Comparative study between superficial and deep cephalic vein of mature brachiocephalic arteriovenous fistula regarding easy needling and complications

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Objective
An accessible vascular access is of utmost importance for patients on hemodialysis. National Kidney Foundation Dialysis Outcome Quality Initiative has defined a criterion for a good functioning arteriovenous fistula (AVF) (Rule of 6). The purpose of this study was to evaluate the effect of depth of cephalic vein in mature brachiocephalic AVF regarding easy needling and puncture complications.
Patients and methods
A prospective cohort study was conducted on adult patients with end-stage renal disease with mature brachiocephalic AVF after fulfilling the inclusion and exclusion criteria over a 6-month follow-up period after creation of the access. They were allocated nonrandomly into two groups (superficial and deep mature cephalic vein with a cutoff value of 6 mm).
Results
During the study period, 50 patients were divided into two groups (A and B), with 25 patients in each group. Group A included 18 males and seven females, whereas group B included five males and 20 females. The mean age of patients in group A was 43.16±11.61 years, whereas in group B was 47.32±9.81 years. Diabetic patients represented 44% in both groups, whereas hypertensive patients represented 60 and 68% in groups A and B, respectively. No patients in group A experienced coronary artery disease, whereas only 4% in group B experienced coronary artery disease. Approximately 10% had history of previous AVF in both groups. Mean BMI in group A was 23.23±2.05, whereas in group B was 28.49±1.39, denoting that all patients in group B were overweight ($P<0.01$). There was a significant difference between two groups regarding depth all over the observation period ($P<0.01$), with no significant difference between the two groups regarding diameter and flow velocity. During follow-up, we found that there was a highly significant difference in complications in both groups during the dialysis procedure, being more in group B ($P<0.01$).
Conclusions
Deep-seated mature cephalic vein (>6 mm depth) is highly associated with overweight patients, with more liability of complications such as hematoma and needling difficulties than superficial one, suggesting the beneficial outcomes of vein superficialization whether one-staged or two-staged procedure for further large randomized studies.

Keywords:
brachiocephalic fistula, deep-seated cephalic vein, difficult needling

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Introduction

Chronic renal failure is one of the major medical conditions that affect humans. In the USA, there are ~50 000 cases of end-stage renal disease (ESRD) per year. Diabetes is the most common contributor to ESRD; more than 30% of cases of ESRD are ascribed primarily to diabetes. Chronic renal failure associated with hypertension causes about 23% of ESRD cases. ESRD causes 1.3% of all deaths in Egypt. A tremendous number of patients with ESRD require maintenance hemodialysis. These patients can approach comfortable and productive life whenever they have dependable and an uncomplicated vascular access for regular hemodialysis [1].

Dialysis is performed as a critical life support in acute or chronic kidney failure. It is a mechanical way to cleanse the blood and balance body fluid and chemicals when

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the kidney is not able to perform these essential functions [2].

Fistulas are usually performed in the forearm or the elbow. A fistula will take a number of weeks to mature, on average, perhaps 4–6 weeks. During treatment, two needles are inserted into the fistula, one to draw blood and one to return it [3].

The autologous arteriovenous fistula (AVF) is the accepted gold standard mode of repeated vascular access for hemodialysis in terms of access longevity, patient morbidity, and health care costs [4].

The native AVF is the vascular access of choice for patients who require hemodialysis; it lasts longer and is associated with fewer complications than other types of vascular access. For hemodialysis patients, these benefits translate into better quality of life and longer survival. Physicians involved in the construction and maintenance of vascular accesses for hemodialysis know that Doppler ultrasound is fundamental for identifying vessels that are suitable for creating an AVF (preoperative mapping) and for early detection of complications (surveillance) [5].

National Kidney Foundation Dialysis Outcome Quality Initiative (NKF-DOQI) introduced the following parameters as a definition for a good functioning AVF: vein diameter more than 6 mm, depth less than 6 mm from the skin, and blood flow of more than 600 ml/min [6].

There is an increasing prevalence of obesity in the community; as a consequence, it is expected that there will be increasing number of obese patients with chronic renal failure requiring hemodialysis, who will need a secondary procedure to improve the use of their hemodialysis vascular access [7].

Aim

The aim of this work was to evaluate the effect of depth of cephalic vein in mature brachiocephalic arteriovenous fistula (BCAVF) regarding easy needling and complications.

Patients and methods

Type of study: this was a prospective cohort study.

Study setting: the study was performed at Ain Shams University Hospitals and Ahmed Maher Teaching Hospital.

Study population: the study included adult patients with ESRD with mature BCAVF after fulfilling the inclusion and exclusion criteria over a 6-month follow-up period after creation of the access.

Inclusion criteria

The following were inclusion criteria:

(1) Well-functioning arm BCAVF.
(2) Deep-seated cephalic vein with a depth of more than 6 mm from the skin (proved by duplex scanning).
(3) Superficial mature cephalic vein with depth less than or equal to 6 mm from the skin.
(4) Mature cephalic vein with a minimum diameter of 6 mm through its length, with a flow velocity of more than 600 ml/min as assessed by duplex scan.
(5) Absence of associated peripheral vascular disease with palpable brachial, radial, and ulnar pulsation. Arterial diameter of more than 1.5 mm and arterial flow velocity of more than 40 ml/min.
(6) Absence of any cardiac problems that would be considered a contraindication for AVF creation such as heart failure.
(7) Adult patients (no pediatric age group was included in this study).
(8) Patients oriented to the procedure details, including its potential complications. A well-informed written consent approved by our IRB (institutional review board) was signed by the patients before the procedure.
(9) Patient ability and willing to come to regular follow-up visits.

Exclusion criteria

The following were the exclusion criteria:

(1) Patients refusing to participate in the study.
(2) Patients who were not anatomically fit for BCAVF owing to lack of a suitable autologous cephalic vein.
(3) Cephalic vein mapping with diameter less than or equal to 1.9 mm or presence of stenosis or thrombosis of cephalic vein.
(4) Arterial flow velocity of less than or equal to 40 ml/min.
(5) Patients with uncorrectable bleeding diathesis.
(6) Patients with cancer receiving chemotherapy.
(7) Patients with multiple myeloma.
(8) AVF that was not well functioning as detected by clinical examination or duplex assessment (low flow fistula, failure of fistula maturation, hypotensive patients, and patients having hand ischemia owing to steal phenomenon).

(9) Any suspicious signs of central venous stenosis or venous hypertension, for example, generalized upper limb edema.
(10) Dilated veins crossing from the upper limb to the chest wall.
(11) Congestive heart failure as defined by ejection fraction less than 30% or history of ventricular assisted device.

All patients fulfilling inclusion criteria were subjected to thorough history taking (patient's demographics, such as age, sex, and comorbidities; history of previous surgeries; history and number of central venous cannulation; and current medications), local and general examination, and full laboratory studies with special attention to bleeding profile. Duplex assessment was done for all cases after six weeks of AVF creation to assess the following: vein depth from the skin, vein diameter, flow volume through the AVF and the vein, and assessment of the outflow veins, including the great neck veins till innominate and superior vena cava.

Sample size: 50 adult patients with ESRD with mature brachiocephalic fistula were allocated nonrandomly into two groups:

Group A

It consisted of 25 patients having a mature brachiocephalic fistula with cephalic vein less than 6 mm deep from the skin.

Group B

It consisted of 25 patients having a mature brachiocephalic fistula with deep arm cephalic vein more than 6 mm deep from the skin.

Ethical considerations

Informed consent was obtained from all patients. Ethical committee approval was granted before initiating the study.

Study procedures

Patients were also evaluated for signs of pulmonary congestion (chest pain, dyspnea, orthopnea, and tachypnea) and heart failure (tender hepatomegaly, ascites, and bilateral lower limb edema); palpation of pulses: in the whole limb (axillary, brachial, radial, and ulnar); and Allen's test to assess dominant artery and adequacy of the palmar arch. Presence of central venous obstruction was evaluated through upper limb of facial edema or dilated neck or chest veins. BMI was recorded. Transmitted vein tapping was done to assess superficial venous patency.

Investigation

Duplex scanning of both upper limbs was done commenting on the following:

(1) Arterial system like flow velocity and diameter preoperatively and 6 weeks postoperatively.
(2) Deep venous system to evaluate patency of them.
(3) Superficial venous system, especially cephalic vein, commenting on flow velocity, diameter, and depth from skin preoperative and 6 weeks postoperatively.

Follow-up

The patients were followed up for the following:

(1) Functional success of AVF of both groups regarding successful cannulation.
(2) Complications such as thrombosis, infection, bleeding, and less thrill.
(3) Follow-up was done at 1, 3, and 6 months after 6 weeks of access creation.

Statistical analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences; IBM Armonk, New York, USA), version 21. Qualitative data were presented as number and percent. Comparison between groups was done by χ^2 test.

Quantitative data were presented as mean±SD. Student t test was used to compare between two groups. P value less than 0.05 was considered to be statistically significant. Patency whether primary or secondary was assessed using Kaplan–Meier curves.

Results

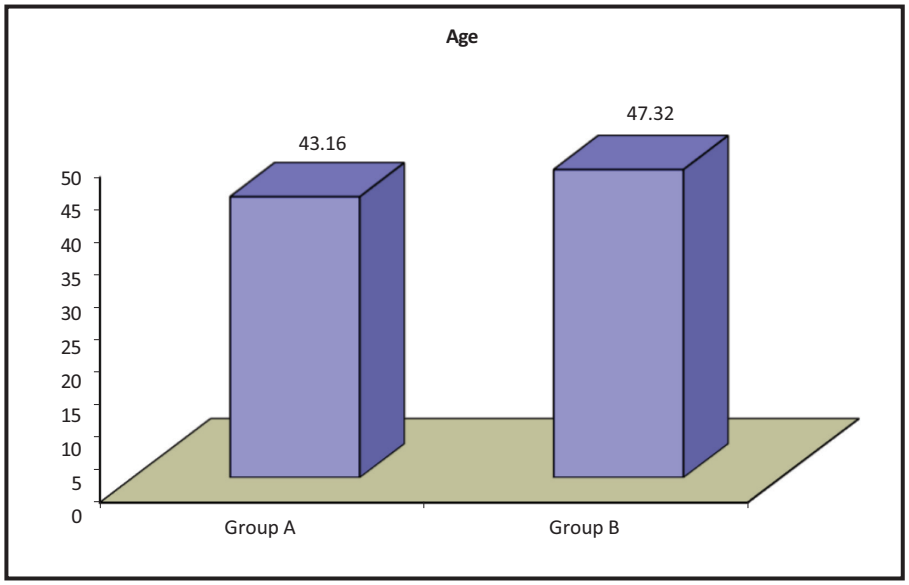
This prospective cohort study included 50 patients, who were divided into two groups (A and B), with 25 patients in each group. Group A included 18 males and seven females, whereas group B included five males and 20 females ($P<0.01$) who presented with chronic renal failure and were planned for BCAVF. We recruited patients who fulfilled the inclusion criteria during the period from November 2021 to July 2022. Age of patients in group A ranged from 20 to 55 years (mean=43.16±11.61), whereas in group B ranged from 20 to 55 years (mean=47.32±9.81) (Table 1 and Fig. 1).

Table 1 Demographic Data I

	Group A *N*=25	Group B *N*=25	Test value	*P* value	Significance
Age					
Mean±SD	43.16±11.61	47.32±9.81	−1.369•	0.178	NS
Range	20–55	20–55			
Sex [*n* (%)]					
Male	18 (72.0)	5 (20.0)	13.607*	0.000	HS
Female	7 (28.0)	20 (80.0)			

*χ^2 test. •Independent *t* test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S); *P* value less than 0.01: highly significant (HS).

Figure 1



Demographic Data I.

Regarding patients' comorbidities, diabetes was present in 44% of cases in both groups, whereas hypertension was present in 60% of patients in group A and in about 68% of patients in group B. No patients in group A experienced coronary artery disease (CAD), whereas only 4% in group B had CAD. Approximately 10% had a history of previous AVF in both groups (Table 2 and Fig. 2). Table 3 shows mean BMI in group A was about 23.23±2.05, whereas in group B was about 28.49±1.39, which means all group B patients were overweight ($P<0.01$) (Table 3 and Fig. 3).

Regarding laboratory investigation, mean hemoglobin in group A was about 9.64 g/dl, whereas in group B was about 9.68 g/dl; mean total leukocyte count in group A was about 5.96×10^3/µl and in group B was about 6.42×10^3/µl; mean platelet was about 315.92×10^3/µl in group A and in group B was about 323.92×10^3/µl; mean serum creatinine was about 5.73 mg/dl in group A and about 6.89 mg/dl in group B; and mean prothrombin time was about 13.32 s in group A and in group B was about 16.02 s, with no significant difference between both groups (Table 4).

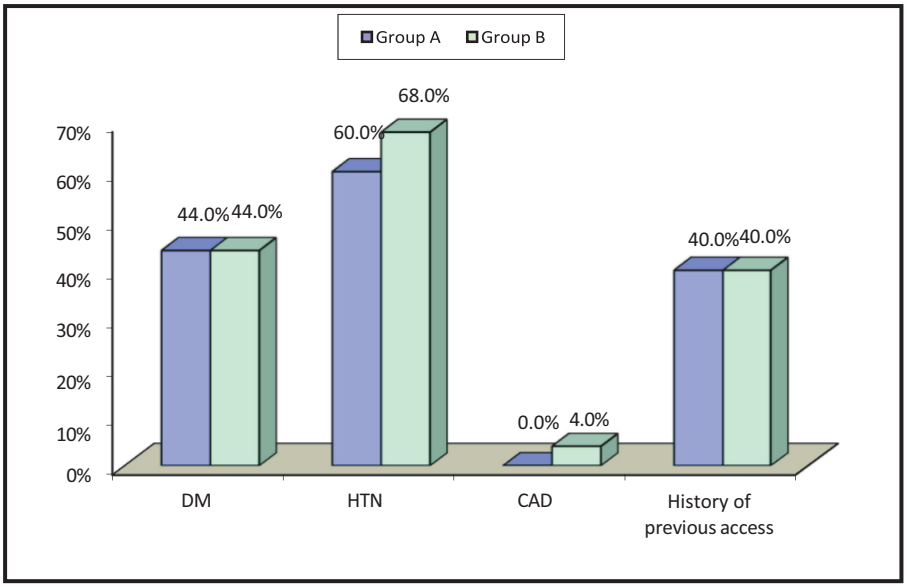
According to our study, mean arterial diameter in group A was about 3.38±0.51 mm, with mean flow velocity of 84.64±6.68 ml/s, whereas in group B was about 3.41±0.59 mm, with mean flow velocity of 82.94 ±5.93 ml/s. Preoperative venous diameter in group A was about 2.83±0.39 mm, ranging from 2.1 to 3.6 mm, and mean depth was 3.72±0.49 mm, ranging from 2.5 to 4.6 mm. However, in group B, preoperative venous diameter was about 2.77±0.66, ranging from 1.9 to 4.7 mm, and mean depth was about 13.02±2.02 mm, ranging from 8.8 to 18.82 mm. There was a significant difference between both groups regarding depth all over the observation period ($P<0.01$), with no significant difference between the two groups regarding diameter and flow velocity (Table 5 and Figs 4 and 5).

Table 2 Demographic Data II

	Group A [*n* (%)]	Group B [*n* (%)]	Test value*	*P* value	Significance
DM					
No	14 (56.0)	14 (56.0)	0.000	1.000	NS
Yes	11 (44.0)	11 (44.0)			
HTN					
No	10 (40.0)	8 (32.0)	0.347	0.556	NS
Yes	15 (60.0)	17 (68.0)			
CAD					
No	25 (100.0)	24 (96.0)	1.020	0.312	NS
Yes	0	1 (4.0)			
History of previous access					
No	15 (60.0)	15 (60.0)	0.000	1.000	NS
Yes	10 (40.0)	10 (40.0)			

CAD, coronary artery disease; DM, diabetes mellitus; HTN, hypertension. *χ^2 test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S); *P* value less than 0.01: highly significant (HS).

Figure 2



Demographic Data II.

During follow-up, we found that there was a highly significant difference in complications in both groups during the dialysis procedure ($P<0.01$), as at 1 month after maturation, difficult needling represented about 8% in group A, whereas it was about 80% in group B, and hematoma was found in about 4% in group A compared with 76% in group B. The rate of infection was high in group B by about 20%, which was treated with medical treatment, and there was no complication that led to thrombosis in both groups. At 3-month postmaturation follow-up, we found no complication in group A, whereas in group B, difficult needling was seen in about 84%, whereas hematoma was seen in 80% ($P<0.01$), which was treated by medical treatment, and the rate of infection was 12%. At 6-month postmaturation follow-up, difficult needling was still seen in about 84%, and hematoma was present in 80% ($P<0.01$). Although there was no infection, only one case was complicated by thrombosis, which was not treated, representing 4% (Table 6).

Discussion

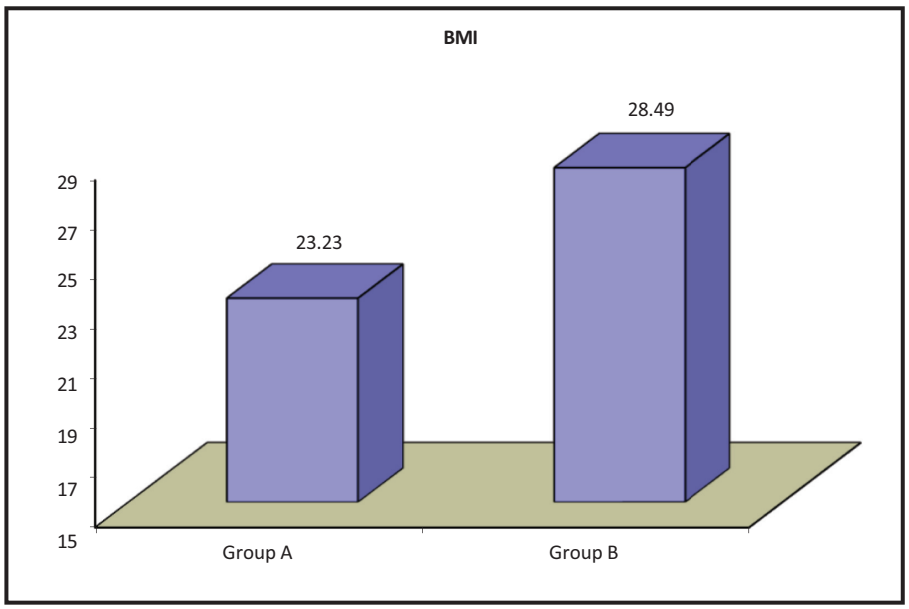
An accessible vascular access is of utmost importance for patients on hemodialysis. National Kidney Foundation Dialysis Outcome Quality Initiative has focused on the importance of autogenous AVF creation as the preferred primary option because of its fewer

Table 3 Body Mass Index & Vital Data

	Group A *N*=25	Group B *N*=25	Test value•	*P* value	Significance
Pulse					
Mean±SD	74.72±8.58	77.68±8.22	–1.246	0.219	NS
Range	58–88	60–90			
SBP					
Mean±SD	137.20±16.71	134.80±17.59	0.495	0.623	NS
Range	100–170	100–170			
DBP					
Mean±SD	76.00±8.66	76.40±8.10	–0.169	0.867	NS
Range	60–90	60–90			
T					
Mean±SD	37.04±0.44	37.05±0.34	–0.107	0.915	NS
Range	36.2–37.6	36.1–37.5			
RR					
Mean±SD	16.68±1.07	17.04±0.89	–1.295	0.202	NS
Range	14–19	16–18			
BMI					
Mean±SD	23.23±2.05	28.49±1.39	–10.614	0.000	HS
Range	20.2–30.35	25.8–31.14			

•Independent *t* test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S); *P* value less than 0.01: highly significant (HS).

Figure 3



Body Mass Index.

complications, better patency, and lower cost. The following parameters were suggested as criteria for a good functioning AVF: vein diameter more than 6 mm, with depth less than 6 mm from the skin, and blood flow of more than 600 ml/min [6].

Cephalic vein course runs superficial to the deep fascia, but sometimes the vein does not lie under the skin closely, especially in the arm; despite it being above the deep fascia, in some cases, the vein behaves as saphenous vein and has a fascial envelope from the underlying fascia. That is why the process of cannulation of the cephalic vein in such patients with thick subcutaneous fat in the upper limb will be difficult [8].

In our study, we evaluated effect of depth of cephalic vein in mature BCAVF, and after recruiting the

Table 4 Laboratory Studies

	Group A *N*=25	Group B *N*=25	Test value•	*P* value	Significance
HB (g/dl)					
Mean±SD	9.64±0.87	9.68±1.14	−0.153	0.879	NS
Range	7.5–11.8	7.7–11.5			
TLC (10^3/μl)					
Mean±SD	5.96±1.99	6.42±1.32	−0.955	0.345	NS
Range	3–10	3.9–10.3			
PLT (10^3/μl)					
Mean±SD	315.92±68.95	323.92±59.76	−0.438	0.663	NS
Range	200–455	200–450			
Esinophol (%)					
Mean±SD	4.36±1.98	4.24±1.92	0.218	0.829	NS
Range	1–8	1–8			
Urea (mg/dl)					
Mean±SD	120.82±24.84	130.70±30.76	−1.249	0.218	NS
Range	68–160	80–183.6			
Creatinine (mg/dl)					
Mean±SD	5.73±0.86	6.89±1.70	−3.045	0.004	HS
Range	4.4–7.6	4.1–10.5			
ALT (U/l)					
Mean±SD	25.16±10.43	24.50±15.39	0.177	0.860	NS
Range	10–50	10–60			
AST (U/l)					
Mean±SD	36.16±10.26	31.82±14.07	1.245	0.219	NS
Range	17–55	3.5–55			
PT (s)					
Mean±SD	13.32±1.73	16.02±2.00	−5.089	0.000	HS
Range	10–17	12–20			
Aptt (s)					
Mean±SD	34.20±4.39	35.40±4.11	−1.000	0.322	NS
Range	26–40	25–40			
INR					
Mean±SD	1.07±0.06	1.08±0.05	−0.792	0.432	NS
Range	1–1.2	1–1.16			
CRP (mg/l)					
Mean±SD	3.29±1.20	4.07±1.54	−1.996	0.052	NS
Range	1–6	1–6.4			

ALT, alanine aminotransferase; AST, aspartate aminotransferase; CRP, C-reactive protein; HB, hemoglobin; INR, international normalized ratio; PLT, platelet; TLC, total leukocyte count. •Independent *t* test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S); *P* value less than 0.01: highly significant (HS).

Table 5 BCAVF Duplex Records

	Group A *N*=25	Group B *N*=25	Test value•	*P* value	Significance
Preoperative arterial					
Diameter (mm)					
Mean±SD	3.38±0.51	3.41±0.59	−0.154	0.878	NS
Range	2.3–4.2	2.1–4.8			
Flow velocity (ml/s)					
Mean±SD	84.64±6.68	82.94±5.93	0.952	0.346	NS
Range	71.6–96.5	73.7–95			
Preoperative					
Depth (mm)					
Mean±SD	3.72±0.49	13.02±2.02	−22.400	0.000	HS
Range	2.5–4.6	8.8–18.2			

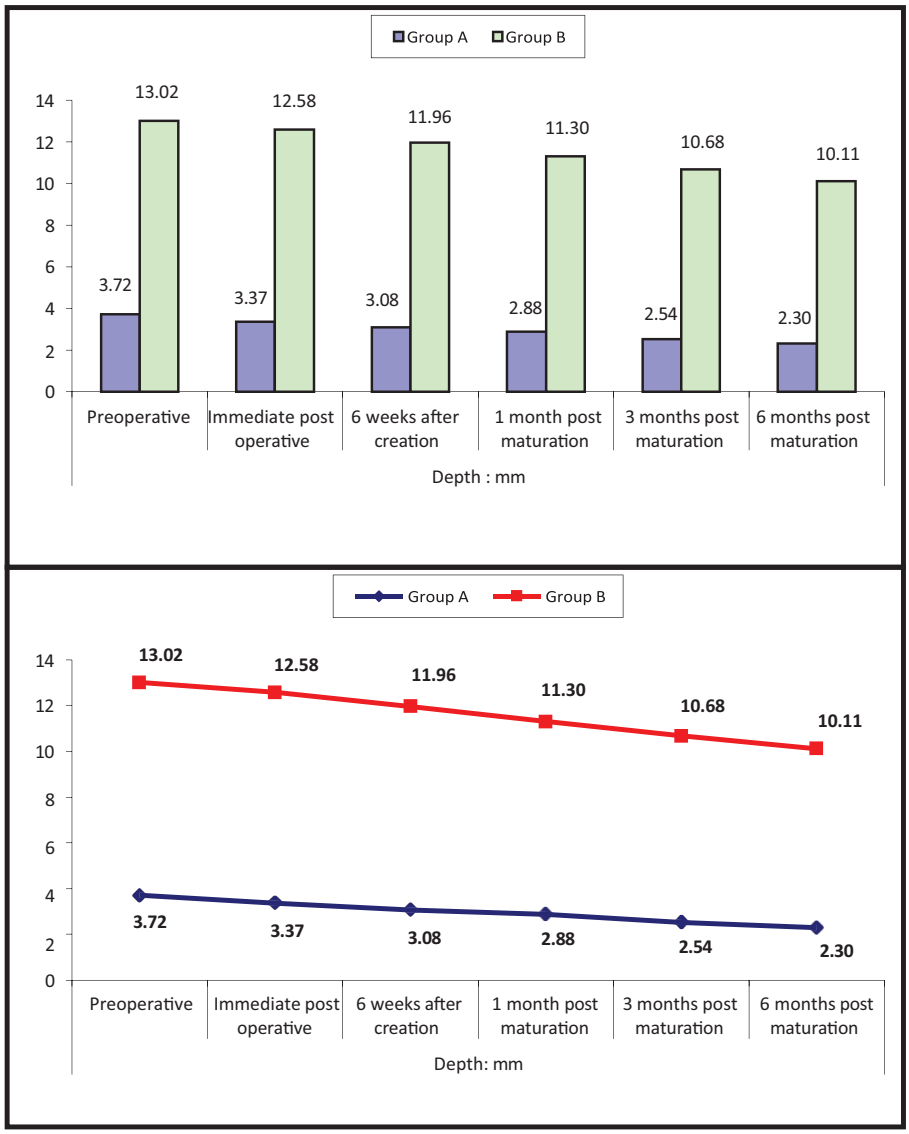
(*Continued*)

Table 5 (*Continued*)

	Group A *N*=25	Group B *N*=25	Test value•	*P* value	Significance
Diameter (mm)					
Mean±SD	2.83±0.39	2.77±0.66	0.419	0.677	NS
Range	2.1–3.6	1.9–4.7			
Immediate postoperative					
Depth (mm)					
Mean±SD	3.37±0.40	12.58±1.97	–22.926	0.000	HS
Range	2.5–4.4	8.2–17.4			
Diameter (mm)					
Mean±SD	3.42±0.44	3.26±0.58	1.041	0.303	NS
Range	2.5–4.5	2.4–5			
Flow velocity (ml/s)					
Mean±SD	171.64±17.63	161.56±20.76	1.851	0.070	NS
Range	140.2–210.1	96.4–192.25			
6 weeks after creation					
Depth (mm)					
Mean±SD	3.08±0.53	11.96±1.90	–22.490	0.000	HS
Range	2.3–4.2	7.7–17			
Diameter (mm)					
Mean±SD	6.32±0.25	6.23±0.14	1.542	0.130	NS
Range	6–7.1	6–6.5			
Flow velocity (ml/s)					
Mean±SD	646.48±31.87	637.80±33.67	0.937	0.354	NS
Range	600–695.6	600–695.57			
1 month postmaturation					
Depth (mm)					
Mean±SD	2.88±0.44	11.30±1.85	–22.141	0.000	HS
Range	2.1–3.6	7.2–15.9			
Diameter (mm)					
Mean±SD	6.93±0.29	6.77±0.36	1.731	0.090	NS
Range	6.3–7.5	5.6–7.3			
Flow velocity (ml/s)					
Mean±SD	718.35±26.17	717.57±38.76	0.084	0.934	NS
Range	670–775.15	650–798.9			
3 months postmaturation					
Depth (mm)					
Mean±SD	2.54±0.40	10.68±1.77	–22.401	0.000	HS
Range	2–3.4	6.9–15.4			
Diameter (mm)					
Mean±SD	7.48±0.30	7.34±0.73	0.934	0.355	NS
Range	6.9–8.1	5.1–8.5			
Flow velocity (ml/s)					
Mean±SD	795.55±33.26	786.71±40.17	0.847	0.401	NS
Range	730–855	720–850			
6 months postmaturation					
Depth (mm)					
Mean±SD	2.30±0.38	10.11±1.73	–22.067	0.000	HS
Range	1.8–3.1	6.5–14.9			
Diameter (mm)					
Mean±SD	8.44±0.25	8.12±0.99	1.573	0.122	NS
Range	8–9.1	5.1–9.3			
Flow velocity (ml/s)					
Mean±SD	824.14±28.26	822.04±42.27	0.206	0.837	NS
Range	771–856	740–900			

•Independent *t* test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S); *P* value less than 0.01: highly significant (HS).

Figure 4



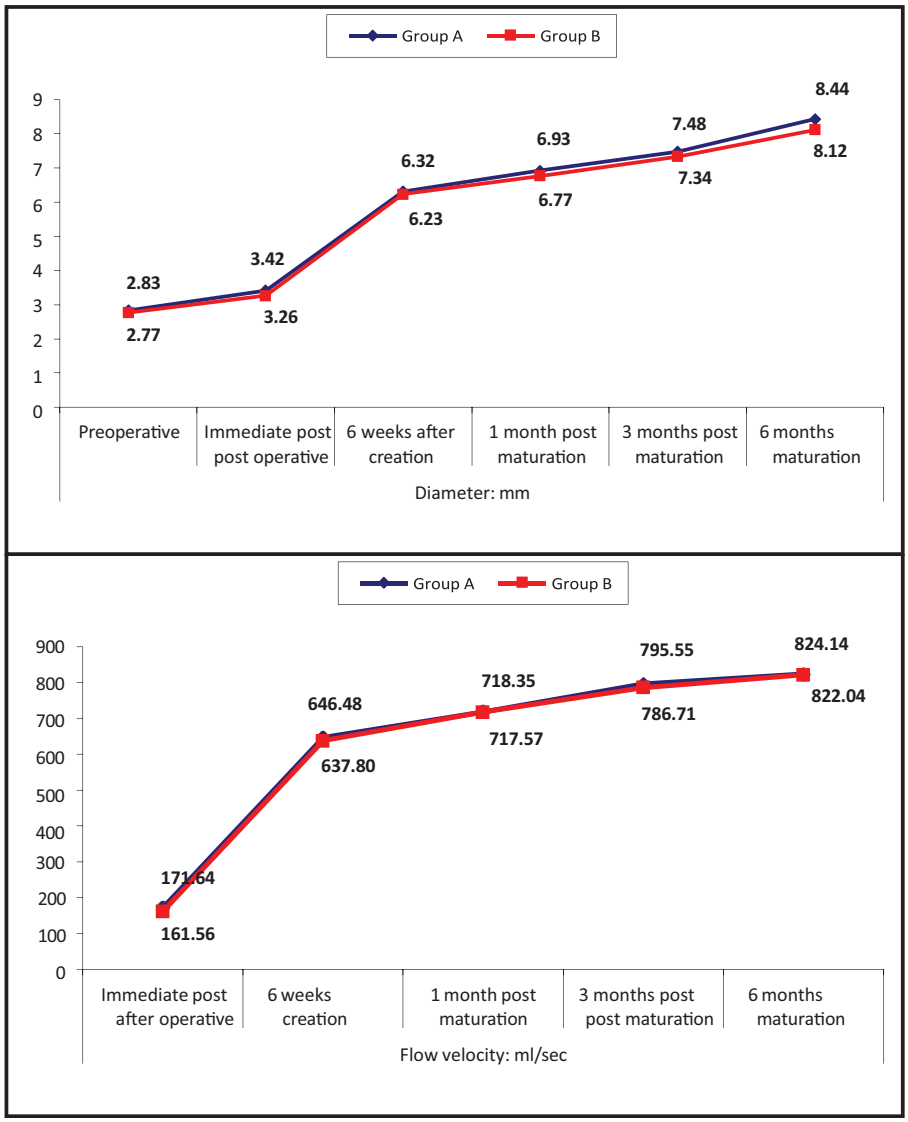
BCAVF's vein depth.

patients based upon cephalic vein depth into superficial and deep groups, we found that there was a nonsignificant difference between both groups regarding diabetes mellitus, hypertension, and CAD. In addition, there were nonsignificant differences between both groups regarding preoperative arterial and venous diameters and flow velocities as well as postoperative vein diameters and flow velocities.

Raulli *et al.* [9] evaluated the association between BMI and outcomes of different types of upper extremity AV access and found a significant difference in BMI in relation to diabetes mellitus and age, whereas there was no difference regarding sex, hypertension, and CAD. Moreover, Kats and colleagues compared outcomes of AVFs in obese (BMI $>30\,kg/m^2$) and nonobese (BMI$<30\,kg/m^2$) over a 2-year study and found that diabetes was more common in obese, whereas there was no significant difference among other comorbidities, age, sex, and diameter of arteries and veins whether forearm or upper arm fistulas [10]. In addition, Stoikes *et al.* [11] reviewed cases of inaccessible mature BCAVFs and those who achieved successful hemodialysis after superficialization and reported significant inaccessibility was more in females and less in hypertensive patients ($P<0.05$) in comparison with accessible mature BCAVFs.

In our study, we found that there were significant differences between both groups regarding mean BMI. We noticed that all patients of deep group were overweight patients, highlighting the effect of

Figure 5



BCAVF's vein diameter & Flow velocity.

Table 6 Complications

	Group A [*n* (%)]	Group B [*n* (%)]	Test value	*P* value	Significance
Complications at 1 months					
Difficult needling	2 (8.0)	20 (80.0)	26.299	0.000	HS
Hematoma	1 (4.0)	19 (76.0)	27.000	0.000	HS
Infection	0	5 (20.0)	5.556	0.018	HS
Thrombosis	0	0	NA	NA	NA
Complications at 3 months					
Difficult needling	0	21 (84.0)	36.207	0.000	HS
Hematoma	0	20 (80.0)	33.333	0.000	HS
Infection	0	3 (12.0)	3.191	0.074	NS
Thrombosis	0	0	NA	NA	NA
Complications at 6 months					
Difficult needling	0	21 (84.0)	36.207	0.000	HS
Hematoma	0	20 (80.0)	33.333	0.000	HS
Infection	0	0	NA	NA	NA
Thrombosis	0	1 (4.0)	1.020	0.312	NS

*χ^2 test. *P* value more than 0.05: nonsignificant (NS); *P* value less than 0.05: significant (S); *P* value less than 0.01: highly significant (HS).

BMI on depth of cephalic veins in comparison with superficial group patients ($P<0.01$).

This finding supports the results obtained while reviewing the available literature. Raulli *et al*. [9] found that obesity is associated with lower rates of AV access maturity within 6 months, with nonsignificant difference of BMI in relation to different types of AV access. Moreover, Kats and colleagues found that obesity was the only significant factor predicting secondary fistula failure. The primary failure rate (inability to ever use the fistula for dialysis, owing to technical failure, early thrombosis, or failure to mature) was similar between both groups. The secondary failure rate (fistulas that fail after being used successfully for dialysis) showed no difference between overweight and normal BMI, though the weight was higher in obese group in comparison with nonobese group ($P=0.004$) [10]. Moreover, Stoikes *et al*. [11] reported significantly higher BMI in inaccessible mature BCAVFs.

In our study, we found significant difference between both groups regarding hematoma and difficult needling, which highlights the possibility of superficialization procedure for more accessibility. These data are supported by other researchers. Raulli *et al*. [9] found nonsignificant difference between BMI categories and perioperative hematomas.

A study done by Chatterjee and Dabas had two cases: a 58-year-old female diabetic hypertensive, ESRD, and obese with BCAVF and other 58-year-old female diabetic hypertensive with ESRD with distal forearm radiocephalic arteriovenous fistula (RCAVF) after failure of previous wrist RCAVF in same arm. Both of them were referred owing to difficult needling after 10 weeks of creation of BCAVF and 12 weeks of creation of RCAVF, and duplex showed good velocity with good diameter of veins but deep-seated (12–14 mm) in case of BCAVF and (10–12 mm) in RCAVF. Superficialization was done for both, and both of them had good recovery. There were no wound complications, and sutures were removed on the 14th day. The fistula is functioning well after 6 months of follow-up [12].

Conclusion

Deep-seated mature cephalic vein (>6 mm depth) is highly associated in overweight patients with more liability of complications such as hematoma and needling difficulties than superficial one, suggesting beneficial outcomes of vein superficialization whether one-staged or two-staged procedure for further large randomized studies.

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Conflicts of interest

There are no conflicts of interest.

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