenous fistula creation were performed using the usual surgical procedures. Primary and secondary patency, thrombosis, infection, formation of an aneurysm, and morbidity of the donor site were followed in patients at 1, 3, 6, and 12 months. The statistical analysis was conducted in SPSS; they were analyzed in terms of mean ± standard deviation, t-test, and chi-square, where $p<0.05$ was regarded as statistically significant.*

***Results:*** *The mean age was 52.4 ± 9.8 years in the LSV group and 54.1 ± 10.2 years in the SFV group ($p=0.62$). Primary patency at 12 months was 66.7% for LSV and 84.6% for SFV ($p=0.21$); secondary patency was 75% versus 92.3% ($p=0.18$). Thrombosis occurred in 3 LSV and 2 SFV patients. Aneurysms were noted in 1 LSV patient. Infection rates and donor site morbidity were comparable, though mild limb edema occurred in 15.4% of SFV patients.*

***Conclusion:*** *The substitute for LSV is SFV, which is a dependable choice of hemodialysis access device with better patency and similar complications. Preoperative mapping and the method of surgery are all required to achieve the best results in patients with ESRD.*

## INTRODUCTION

Chronic kidney disease is among the leading causes of disability and death in the world. The rate of its prevalence is claimed to be 21.2 in Pakistani adults. The rates and prevalence of chronic kidney disease are increasing at an alarming rate across the world resulting in a high health burden on the planet [1,2]. As life expectancy of CKD patients increases, there is always a need to ensure long term vascular access to have hemodialysis done because it not only impacts the treatment outcome but the life of a patient as well [3].The arteriovenous fistula due to increased primary patency and reduced infections has always been identified as the most effective mode of hemodialysis access, making it the choice of primary mode of access. Despite the many other modalities that can be employed over time, the other modalities are favorable as secondary and central venous catheters as the last mode of access [4,5]. Access sites are usually selected in the upper extremities because of the excellent visibility and the reduced risk of infection and thrombosis when placing the needle. Radiocephalic fistula is still considered the conduit of choice when the cephalic veins in the arm are large enough, but less than 30% of patients can be put on this set-up [6,7]. A compromised native cephalic vein is due to several attempts of venipuncture and IV cannulation that the patient had previously undergone [8]. Moreover, there is a loss of cephalic vein access sites due to previous unsuccessful access procedures, which makes radiocephalic and brachiocephalic arteriovenous fistula formations impossible. The superficial femoral and the great saphenous veins are transposed to the upper limb, and in this subgroup of patients with exhausted upper extremity veins, they have been reported to be effective autologous grafts in vascular access [9,10]. This research paper makes a comparison between the long saphenous vein and the superficial femoral vein as hemodialysis access conduits in terms of primary patency, assisted primary, secondary, and complications.

### Study Objectives

To compare the long saphenous vein and superficial femoral vein conduits used in hemodialysis access, primary and secondary patency, complications, morbidity of the donor site, and general suitability in patients with end-stage renal disease.

## Materials and Methods

### Study Design & Setting

The proposed observational study was conducted at the Department of Vascular Surgery at Department of Vascular Surgery, Combined Military Hospital Rawalpindi , from January 2023 to January 2024, and consider 25 ESRD patients who undergo lower-limb venous conduit placement to gain hemodialysis access.

### Participants

Twenty-five ESRD patients were selected and subdivided into two groups (LSV n=12 and SFV n=13) according to the preoperative assessment of the vein. Patients ranged from 18 to 75 years. Duplex ultrasonography of the veins in the preoperative assessment was done to assess the suitability, patency, and diameter. Demographic, comorbidities, and baseline clinical characteristics were documented.

### Sample Size Calculation

Given a 15 percent difference in primary patency in the case of LSV and SFV in 12 months, alpha= 0.05 and power= 80, 12 patients per group were the minimum. The number of patients reached was 25, considering the possible drop-out and loss to follow-up.

### Inclusion Criteria

Patients with end-stage renal failure on the need of hemodialysis access who lack appropriate cephalic and basilic veins on the forearm and arm to use as primary vascular access • Male and Female -18-70 years old.

### Exclusion Criteria

This is because patients under the age of 18 and over the age of 70 years have a history of coagulopathy and bleeding disorders, and those

who have had known peripheral arterial disease (PAD) or severe vascular compromise in the lower extremities.

**Diagnostic and Management Strategy.**
Duplex ultrasonography was used to measure the quality, patency, and vein diameter of the preoperative stage. Harvesting of the veins and AVF was done using standard methods of surgery. Clinical assessment and duplex to monitor patency and complications were used postoperatively at 1, 3, 6, and 12 months.

**Statistical Analysis**
The SPSS version XX was used to analyze data. Continuous variables are expressed in mean, standard deviation, and percentages in categorical variables. Comparison was made between groups in terms of an independent t-test of continuous variables and chi-square or Fisher's exact tests of categorical variables. The p-value was taken to be significant when it was less than 0.05.

**Ethical Approval**
Ethical approval for this study was obtained from the Institutional Review Board (IRB) prior to data collection. All procedures were conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from all participants, and confidentiality and anonymity of the data were strictly maintained throughout the study.

**Results**
A total of 25 patients were included in this study, with 12 in the long saphenous vein (LSV) group and 13 in the superficial femoral vein (SFV) group. The mean age was 52.4 ± 9.8 years in the LSV group and 54.1 ± 10.2 years in the SFV group (p=0.62). Male-to-female ratios were 8:4 and 9:4, respectively (p=0.88). Comorbidities were comparable between groups, with diabetes present in 50% of LSV and 54% of SFV patients (p=0.81), and hypertension in 67% versus 69% (p=0.91). Preoperative vein diameters averaged 4.2 ± 0.6 mm for LSV and 5.1 ± 0.7 mm for SFV (p=0.01), indicating significantly larger caliber for SFV conduits. At 12 months, primary patency rates were 66.7% for LSV and 84.6% for SFV (p=0.21). Secondary patency was 75% for LSV and 92.3% for SFV (p=0.18). Thrombosis occurred in 3 LSV patients versus 2 SFV patients (p=0.63), and one aneurysm was observed in the LSV group with none in the SFV group. Infection rates were comparable, 8.3% in LSV and 7.7% in SFV. Donor site morbidity was minimal, with mild limb edema observed in 15.4% of SFV patients. No patient required reoperation. Overall, SFV conduits showed a trend toward superior patency and slightly lower complication rates compared to LSV, supporting SFV as a reliable alternative when LSV is unavailable or unsuitable.

**Table 1: Baseline Demographic and Clinical Characteristics**

| Characteristic | LSV Group (n=12) | SFV Group (n=13) | p-value |
|---|---|---|---|
| **Age (years, mean ± SD)** | 52.4 ± 9.8 | 54.1 ± 10.2 | 0.62 |
| **Male/Female** | 8/4 | 9/4 | 0.88 |
| **Diabetes mellitus** (%) | 50% | 54% | 0.81 |
| **Hypertension** (%) | 67% | 69% | 0.91 |
| **Preoperative vein diameter (mm)** | 4.2 ± 0.6 | 5.1 ± 0.7 | 0.01 |

Baseline demographic and clinical characteristics of patients in the long saphenous vein (LSV) and superficial femoral vein (SFV) groups. Values are presented as mean ± standard deviation or number (%).

**Table 2: Intraoperative Parameters**

| Parameter | LSV Group (n=12) | SFV Group (n=13) | p-value |
|---|---|---|---|
| **Conduit length (cm, mean ± SD)** | 28.5 ± 3.2 | 31.2 ± 3.8 | 0.07 |
| **Operative time (minutes)** | 95 ± 12 | 110 ± 15 | 0.03 |
| **Vein diameter at anastomosis (mm)** | 4.1 ± 0.5 | 5.0 ± 0.6 | 0.01 |

Intraoperative parameters including conduit length, operative time, and vein diameter at anastomosis site for LSV and SFV groups. Values are mean ± standard deviation.

**Table 3: Postoperative Outcomes**

| Outcome | LSV Group (n=12) | SFV Group (n=13) | p-value |
|---|---|---|---|
| **Primary patency at 12 months** (%) | 66.7% | 84.6% | 0.21 |
| **Secondary patency at 12 months** (%) | 75% | 92.3% | 0.18 |
| **Thrombosis** (%) | 25% | 15.4% | 0.63 |
| **Aneurysm formation** (%) | 8.3% | 0% | 0.31 |
| **Infection** (%) | 8.3% | 7.7% | 0.92 |

Postoperative outcomes of hemodialysis conduits including patency, thrombosis, aneurysm formation, and infection rates in LSV and SFV groups.

**Table 4: Donor Site Morbidity and Complications**

| Complication / Morbidity | LSV Group (n=12) | SFV Group (n=13) | p-value |
|---|---|---|---|
| **Limb edema** (%) | 0% | 15.4% | 0.18 |
| **Wound infection** (%) | 8.3% | 7.7% | 0.92 |
| **Hematoma** (%) | 0% | 7.7% | 0.31 |
| **Reoperation required** (%) | 0% | 0% | – |

Donor site morbidity and complications following vein harvesting in LSV and SFV groups. Values presented as percentage (%).

## Discussion

This paper compared the results of long saphenous vein (LSV) conduits and superficial femoral vein (SFV) conduits as hemodialysis access in a group of 25 end-stage renal disease (ESRD) patients [11]. The findings of our study indicate that SFV conduits were more likely to record a high primary and secondary patency rate in 12 months as compared to LSV, with similar complication rates, and favorable results support the emerging evidence that SFV conduits can serve as an appropriate alternative to LSV, especially in situations where LSV is inappropriate or not available [12].Primary patency at 12 months was 66.7% in our cohort (LSV), and 84.6 (SFV), and secondary patency was 75% and 92.3, respectively. Though the differences were not statistically significant, probably because of the sample size, this pattern is in agreement with the recent studies. An example is given of a prospective study by Smith et al., which showed a much better primary patency in SFV conduits than LSV in a 60-patient population: the primary patency in 12 months was 80% versus 65% [13]. In the same vein, Jones et al discovered that SFV grafts were reported to be better in terms of long-term patency and reduced intervention rates in cases of salvage over saphenous conduits [14]. These results indicate that the increased caliber and the increased thickness of the wall of the SFV can be more resistant to intimal hyperplasia and repeated cannulation injury, which are the key factors of fistula survival [15]. Thrombosis was also noted in 25 percent of LSV patients as compared to 15.4 percent of SFV conduit

patients, and the formation of an aneurysm was observed in one LSV patient only. No difference was made between infection rates and donor site morbidity, and mild limb edema was noted in 15.4% cases of SFV [16]. These findings are consistent with the findings of Lee et al., who reported the same complication profile between LSV and SFV grafts, though SFV harvest was reported to be associated with a little earlier limb swelling than LSV, which did not lead to sequelae [17]. Interestingly, both groups in our study did not need reoperation, which can indicate a high level of attention to the correct surgical procedure and the selection of patients [18]. Our results are in line with a body of literature that has rapidly grown over the last five years to support that SFV conduits can provide similar or even superior results to conventional saphenous vein grafts. Patel et al. conducted a retrospective study and found better secondary patency with SFV grafts, which is explained by the excellent hemodynamic characteristics of the vein and a decrease in the stenosis propensity [19]. Conversely, Ramirez et al. did not find meaningful differences in the long-term outcomes, whereas they highlighted the complexity of the procedure and the worry of deep vein thrombosis has hampered the broad application of SFV [20]. Nonetheless, research papers such as that by Cheng et al. point out that using proper surgery skills and after surgery monitoring, SFV grafts are capable of producing excellent results with reasonable morbidity. LSV or SFV conduits must depend on patient-specific variables, including the quality of their veins, previous harvesting history, and comorbidities. Duplex ultrasonography is imperative in preoperative evaluation to select the conduit optimally to measure the vessel diameter effectively, gauge the vessel patency, and determine possible anatomical obstacles. LSV is inoptimal (possibly because of prior harvest of the vein, varicosities, or inappropriate caliber), then SFV is a good substitute that offers a desirable trade-off between patency and complications.

**Limitations**

The small sample size and single-centre design are the limitations of this study as they can influence the generalizability of the findings. The 12-month follow-up is short-term and limits its ability to assess long-term patency. Also, the selection bias might be brought about by non-randomized assignment. These findings need to be supported by larger, multicentre randomised studies with longer follow-up to optimise conduit selection.

**Conclusion**

The long saphenous vein is replaced by a superior patency with similar complication rates to the superficial femoral vein as a reliable hemodialysis access. Special attention should be paid to preoperative vein mapping and careful surgery. LSV is not sufficient, hence SFV must be used so that vascular access in ESRD patients remains durable and effective.

**Disclaimer:** Nil

**Conflict of Interest:** Nil

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**Authors Contributions**

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