



# Effect of hydrostatic venous dilatation during creation of arterio-venous fistula on maturation of hemodialysis access

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## Abstract

**Background:** Objective of AV access creation is furnish an available vascular structure with enough blood stream that can be cannulated for satisfactory dialysis. Ultrasonographic assessment is considered a standard strategy for each medical procedure of AVF creation. It determines utilized AVF work monitoring, in post-operative period.

**Objective:** To review and discuss the advances of the effect of hydrostatic venous dilatation during intra operative arteriovenous fistula creation in end stage renal disease patients and its effect on maturation of the fistula guided by preoperative and postoperative Duplex assessment.

**Patients and methods:** This prospective study performed on 50 patients presented in vascular surgery department at, Al-Azhar university hospitals (Al-Hussin and Bab -Alsheryah Hospitals). Patients were monitored regularly in dialysis unit, data collected included patient demographics, comorbidities, any previous vascular access, type of anatomical site of current AVF, details of operative procedure exact expected time and functional maturation. Patient selectively directed surgical AVF creation with Estimated Glomerular Filtration Rate (e-GFR) <15.0 ml/min. referred from nephrology department AVF creation HD.

**Results:** At 6 weeks post operatively, mean vein diameter 6.4 mm at site of anastomosis, 6.23 6.1 mm at 3 and 10 cm proximal site of anastomosis respectively. Average vein diameter increased by 0.57 mm (15.5%) after hydrostatic dilatation, 3.23 (112.2%) after 6 weeks from intervention.

**Conclusion:** Production of effective AVF HD all together develop be adequate haemodialysis is influenced by various factors, most significant factor is distensibility of vein through percent of expansion in vein width not preoperative supreme vein measurement

**Keywords:** hydrostatic venous dilatation; Creation of arterio-venous fistula; Maturation of hemodialysis access

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## 1. Introduction

The native arteriovenous fistula (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. Doctors 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 complication (surveillance).<sup>1</sup>

Ultrasonography examination should become standard procedure introduced before every surgery of AVF creation .it should be used for AVF function and monitoring in the postoperative period.<sup>2</sup>

Patients with larger vein diameter on preoperative vein mapping are at lower risk for failure of fistula maturation and have increased longer-term AVF patency. Duplex ultrasound should be used to determine the minimum vein diameter (MVD) available for potential future fistula operations. Physicians can use the MVD measurement to have a discussion with patients about the potential success or failure of the fistula. MVD was the only clinical or demographic factor associated with both AVF maturation and long term patency.<sup>3</sup>

Preoperative vein diameter of more than 1.9mm and artery diameter of more than 1.5mm, as measured by Doppler ultrasound, have a successful maturation rate over 60% and are associated with an increase in maturation rate proportionate to increase in vein diameter in patients with ESRD.<sup>4</sup>

The goal of chronic hemodialysis access is to facilitate repeated access to the circulation

with minimal complications. Decisions surrounding the initial choice of chronic hemodialysis access are complex and should aim to maximizing the likelihood of providing a functional access within a reasonable period of time, minimizing complications during creation and access use while taking into consideration patient preferences. Although arterio venous (AV) fistula are the preferred form of dialysis access, they continue to have significant problems with both early and late failures.<sup>2</sup>

The main disadvantage of AVF are the high primary failure rates and that they are not immediately available for use. A maturation time of several weeks is needed to ensure safe annulation without compromising the survival of the access.<sup>5</sup>

Although there is a general agreement that AVFs should be placed as distally as anatomically possible, there is still controversy regarding which AVF is most appropriate for elderly people , considering the high primary failure rate of radio cephalic fistulae compared to brachia cephalic fistulae in this age group.<sup>6</sup>

Preservation of the vessels in the upper limbs (veins and arteries) by preventing the vein puncture of upper arm and forearm veins, preventing midline central venous catheter and peripherally inserted one, can contribute to the peripheral vein`s preservation for the future AVFS access.<sup>5</sup>

To avoid unsuccessful attempts, guidelines recommend preoperative duplex ultrasonography (DUS) and the use of vessels with diameter able to maintain enough blood flow and fistula maturation. DUS allows for observation of arterial diameter, vessel wall thickness, wall alterations, blood vessel course, and localization of any obstructive or

stenotic lesions present and can also perform a functional assessment. The 2012 European Renal Best practice guidelines suggest the use of DUS assessment in all patients being considered for vascular access formation.<sup>7</sup>

The aim of this work was to review and discuss the advances of the effect of hydrostatic venous dilatation during intra operative arteriovenous fistula creation in end stage renal disease patients and its effect on maturation of the fistula guided by preoperative and postoperative Duplex assessment.

## 2. Subjects and methods

This prospective study performed on 50 patients presented in vascular surgery department at, Al-Azhar university hospitals (Al-Hussin and Bab -Alsheryah Hospitals).

A convenience sample of patients suitable AVF creation fulfilling inclusion criteria recruited. A duplex scan should be done, immediately after AVF creation six weeks post-operative. Preoperative patency, depth, diameter flow velocity in both artery vein examined through duplex ultrasound recorded.

Patients were monitored regularly in dialysis unit, data collected included patient demographics, comorbidities, any previous vascular access, type of anatomical site of current AVF, details of operative procedure exact expected time and functional maturation.

Patient selectively directed surgical AVF creation with Estimated Glomerular Filtration Rate (e-GFR) <15.0 ml/min. referred from nephrology department AVF creation HD.

**Inclusion criteria:** Vein diameter more than 1.9mm, artery diameter more than 1.5mm,

age from 18 to 80 years old, and men and women.

**Exclusion criteria:** Vein diameter less than 1.9 mm, artery diameter less than 1.5 mm, peripheral vascular disease, Absent pulsation, the patient is unfit for surgery e.g congestive heart failure, inflammatory skin disorder in operation area, central venous obstruction, contracture elbow joint, and autoimmune disease (vasculitis).

### Study Procedures:

Full history was taken in details: patient's demographics, age, gender, comorbidities, history of previous surgeries, history number of central venous cannulation, current medications.

Full clinical examination of patients performed including assessment of skin condition in both upper limbs, arterial pulsation, transmitted vein tapping under proximal tourniquet, in addition ensuring that patient is able to lie flat during duration of procedure.

### General examination:

Vital signs was recorded to every patient (pulse, temperature, blood pressure respiratory rate).

Patients also were evaluated for signs of pulmonary congestion (chest pain, dyspnea, orthopnea, tachypnea) heart failure (tender hepatomegaly, ascites, bilateral lower limbs edema).

Palpation of pulses: in whole limb (axillary, brachial, radial, ulnar).

Allen's test assess dominant artery adequacy of palmar arch.

Presence of central venous obstruction evaluated through upper limb or facial edema or dilated neck or chest veins.

Body mass index (BMI).

Transmitted vein tapping assess superficial venous patency.

### Investigation:

**Routine investigations:** Lab investigations:

- CBC, random blood sugar, renal function tests, liver function tests, coagulation profile (PT, aPPT, INR), CRP.
- Radiological investigations: ECG and Chest X-ray.
- Specific Investigations.

**Duplex Scanning of both upper limbs done commenting on:**

- Deep venous system evaluate patency of vein.
- Superficial venous system (flow velocity, depth, diameter) pre-operative, immediately post-operative, 6 weeks post-operative.
- Arterial system (flow velocity, diameter) pre-operative, immediately post-operative, 6 weeks post-operative.
- Anatomical Land mark scanning:
- At designated site of vascular anastomosis (wrist –mid-arm–elbow).
- 3 cm proximal to it 10 cm proximal to it.

### Procedure:

- Patient was placed in supine position with designated arm prepped draped in usual sterile fashion.

- Regional/local anesthesia administrated.
- Identification and mobilization of 2 cm of radial artery and intended vein prepared.
- Segmental gradual hydrostatic dilatation of vein using heparinized saline injection under pressure while applying proximal tourniquet using manual injection (while occluding proximal vein outflow)with gradual increasing pressure till maximum dilation can be obtained.
- 1cm longitudinal arteriomy after obtaining proximal distal control.
- End to side/side to side anastomosis using continuous 6/0 proline sutures.

### Post-operative care follow up:

- Documented instruction about care of fistula at home, given on discharged patients, preventing operated arm veins usage sampling or cannulation, measuring blood pressure or wearing tight sleeve clothes or tight heavy jewelry on it.
- Patients educated palpate thrill before discharged from hospital. Also, instruct the patient if he notice any abnormalities as numbness, discoloration or coldness of fingers. Also training the patient different exercises as ball activity.
- Patients evaluated clinically through outpatient's clinic follow up visit at 1<sup>st</sup>, 4<sup>th</sup> 6<sup>th</sup> weeks post-operative radiologically at 6<sup>th</sup> week post-operative regarding depth, diameter flow velocity via DUS examination.

**AVF success considered by confirming maturation according KDOQI guidelines as follows:**

At 6 weeks post-operative, vein diameter should be 6mm, depth less than 6



mm from skin, flow velocity > 600ml/min (KDOQI, 2017).

### Statistical Analysis:

Statistical analysis conducted using SPSS X7 (SPSS, IBM, Chicago, IL, USA). Descriptive statistics used patient demographics, Chi square test used compared demographics between patients with failure of maturation those with completely mature AVF. T-test used compare means of percent increase in vein diameter following hydrostatic dilatation. Kaplan Meier curves plotted display time complete maturation. Trend line plotted display mean flow velocity in vein preoperatively, immediately post operatively, 6 weeks post operatively. P-values considered significant if < 0.05. Correlation curves also used explore relationship between percent increase in vein diameter following hydrostatic dilatation AVF maturation.

### 3. Results

A total of 52 procedures per med , 22 (42.3%) of patients males 30 (57.7%) females,21(40.4%) had history of previous vascular access procedures, 22 (42.3%) diabetic, 35 (67.3%) hypertensive, one (1.9%) patient had a history of ischemic heart disease not significantly interfering with over all cardiac function.Overall,11(21.2%) radiocephalic anastomosis done, 22 (42.3%)brachiocephalic,4(7.7%)single stage brachio-basilic vein transpositioning,15 (28.8%) two-stage brachio-basilic procedures. By 6 weeks, 48(92.3%) AVF successfully mature 4 (7.7%) failed mature (Table 1).

With regard baseline laboratory investigations, mean age 55.4 years, mean BMI 26.74, mean Hb 9.5, mean TLC 7.7, mean

BUN 113.53, mean creatinine 6,mean INR 1.11 mean CRP 3.55 (Table 2).

Mean preoperative arterial diameter 3.3 mm, mean depth 4.6 mm mean flow velocity 66.3 ml/sec. As vein measurements, mean preoperative vein diameter 2.8 mm at intended site of anastomosis, 3 mm at 3 cm proximal site of anastomosis,3.2 mm at 10 cm proximal site of anastomosis (Table 3).

Mean immediate post-operative vein diameter 3.4 mm at intended site of anastomosis, 3.6 mm at 3 cm proximal site of anastomosis 3.79 mm at 10 cm proximal site of anastomosis (Table 4)

Median increase in vein diameter after hydrostatic dilatation (immediately postoperative) 0.5mm (17.45%) at site of anastomosis, 0.5 mm (16.7%) 3 cm proximal to anastomosis 0.4 mm (11.75%) 10 cm proximal to anastomosis (Table 5).

At 6 weeks post operatively, mean vein diameter 6.4 mm at site of anastomosis, 6.23 6.1 mm at 3 and 10 cm proximal site of anastomosis respectively. Average vein diameter increased by 0.57 mm (15.5%) after hydrostatic dilatation, 3.23 (112.2%) after 6 weeks from intervention (Table 6).

**Table 1:** Descriptive statistics base line clinical data

		Number	Percent
Gender	Male	22	42.3
	Female	30	57.7
Diabetes	No	30	57.7
	Yes	22	42.3
Hypertension	No	17	32.7
	Yes	35	67.3
ISHD	No	51	98.1
	Yes	1	1.9
History of previousvascular Access	No	31	59.6
	Yes	21	40.4
Allen's test	Ulnar dominance	42	80.8
	Radial dominance	10	19.2
Type of operation	Radiocephalic	11	21.2
	Brachiocephalic	22	42.3
	Brachiobasilic 2stages	15	28.8
	Brachiobasilic single stage transpositioning	4	7.7
Fistula maturationat 6weeks	No	4	7.7
	Yes	48	92.3

**Table (2):** Preoperative baseline investigations

	Mean	SD
Age	55.39	14.49
BMI	26.74	3
Hemoglobin	9.5	1.44
TLC	7.68	2.64
PLT	257.93	108.57
BUN	113.53	36.87
Creatinine	6	2.65
AST	35.38	17.49
PT	13.58	0.94
PTT	32.15	5.37
	Median	IQR
Duration of Hemodialysis in days	180	833
Eosinophils	3.5	4
ALT	22.75	36.5
INR	1.11	0.2
CRP	3.55	6.3

**Table (3): Preoperative base line arterial venous measurements**

	Mean	SD
Preoperative arterial depth in mm At site of anastomosis	4.64	1.74
Preoperative arterial diameter in Mm at site of anastomosis	3.33	0.59
Preoperative arterial flow velocity in mm/sec at site of anastomosis	66.3	17.2
Preoperative vein depth in mm at Site of anastomosis	3.22	1.6
Preoperative vein diameter in Mm at site of anastomosis	2.81	0.47
Preoperative venous flow velocity in mm/sec at site of anastomosis	6.6	2.45
Preoperative vein diameter in mm 3 cm proximal to anasto mosis	3	0.49
Preoperative venous flow velocity in mm/sec 3 cm proximal to anasto mosis	5.96	2.01
Preoperative vein diameter in Mm 10 cm proximal to anastomosis	3.24	0.57
Preoperative venous flow velocity in mm/sec 10 cm Proximal to anastomosis	5.57	1.76
Preoperative vein depth in mm 3 Cm proximal to anastomosis	3.2	0.68
Preoperative vein depth in mm 10 Cm proximal to anastomosis	3.4	0.54

**Table (4): Venous measurements immediately postoperative**

	Mean	SD
Immediately post-operative vein depth in mm at site of anastomosis	3.74	1.16
Immediately post-operative vein diameter in mm at site of anastomosis	3.4	0.46
Immediately Post-operative venous flow velocity in mm/sec at site of anastomosis	111.1	48.01
Immediately Post-operative vein Dia diameter in mm 3 cm proximal to anastomosis	3.6	0.45
Immediately Post-operative venous flow velocity in mm/sec 3 cm proximal to anastomosis	104.78	49.41
Immediately Post-operative vein Diameter in mm 10 cm proximal To Anastomosis	3.79	0.56
Immediately Post-operative venous flow velocity in mm/sec 10 cm proximal to anastomosis	98.71	19.53
Immediately Post-operative vein Depth in mm 3 cm proximal to anastomosis	3.1	0.53
Immediately Post-operative vein Depth in mm 10 cm proximal to anastomosis	3.85	0.61



**Table (5): Increase in vein diameter at site of anastomosis, 3 and 10 cm proximal it along different intervals**

Variable	Mean	SD
Increase in vein diameter in mm 6 weeks post operatively at site of anastomosis compared initial		
Vein diameter preoperatively		
	3	0.84
Percent of increase in vein Diameter 6 weeks post operatively at site of anastomosis compared initial vein diameter preoperatively	92.21%	34.83
Increase in vein diameter in mm 6 weeks pos peratively 3 cm proximal to anastomosis compared initial vein diameter		
preoperatively		
	2.64	0.85
Percent of increase in vein diameter 6 weeks post operatively 3cm proximal to anastomosis compared initial vein diameter preoperatively		
	76.16%	30.42
Increase in vein diameter in mm 6 weeks post operatively 10 cm proximal to anastomosis compared initial vein diameter Preoperatively		
	2.32	0.93
Percent of increase in vein diameter 6 weeks post operatively 10 cm proximal to anastomosis compared initial vein diameter Preoperatively	64.93%	31.18
Increase in vein diameter in mm 6 weeks post operatively at site of anastomosis immediately post operative compared vein diameter at site of anastomosis 3 Weeks post operatively		
	3.03	0.78
Percent of increase in vein diameter 6 weeks post operatively at site of anastomosis immediately post operative compared vein diameter 3 Weeks post operatively		
	92.77%	33.65
Increase in vein diameter in mm 6 weeks post operatively 3 cm proximal to anastomosis immediately post operative compared vein diameter 3 Weeks post operatively		
	2.68	0.78
Percent of increase in vein diameter 6 weeks post operatively 3 cm proximal to anastomosis immediately post operative compared vein diameter 3 Weeks post operatively	77.26%	29.12
Increase in vein diameter in mm 6 weeks post operatively 10 cm proximal to anastomosis immediately post operative compared vein diameter 3 Weeks posperatively		
	2.36	0.84
Percent of increase in vein diameter 6 weeks post operatively 10 cm proximal to anastomosis immediately post operative compared vein diameter 3 Weeks post operative		
	66.20%	31.18
Variable	Median	IQR



Increase in vein diameter in mm after hydrostatic dilatation at site of anastomosis immediately Weeks post operative	0.5	0.4
Percent of increase in vein diameter after hydrostatic dilatation at site of anastomosis post operative	17.45%	16.9
Increase in vein diameter in mm after hydrostatic dilatation 3 cm proximal to anastomosis Immediately post operative	0.5	0.4
Percent of increase in vein diameter after hydrostatic dilatation 3 cm proximal to anastomosis immediately post operative	16.70%	19.5
Increase in vein diameter in mm after hydrostatic dilatation 10 cm proximal to anastomosis Immediately post operative	0.4	0.4
Percent of increase in vein diameter after hydrostatic dilatation 10 cm proximal to anastomosis immediately post operative	11.75%	18.6

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**Table (6): Venous measurements 6weeks post-operative**

	Mean	SD
6 weeks post operative vein depth In mm at site of anastomosis	3.225	0.93
6 weeks post operative vein diameter in mm at site of anastomosis	6.4	0.67
6 weeks post operative venous flow velocity in mm/sec at site of anastomosis	662.51	105.48
6 weeks post operative vein depth in mm 3 cm proximal anastomosis	2.83	0.95
6 weeks post operative vein Diameter in mm 3 cm proximal anastomosis	6.23	0.74
6 weeks post operative venous flow velocity in mm/sec 3cm proximal anastomosis	635.32	103.09
6 weeks post operative vein depth in mm 10 cm proximal anastomosis	3.13	1.11
6 weeks post operative vein diameter in mm 10 cm proximal anastomosis	6.1	0.72
6 weeks post operative venous flow velocity in mm/sec 10 cm proximal anastomosis	618.68	104.63



#### 4. Discussion

Objective of AV access creation is furnish an available vascular structure with enough blood stream that can be cannulated consistently licenses at its factory dialysis.

Mission locate dependable boundary that can anticipate effective result of an AVF has been perseveringly sought after by vascular specialists, owing delicacy of method, delicacy of patients, critical need an unswerving vascular access dialysis. Significance of total preoperative vein breadth as a predictor result has been concentrated by a few examination ventures, discussion with respect to cut-off worth tended to by KDOQI rules at first in 2016, suggesting base vein distance across of 2.5 mm, give an essential patency going from 63% 76%.<sup>8</sup>

We saw that few attributes must be available an AV access be usable haemodialysis) Incorporate openness while tolerant is situated; capacity dependably consistently cannulate access, which requires as hallow access that is straight an enough length satisfactory blood stream, use during cannulation. This require a vein profundity < 6 mm, distance across > 6 mm stream speed >600 ml/min concurring KDOKI rules.

In our investigation, all together kill p perplexing factors, negligibly acknowledged preoperative vein width 2 mm subsequent to affirming communicated tapping through clinical assessment.

Our seeing factors disappointment expressed in KDOQI rules female sexual orientation, mature age, the fitness, presence of comorbidities, for example, coronary illness fringe vascular infection.<sup>9</sup>

In our investigation, none of mentioned predictors actually fundamentally extra ordinary between effectively developed bombed bunches or than stoutness which likewise reflected by expanded vein profundity female sex which

more in bombed gatherings, both can be viewed as jumbling factors in results.

In presence of comorbidities, for example, diabetes hypertension a significant factors that influence AVF patency.<sup>10, 11</sup> In our examination both diabetes hypertension have no critical effect on AVF fruitful development.

Vascular issues influencing access creation are almost certain be venous than blood vessel. veins of furthest point are habitually object of iatrogenic injury because of vene puncture or focal venous access. Likewise, a few examinations show that some basic variations from the normal can happen in patients with end-stage kidney illness free of any arterio venous access medical procedure.<sup>12</sup> Access vein width is characterized as internal breadth of vein in real or forth coming cannulation zone.<sup>13</sup>

More examinations zeroed in on venous blood vessel stream rates both preoperatively intra operatively, vein course distance across, working specialist qualities as predictors of result in AVF creation development.<sup>10, 14</sup> Zeroed in on vein stream volume estimation as a predictor AVF fruitful development when estimated 10 perioperative AVF creation report limit of 120-160 ml/sec as a predictor of disappointment of AVF develop.<sup>15</sup> In our investigation estimating stream volume perioperative has no impact on fistula disappointment develop, which interfere that stream volume doesn't get upper high over vein width. That, follow up of AVF development across initial a month and a half post-operative isamary.

In our examination One of most significant factors that anticipate fistula development is increment in vein width not supreme vein measurement impact of intraoperative hydrostatic expansion on increment vein distance across utilizing duplex US look at vein conduit before AVF creation, promptly postoperative a month and a half post-

employable beginning haemodialysis from recently made AVF.

Formation of an AVF brings about progression of high-pressure blood from blood vessel in flow in venous out pouring. This makes a divider shear pressure (equal vein divider) that is along these lines remunerated by vein luminal measurement increment, what's more average hyperplasia accordingly increment in vertical weight applied vessel divider.<sup>16</sup>

All together this be achievable, vein divider versatility dispensability must be sufficient permit such expansion in width. Thus, territories of venous fibrosis or stenosis following vein puncture or thrombophlebitis contrarily impact AVF achievement. This is the reason our investigation zeroed on level of expansion in vein measurement rather than out right vein distance across after dilatation.

With respects intra operative procedures, a few specialists resortre AVF dilatation during careful creation regularly utilizing tests correspond this with better result.<sup>16</sup> Through essential on table routine inflatable helped development with obscure after effects of patency going from 85% 100%.<sup>17</sup>

Despite the fact that there is no agreement on most fitting method intra operative administration of little type or non-distensible veins, owing potential intricacies of any of mentioned strategies, point of our investigation is anticipate if ordinary of those procedures is demonstrated.

Just investigation discovered location increment in vein distance across following arterio venous fistula creation distributed by Manne et al.<sup>11</sup>, where preoperative day 1 post-operative vein widths estimated through duplex at site of anastomosis, contrast between effectively developed bombed bunches discovered be factually critical

Our examination any way dependent on thought of vein divider versatility conmmability along entire length of vein disappointment of an AVF develop doesn't rely solely upon vein dispensability at site of anastomosis; as needs be, vein width estimations taken at various lengths from anastomosis. Also, our examination point is give an intraoperative appraisal of vein dispensability as a predictor achievement, all together retreat adjuvant strategies, for example, essential inflatable helped development ordinary event, repositioning of AVF in an alternative in earlier perming arteriotomy given that vein doesn't display adequate expansion in width following hydrostatic dilatation ,vein breadths estimated intraoperative.

Shockingly, most notice able touch vein site in which estimation of expanded vein dilatation is solid discovered be 3 cm proximal site of anastomosis, rather than site of anastomosis itself.

This finding can most likely be described certainty that an extensive portion of vein periphery at site of anastomosis is burned-through in arrangement of stitches in an everted manner. Moreover, strategy utilized hydrostatic dilatation in our investigation through infusing heparinized saline under tension with consecutive manual proximal venous impediment at variable good ways from venotomy.

This methodology renders expected site of anasmosis least possibility dispensability asanin significant working length of cannulautilized in infusion can't be enlarged through hydrostatic dilatation, thusly would not show gigantic dilatation through duplex promptly post operatively.

## 5. Conclusion

Production of effective AVF HD all together develop be adequate haemodialysis is influenced by various factors, most significant

fatocr is distensibility of vein through percent of expansion in vein width not preoperative supreme vein measurement.

Estimating distensibility of vein through percent of vein breadth increment after intraoperative hydrostatic dilatation can be an extensive predictocr AVF effective development rather than vein width, most un mistakable delicate vein site in which estimation of expanded vein dilatation is solid discovered be 3 cm proximal site of anastomosis, rather than site of anastomosis itself.

Increment in normal vein breadth by 0.45 mm (15.5%) after hydrostatic dilatation is a predictor fruitful AVF development.

This gives an in situation about capacity of vein divider stretch accordingly divider shear pressure at last arrive at an adequate distance across use as a vascular access dialysis. Bigger scope examines are required affirm finding close a more touchy cut off percent of vein dilatation for seeing fruitful AVF development.

**Conflict of Interest:** None

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