

## Techniques in Vascular Access

This outstanding article by Dr. Ingemar Davidson and Carmen Bartsch, RN is the first in a series of articles on technical aspects in the creation and management of vascular access patients. The aim of this series is educational: nurses, doctors, surgeons, radiologists want practical and hands on advice, something they can relate to and apply the next day in their daily clinical practice, in the operating room or in the radiological suite. The format includes a case report, which highlights real problems and stimulates the interest of the reader. Dr. Davidson chooses to deliver his message following this outline: 1) Present pertinent medical history of the **problem(s)** in the specific patient; 2) Outline the **treatment options**; 3) Tell **what was done and why**; 4) Report the **outcome**, and finally 5) a **comment** section summing up issues related to the technique described in the case report. We thank Dr. Davidson for his availability to publish in the Journal of Vascular Access this article, which will be part of an important future educational material describing patients with specific problems in the creation of vascular access and their solutions. Wichtig Editore will produce and distribute this educational work in a series of CDs.

*Call for papers: we welcome contributions describing techniques in vascular access. The format of the articles may be similar to the one chosen by Dr. Davidson or restricted to short technique description. Proposals of titles can be sent to the following address: [maurizio.gallieni@fastwebnet.it](mailto:maurizio.gallieni@fastwebnet.it) Before accepting the commitment to write the article, the editor will confirm that the specific technique has not been already described or reserved by other authors.*

**Maurizio Gallieni**  
Managing Editor

# Basilic Vein Transposition

## A case report with contra-lateral removal of a large A-V fistula

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### INTRODUCTION

Increasing the prevalence of arterio-venous fistulae (AVF) over synthetic grafts is critical for decreasing the patient morbidity and controlling costs of dialysis. This is highlighted in the guidelines set forth by The National Kidney Foundation - Kidney Disease Outcomes Quality Initiative (NKF K/DOQI), which encourage the increased use of autogenous veins in dialysis access creation.

The basilic vein in the upper arm is usually of relatively large caliber and has been called the "hidden" vein because it is not visible by simple inspection or palpation. Therefore, it has escaped the damage inflicted by previous repeated veno punctures.

In cases of small or missing cephalic vein in the upper arm, a suitable basilic vein is often detected by duplex scanning and used as an access site, creating a native brachial artery-basilic vein AV fistula.

The transposed basilic vein AV fistula is technically feasible in many cases, even in patients with multiple previous access surgeries. This underused basilic vein procedure should be considered before placement of polytetrafluoroethylene grafts for long-term dialysis vascular access.

We describe here a case detailing the technique of the basilic vein transposition in a patient with a large contralateral AV fistula with central vein occlusion, resolved with a two stage surgical solution.

### PATIENT HISTORY/PROBLEM

The patient is a 42-year old man on dialysis since the early 1990s. He was sent to the Hospital Dialysis Access Clinic because of concerns with the enlarging left upper arm brachio-cephalic arterio venous fistula (AVF). There is no pain, or dis-

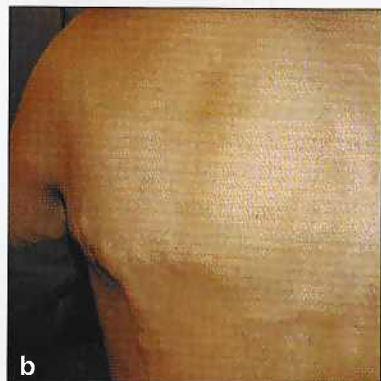
comfort other than some cosmetic concerns. The dialysis treatments proceed without problems. Figure 1 depicts the external impression of this enormous left upper arm brachio-cephalic AVF. The chest wall is covered with dilated venous collaterals. Also, the left external jugular vein is distended. All of these veins appear to drain into the right side of the chest. The clinical impression is a stenosis or more likely an occlusion of a left major central intra-thoracic vein. The dilated external jugular (EJ) vein also suggests an occlusion proximal to the subclavian vein (Fig. 1a).

### FINDINGS ON EXAMINATION

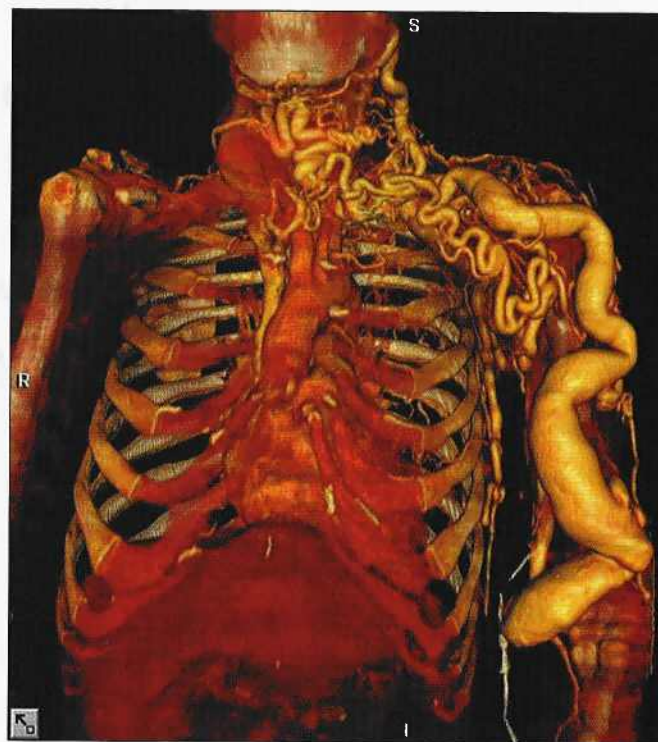
On further examination this left huge upper arm AVF is found to have a "hammer" pulse which is expected from the venous outflow resistance. There are no deteriorating skin changes (as often seen in similar cases at the repeat needle punctures sites in the aneurysmatic areas).

In fact the entire left upper torso is covered with venous collaterals. All of these dilated veins seem to drain into the right chest. No veins are seen on the right chest wall. Again other than cosmetic reasons, patient has no pain or discomfort from this condition. Figure 1b shows the patient's back with numerous dilated veins.

Based on the clinical impression, the patient was referred to the interventional radiology department for exact anatomical diagnosis and also for possible correction with balloon angioplasty. A CT angiogram showed a complete occlusion of the left innominate vein (Fig. 2). Despite time-consuming attempts, a guide-wire could not be passed across the occlusion and the patient was sent back to surgery for further management.



**Fig. 1 - a)** Initial presentation showing a left brachio-cephalic AVF with outflow obstruction. **b)** Even the left back is covered with dilated collateral veins.



**Fig. 2 -** The CT angiogram of the AVF and central vein confirms a left central (innominate) vein missing. Numerous large left chest vein collaterals are draining into the right chest.

## MANAGEMENT OPTIONS

The patient did not return for clinic appointments and was lost to follow-up for one year. As he returns, the left upper arm brachio-cephalic fistula has continued to grow. The dialysis treatments are carried out without problems. There are still no pain or skin changes (Fig. 3).

It is now obvious to the treating team as well as to the patient that this fistula eventually will fail, and will have to be surgically removed. It may thrombose in which case the entire AVF will become hard and often within days inflamed. This situation usually requires urgent surgical intervention and the need for a dialysis catheter insertion. The current management options in this patient are to:

1. Place a right internal jugular (IJ) dialysis catheter and excise the large AVF. The right subclavian vein and the internal jugular vein are patent as per duplex Doppler. The flow pattern fluctuates with breathing and augments with compression of his right arm.



**Fig. 3 -** This image shows the patient 12 months after the one in Fig. 1. The proposed new basilic vein transposition fistula (option 2) is marked on the right upper arm.

2. Find a new surgical site for hemodialysis access. Then remove the left large AVF, when this new access is being successfully used for dialysis.
3. Consider peritoneal dialysis. The patient does not want an abdominal catheter; besides he has an upper midline surgical scar (as seen in Fig. 3) from remote trauma surgery.

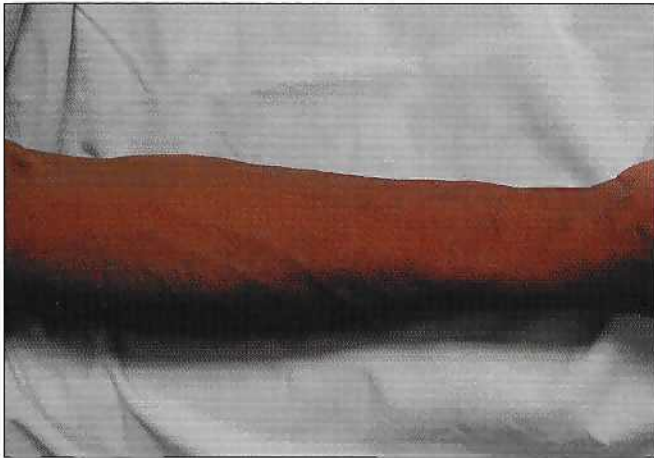


Fig. 4 - There is no consistent right forearm main cephalic vein; this is likely thrombosed from past venopunctures.

4. Do nothing at this point. Since he is doing fine on dialysis and the current concern is mainly cosmetic, just wait for an urgent situation to develop and deal with it at that time.

The right forearm displays a common finding in an individual who has been around medical institutions for a chronic disease. There is no continuous right forearm cephalic or basilic vein. Multiple collaterals are present as a result from past IVs and needle puncture blood draws (Fig. 4).

#### THE BASILIC VEIN TRANSPOSITION PROCEDURE

The right upper arm basilic vein is consistently visible and palpable from upper forearm to the axilla. This venous anatomy in a thin man makes this patient ideal for teaching purposes (Fig. 5).

By duplex Doppler examination the basilic vein joins the brachial vein high up in the axillary region and measures 6-7 mm in diameter. Again, the right central veins are patent including the superior vena cava, as we also learned from the previous central venogram and balloon angioplasty attempt. The basilic vein will be mobilized into the antecubital fossa (where it becomes the median antecubital vein) and divided at the (X). At this point a diving branch (vena communicantes) usually connects to the deep veins along the brachial artery.

The patient is now scheduled for a right upper arm basilic vein transposition in an outpatient setting (Fig. 6). This otherwise stable man can undergo general anesthesia. However, supraclavicular or axillary regional nerve block anesthesia is the preferred anesthesia for the majority of upper extremity vascular access surgery cases. When this new

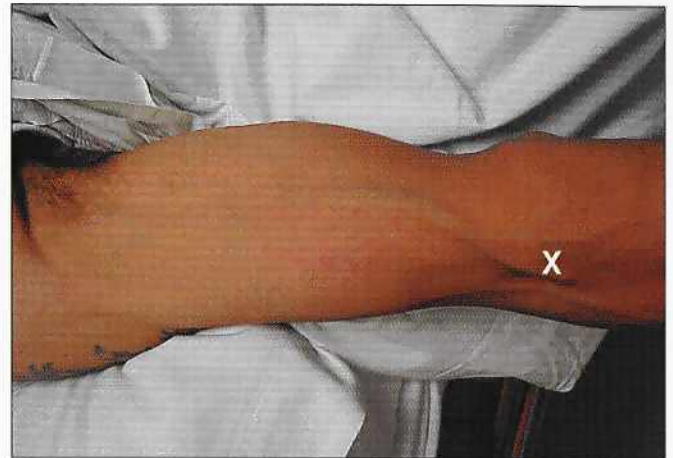


Fig. 5 - This image shows the right upper arm with the basilic vein visible from upper forearm to the axilla.



Fig. 6 - Patient in the Preop holding area with the left upper arm marked for basilic vein transposition.

right upper arm AVF has matured after 4-6 weeks, the left gigantic AVF will be excised (See Figures 16-18). The right upper arm basilic vein (skin incision line) and the proposed transposed position are marked (Fig. 6).

This image was taken in the day surgery preoperative holding area. The left upper AVF is slightly larger than a year earlier as it appears in Figure 1.

Figure 7 depicts a close-up of the preoperative proposed location of the transposed basilic vein. Skin incision will be made along the marked basilic vein. Also the intended transection of the basilic vein (or rather the median antecubital vein) at the antecubital fossa is shown at (X). The extension below the antecubital fossa as in this case is helpful to obtaining sufficient length of the basilic vein to make the loop long and wide enough to facilitate dialysis needle punctures.

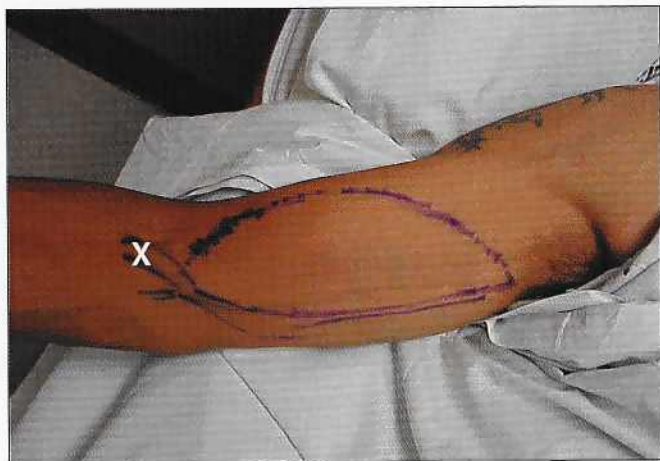


Fig. 7 - Close-up image of the right upper arm now marked for the basilic vein transposition procedure. The X marks the intended division site of the median antecubital vein.

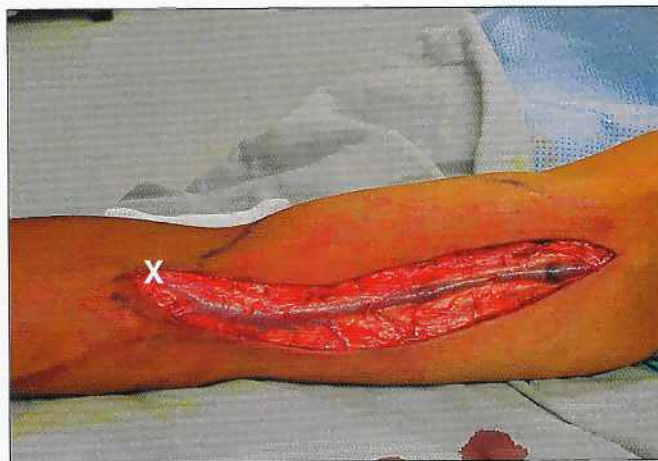


Fig. 8 - This image shows the exposed right upper arm basilic vein. Several side branches faintly visible will be suture-ligated towards the basilic vein.

#### DETAILED SURGERY STEPS

**Position of the patient** is important for the surgeon's comfort in order to prevent awkward standing, sitting or semi standing positions during the often 1.5-2 hour long surgery. The author recommends the use of an arm board table with a stabilizing leg preventing movements should an assistant suddenly decide to lean or rest his/hers arms on it during a critical surgical step. The arm is placed mid way on the table to optimize the surgeon's and the assistant's comfort (and safety of the surgery itself). The patient is positioned as lateral as possible on the operating room table, again to optimize the surgeon's access to the field. This is especially crucial when operating in the axilla as in this case, part of the time. For this patient position matters to be effectively and consistently implemented, the surgeon or a dedicated assistant must be present during this initial phase of the surgery setup. Cooperation from the anesthesia team is of course of paramount importance.

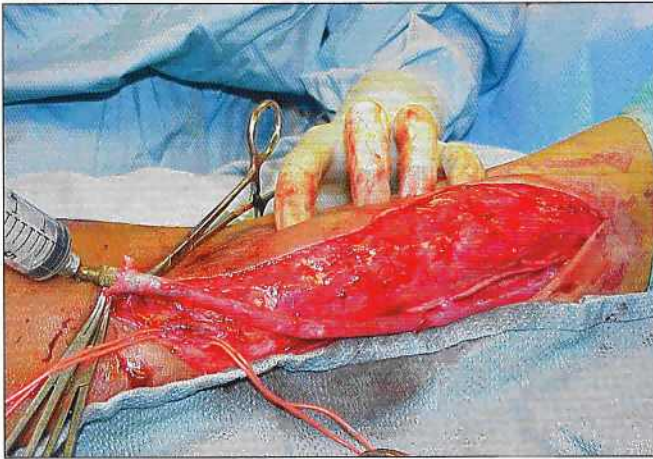
**Skin incision.** The skin is to be marked in the pre-operative holding area based on findings at the duplex Doppler examination. Ideally the surgery takes place within 24-38 hours after duplex Doppler examination and the skin marks are still present or only have to be enforced. Incision may begin in the sub axillary region or at the elbow level, depending on local anatomical circumstances, guided by the duplex Doppler findings. The author tends to start in one area and extend the skin incision as the basilic vein length is increasingly exposed (Fig. 8).

At the onset, when the basilic vein is found and surrounded with a soft rubber loop, make sure the vein exposed is indeed the basilic vein. One may easily get lost, especially in obese individuals.

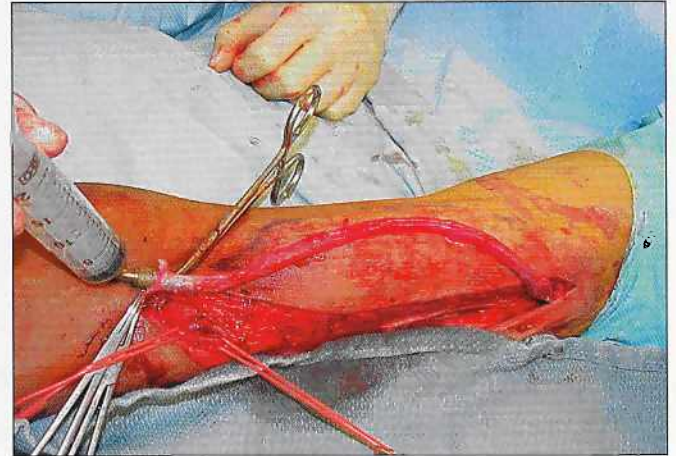
As the dissection proceeds, side branches become exposed; the smaller ones are ligated (with 5-0 or 4-0 Vicryl). There are uniformly large connecting branches to the brachial veins at different levels. Also, there is a consistent branching usually about 4-6 cm above the antecubital fossa. (The medial branch becomes the forearm basilic vein, which also sometimes becomes the subject to similar transposition procedures). However, there is much variation and surprises. The authors tend not to divide and ligate any larger branches until complete certainty has been established as to what vessel and how long segment is needed. Often one can use the bifurcation of the median antecubital vein (an extension of the basilic vein) as it gives off the vena communicans to the deep concomitant brachial vein 1-3 cm below the antecubital skin crease (At X in Fig. 8).

A word of caution is warranted at this point. The most common surgical injury during the basilic vein transposition procedure is to the **medial antebrachial cutaneous** nerve. It is often tightly adhered to the basilic vein on the lateral (radial) aspect as shown in Figure 8. Distally above the elbow this nerve often splits and crosses over on top of the basilic vein as depicted in Figure 11a.

At this point the entire length of the basilic vein is exposed (Fig. 9). The cutaneous sensory nerve is intact and now completely separated from the vein. An atraumatic vascular ("Heifetz") clip is placed proximally on the vein (in this image hidden under



**Fig. 9** - The entire basilic vein is now mobilized and expanded with saline under moderate pressure to a uniform diameter of approximately 6-7 mm. The medial antebrachial cutaneous sensory nerve is visible in the right aspect of the picture above the vein.



**Fig. 10** - The basilic vein is placed in an approximated position to assess tunnel length for optimal vein to artery anastomosis alignment. This overview depicts the approximate routing of the tunnel. The detailed steps (from a different patient) are illustrated in Fig 11a-i.

the skin at far right), facilitates dilating the vein under slight pressure by injecting heparinized (10 units/mL) saline using a smooth “Christmas” tree into the vein. This also reveals leaks from missed venous branches, which could cause severe tunnel bleeding that may cause the AVF to fail.

Also in his case the antecubital vein bifurcation (shown at the end of vein on the Christmas tree) will be used as a patch end-basilic vein to side brachial artery anastomosis. The brachial artery has been mobilized and surrounded by two (red) vessel loops.

In this close-up image (Fig. 9) the medial antebrachial cutaneous sensory nerve is prominently visible. The aneurysmatic like dilated, most proximal part (at the far right in the picture) of the vein represents a valve complex. Gore-Tex suture ligatures are seen in two places. The basilic vein diameter is uniformly about 6-7 mm (Figs. 8, 10).

At this point the basilic vein has been pulled through the tunnel using the curved sheath tunneler.

This critical step involves suturing the corner stitches of the vein to the rod still inside the sheath. Maintaining the vein orientation is crucial for vein patency.

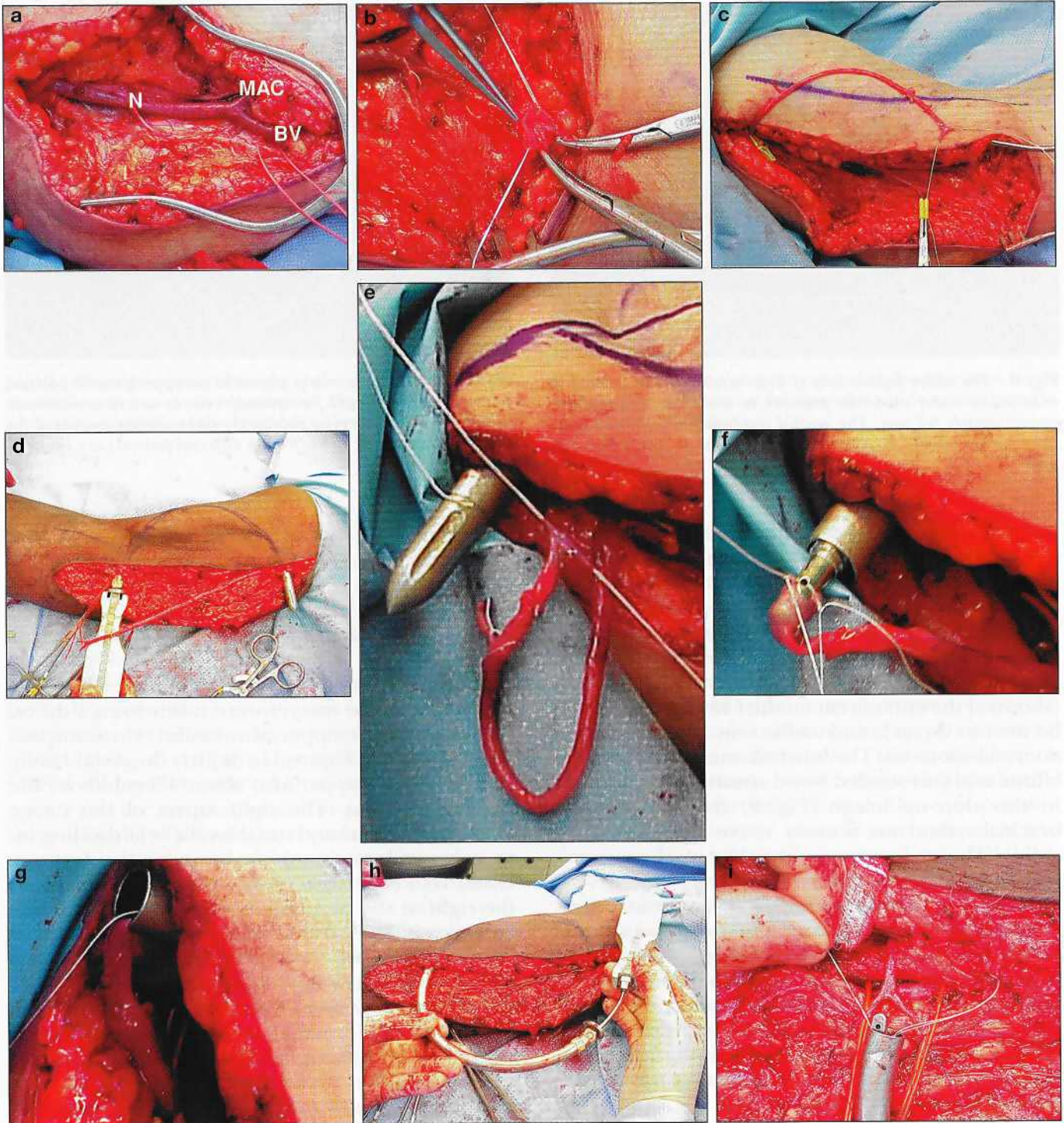
The rod is then pulled allowing the vein into the sheath. As the entire vein is pulled inside, the sheath is also pulled out of the tunnel tract exposing the end of the vein at the distal aspect of the wound still sutured to the rod. The sutures are cut to free the vein from the rod. Orientation is maintained by immediately placing the final corner stitches (Prolene 7-0, BV-1 needle). The vein is again distended with saline to ensure lack of kinking or other mechanical mishaps during tunneling.

The tunneling steps using the sheath three-piece tunneler is described in more detail in Figures 11 a-i.

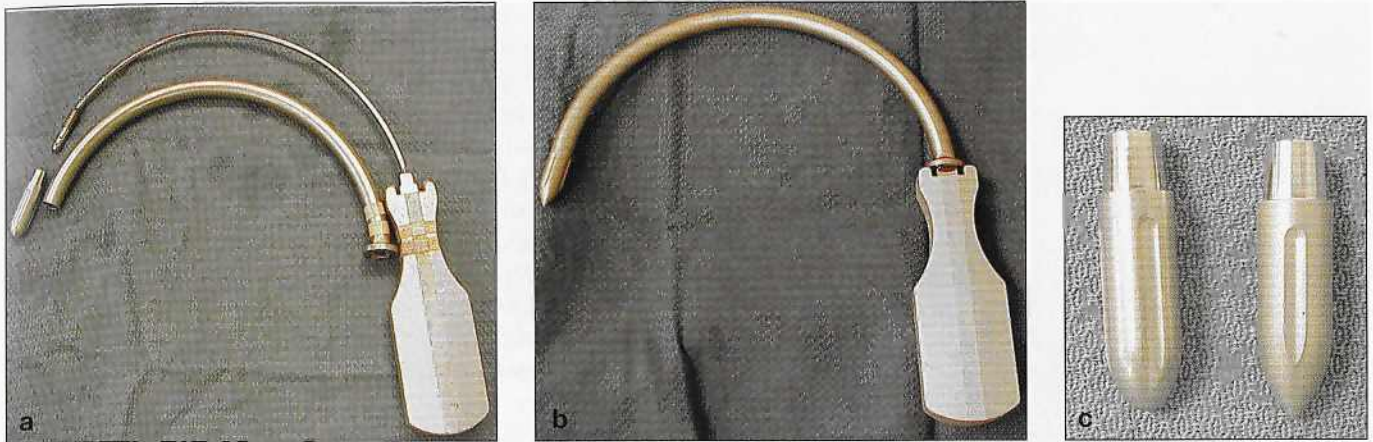
#### THE TUNNELING STEPS

The tunneling steps are described in detail in Figures 11a-i. These images were taken from a different patient’s left upper arm basilic vein transposition procedure. Figure 11a depicts the distal basilic vein of the left upper arm about 4-5 cm above the antecubital fossa. The right aspect of the image shows the normal and usual basilic vein dividing into a lower branch, which becomes the forearm basilic vein (BV) (mark). The vein going upward to the right in the picture becomes the median antebrachial vein (MAC) that joins the cephalic vein below the antecubital fossa. In this case as seen below in Figure 11b, a longer segment of vein required more distal exposure of the basilic vein branch. A branch of the medial antebrachial cutaneous nerve (N) is crossing the basilic vein. These nerve branches should be preserved, as the basilic vein will be mobilized by sliding back underneath this nerve. As the dissection proceeds the basilic vein goes in to vasospasm, which is reversed by expanding under pressure with saline (Figs. 9, 10).

After dissection of the entire basilic vein, the length required or rather the possible length available is dictated by the size of the vein (estimated diameter of at least 2.5-3.0 mm). Ideally, as in this case the basilic vein bifurcates again at or slightly below the antecubital fossa. These branches are clamped about 5-10 mm below the bifurcation point (Fig. 11b). The



**Fig. 11 - a)** This image shows the exposed basilic vein at the distal upper arm with typical branching into the forearm basilic vein (BV) and medial antecubital vein (MAC). The hand is to the right. **b)** The basilic vein branches are clamped 4-5 mm below a bifurcation point at or slightly below the elbow joint. The vein is opened between the branches thereby creating the vein "patch". Gore-Tex stitches have been placed at each vein branch. Note the marked spasm in the vein distal to the bifurcation. **c)** This image is from a left upper arm. The basilic vein is placed in the approximate loop configuration in an attempt to assess its course for optimal alignment to the brachial artery. **d)** This is a patient's right upper arm. The three-piece sheath tunneler has been inserted in a semi circle loop formation. **e)** Close up image of the tunnel sharp head. (Also see fig 12c). The vein is lined up ready to be sutured to the rod. The tunneler head is to be removed next. **f)** The distal basilic vein is sutured to the rod. Ideally as in this case the vein can slide onto the smooth rod. Orientation is maintained. **g)** Detail image of the proximal basilic vein just below the axilla as it enters the sheath. The sheath is now ready to be pulled. **h)** The outer sheath is gently pulled back onto and over the rod. **i)** The corner sutures used for orientation have been cut and replaced with 7-0 Prolene on a BVI needle. The brachial artery surrounded by two rubber bands is seen behind the now transposed basilic vein.



**Fig. 12 - a)** This image shows the sheath tunneler assembled with the sharp bullet head ready to use. **b)** The sheath tunneler has three components: The sheath, the rod with two vertical holes and the bullet head. **c)** This picture depicts a close-up view of the blunt (left) and sharp (right) "bullet" heads (see footnote).

vein is opened between the branches (creating a venous "patch") while the hemostats are left on to keep the vein stabilized and oriented (Fig. 11b).

A length of the basilic vein of at least 25-30 cm is critical for creating a functional AVF. Also it is of paramount importance to keep the corner stitches strictly oriented at all times to prevent twisting or rotating the vein. It is helpful to assess the length of the vein, in relation to the proposed subcutaneous route (Figs. 10a, 11c). The surgeon has to approximate the length taking the depth of subcutaneous adipose tissue into account. Also as the wound is closed, tension on the vein is released somewhat as the lateral skin mass is moved medially 1-2 cm.

The brachial artery-basilic vein AVF anastomosis in this case will be sewn with prolene sutures 7-0 or a CVI needle. The corner stitches (Gore-Tex CV6-TTc12) shown in Figure 11b-c are used temporarily for suturing the basilic vein to the rod tunneler (Fig. 11c). The Gore-Tex suture material is very strong, easy to work with, and has unique tying qualities, as it can be tightened after 2-3 knots. Therefore it requires 6-7 square knots to be secure and not unravel. Also because of its bright white color it is easily seen and shows well in photographic displays (Fig. 11b-c).

Once the entire vein is free the sheath tunneler is inserted (Fig. 11d). Except for the beginning and the end of the loop the tract should run fairly close to the skin surface. This is of course technically harder in obese patients. The author prefers the sharper head (Fig. 12c), which is easier to direct as the tunneler penetrates the subcutaneous tissue.

After the tunneler has been inserted, the end of the basilic vein is oriented with the Gore-Tex corner stitches (Fig. 11e). This is a critical step, making

sure that the basilic vein is not accidentally twisted or rotated. The way the white Gore-Tex suture must be oriented, when sewn onto the rod (Fig. 11f), becomes clear when examining Figure 11d. The sharp head Fig. 11e) is now twisted off the rod and the vein sutured onto the rod through the two available vertical holes (Fig. 11f).

The three-piece sheath tunneler allows the basilic vein to be placed in the subcutaneous space without trauma, tension by pulling the vein through tissues causing injury to the vein itself. The two Gore-Tex vein corner sutures in Figure 11f are now placed horizontally on opposite sides of the rod to maintain orientation of the vein, in this case through the innermost of the two holes. Ideally as shown in this image, the basilic vein can slide onto the rod. The rod with the vein is now ready to be pulled into the sheath.

As the rod with the basilic vein is being pulled into the sheath the proximal and larger basilic vein lines up in the axillary side of the operating field (Fig. 11g). It is now time to pull the sheath gently back onto the rod while watching the proximal axillary portion of the vein stay under slight tension. Abundant vein tends to cause troublesome kinking. Further mobilization of the basilic vein in this area may be needed later after arterial pressured blood is flowing through to make a smooth transition into the axilla. As the skin edges are pulled together at closing lining of the veins is usually improved.

As the sheath is pulled back onto the rod the vein still attached, the rod will appear at the anastomosis site (Not yet shown in Fig. 11h). The two red ves-



**Fig. 13** - Before performing the anastomosis a final check of the transposed basilic vein is made confirming smooth aligning in the subcutaneous tunnel. Although not visible in this image corner stitches (Prolene 7-0/BV1) are in place.

self-loop rubber bands are placed around the brachial artery.

The distal basilic vein is then freed from the rod by cutting the Gore-Tex sutures using a #11 knife blade (Fig. 11i). Corner stitches with Prolene (7-0:BV1) have been placed, but barely visible in Figure 11i. The basilic vein patch design by using the bifurcating vein (Fig. 11a-b) is clearly depicted in Figure 11i. Sometimes abundant vein needs to be trimmed or excised.

The details of sheath tunneler are shown in Figure 12 a-c (see footnote). Figure 12a displays this assembled device ready for use. It consists of three pieces and was designed to use for placement of forearm loop PTFE grafts (Fig. 12b). The "bullet head" comes in a blunt and a more sharp/pointed version as shown in the close up image (Fig. 12c). The author prefers the sharper bullet head, which is less traumatic and provides better depth control when inserting the device through the subcutaneous tissue.

After the vein is inserted and pulled through the subcutaneous tunnel, it is again expanded with saline under slight pressure. The vein should be visible and palpable as a continuous conduit as shown in Figure 13. The Heifetz vascular clip is now faintly visible at the far right corner of the wound. Because of the careful planning of the tunneling procedure the vein to artery anastomosis can now proceed without tension.

With careful planning during the vein dissection, and the tunneling steps the basilic vein aligns well onto the brachial artery (Fig. 14a). Two sets of cor-

ner stitches have been in place at all times since the basilic vein was transected (Fig. 11b).

Figure 14b shows a close up image of the very first suture in the back wall anastomosis. In this image the brachial arteriotomy is clearly seen while the basilic vein lumen is less obvious (at X in the image). The author prefers to (exactly) place 2-3 running sutures starting in the proximal back wall corner before placing the distal artery corner stitch. This distal corner stitch is not tied until the back wall-running suture has been completed. To maintain exact suturing technique stitches close to the corners are done singly through the artery and vein. The yellow felt covered clamps on the brachial artery in this picture are used when the soft Heifetz clips fail in cases of high blood pressure (usually, systolic greater than 150 mmHg) or when the artery is large (6-8 mm in diameter). The vein requires no clamp because of the valves in the vein preventing backflow of blood.

Figure 14c details the back wall suturing in progress. A nerve-hook in the basilic vein (only for demonstration purposes) depicts the site of the distal corner stitch that will be placed in the artery at this time. The median nerve (MN) and the brachial veins (BV) are labeled.

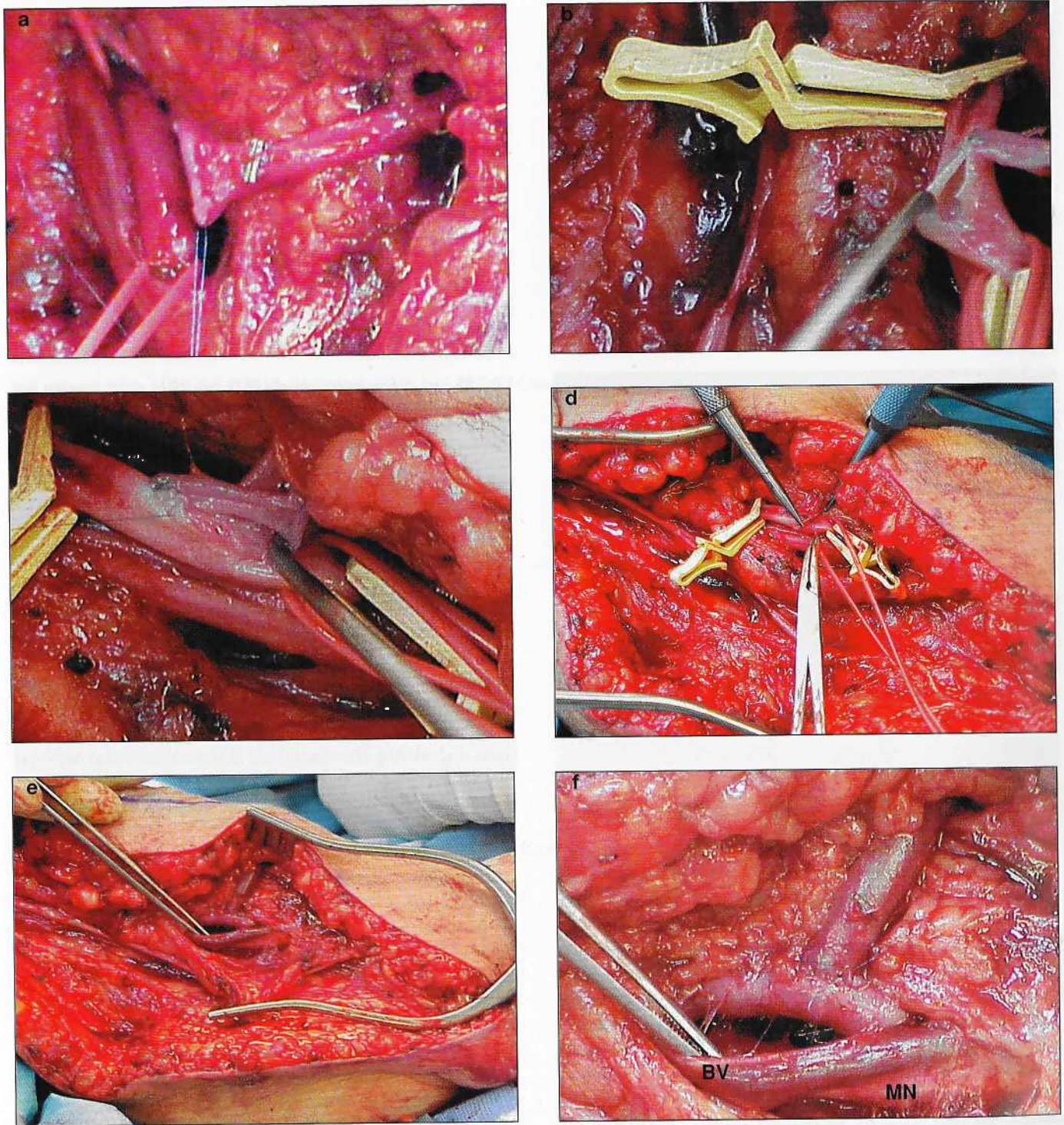
With the back wall completed Figure 14d shows an overview of the operating field. The first distal corner stitch is placed singly through the vessels. Since the surgeon in this case is sitting on the upper (patient head) side, the first stitch goes outside in through the artery. This image shows the second step of the first corner stitch with the needle penetrating the vein inside out.

The completed vascular anastomosis is outlined in Figure 14e. The brachial vein is pulled downwards to visualize the artery. The medial antebrachial cutaneous nerve indicates the original location of the now transposed basilic vein.

The final close up anastomosis site is shown in detail in Figure 14f. When using magnifying loop this should be the surgeon's operating view facilitating exact surgical technique.

## WOUND CLOSURE

The transposed basilic vein already measures 6-7 mm in diameter. A strong palpable thrill can be felt along its entire tract. In this case the authors used skin staples for closure. Postoperative patient instructions include elevation of the arm, and hand fists using a soft ball to minimized edema. This transposed vein was used for dialysis needle punctures three weeks after surgery.



**Fig. 14 - a)** Corner stitches with Prolene (7-0, needle BV1) have been placed. Sutures are attached to Mosquito hemostat rubber shods that are correctly oriented all times to prevent accidental rotation of the vein. The basilic vein now aligns nicely to the brachial artery. **b)** Detailed image of the first suture of the back wall anastomosis. **c)** At this point 3 running sutures have been placed in the back wall anastomosis. The distal corner stitch is in place but not tied. A "right angle" hook is located in the basilic vein lumen for photographic visualization purposes only. **d)** Overview of the basilic vein to brachial artery anastomosis operating field. At this point the first front wall suture is placed inside-out through the vein at the distal anastomosis corner. The hand is to the right in this left upper patient arm. **e)** An overview of the finished brachial artery to basilic vein AVF anastomosis. The hand is to the viewer's right. Note the slight desired angle by which the vein enters the artery. This will become more pronounced as the skin edges are pulled together at closing, likely beneficial from a hemodynamic aspect. **f)** This close up view of the previous image details the transposed end basilic vein to side of brachial artery anastomosis. The brachial vein (BV) and the median nerve (MN) are pulled forward to expose the artery. The 7-0 Prolene sutures are faintly visible at the anastomosis site.



**Fig. 15 - a)** A few interrupted (PDS 5-0 RB1) subcutaneous layers are recommended. Skin staples were used in this case. **b)** A subcuticular running (5-0 PDS RB1 needle) suturing technique was used in this female patient undergoing the basilic vein transposition procedure. **c)** Steristrips tapes are left in place for 10-14 days. This is the same patient as in Fig. 15b.

Closing the long skin incision with staples is time saving but may leave more scarring and be less cosmetically appealing immediately after surgery. Also the staples tend to adhere to clothing and may therefore represent a less than optimal technique. For these reasons a gauze bandage on top and around the upper arm is recommended.

Although a subcutaneous running suture is more time consuming (Fig. 15b), it does result in a better cosmetic appearance and is recommended especially in females. Because the scar will be on the inside of the upper arm it does show very little and can of course be concealed by clothing with sleeves, an advantage shared by all upper arm access procedures. In the patient shown in Figure 15b two 5-0 PDS sutures were run from either corner and tied at the site where the needle driver is pointed. A common finding in the follow up surgical clinic is the PDS suture knot sticking up through the incision because of poor suture-tying technique. The author makes great effort to place the last needle from skin level to deeper subcutaneous layer where the final tied knot will be located. In addition by placing one of the two needles from deep inside and out

through the skin (the needle driver in Fig. 15b is attached to the short, but now cut suture), the knot is pulled away from the skin level while the steristrips are applied, preventing the suture to penetrate through the wound.

Steristrips are then applied. Although most surgeons apply these transversely across the incision (Fig. 15c), the author prefers these to be placed on top and along the incision. This makes the wound less likely to come apart should removal take place too early by inexperienced personnel. Also placing these tapes across the incision using some tension to "approximate" the skin edges tends to cause bothersome blistering prone to infection. This is perhaps more likely in people with sensitive skin so common in the ESRD population.

#### REMOVAL OF THE LARGE UPPER ARM AVF

Now that the new right upper arm basilic vein AVF is being used at six weeks after the vein transposition surgery, it is time for the large left AVF to be removed. It has probably further increased slightly in size (Fig. 16a).

Using separate incisions with skin bridges in between the vein was dissected free. Usually there are loose tissue planes allowing convenient combined blunt and sharp dissections. This is best done with the fistula still be flowing (Fig. 16b).

The image in Figure 17a shows the distal two incisions with the aneurysmatic cephalic vein mobilized. Despite the size and somewhat grotesque

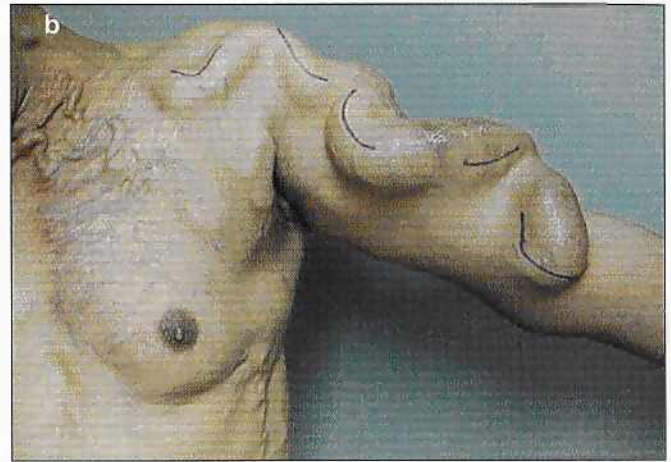


Fig. 16 - a) Time for removal of the giant left upper arm AVF. b) Close up image outlining five proposed skin incision markings for AVF removal.

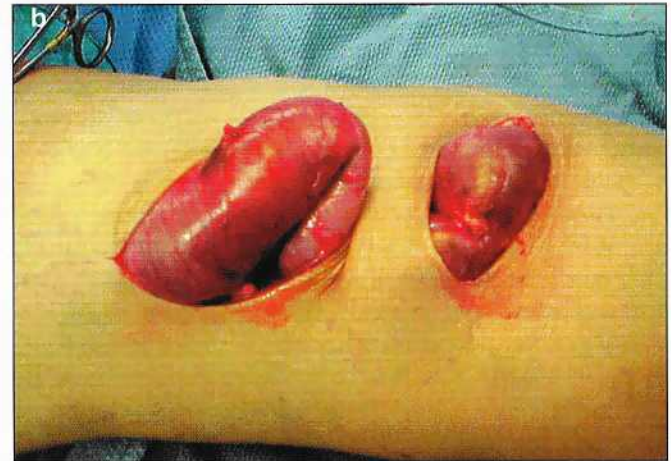


Fig. 17 - a) The distal first part of the large aneurysmatic vein is dissected free. b) The cephalic vein can now slide under the skin bridge.

look of this vein the dissection is usually fairly easy. The authors find the dissection facilitated with the fistula still intact and flowing. The mobilization is carried out with blunt and sharp dissection as needed. There are commonly loose tissue planes allowing bloodless surgery.

The large vein is now completely mobilized allowing the large aneurysmatic veins slide under the skin bridges (Fig. 17b). The rest of the entire vein is mobilized in the same fashion through the remaining skin incisions.

The vein is dissected towards the brachial artery, a (DeBakey) vascular clamp is placed across and the vein is divided. Using a Prolene suture (i.e. 4-0-SH needle), the anastomosis is over sewn in a running fashion. The authors use a running back and forth suture technique behind the vascular clamp from

one corner to the other. The clamp is then removed and the same suture is run continuously back to the first corner and tied again.

At this point the large vein mobilized through the three most distal skin incisions was removed. The proximal segment of the vein felt soft and the chest wall veins appeared collapsed. It was then decided to leave the remaining vein (under the two most proximal skin markings). The rationale for this is that this vein would serve as a convenient blood draw access. However, in hindsight this decision turned out to be wrong as shown in Figure 18a.

At one week follow up after surgery, the arm wounds are healing nicely and the distal upper arm has flattened. However, the proximal cephalic vein (between the arrows) is thrombosed (Fig. 18a). There is no pain or inflammation. Therefore, at

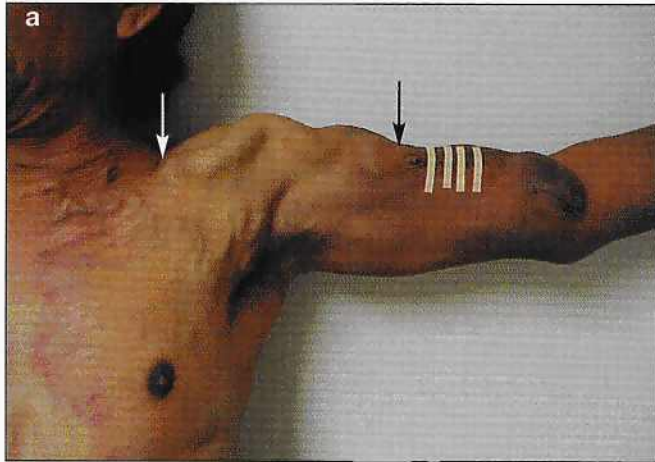


Fig. 18 - a) Seven days post op. The decision to leave the proximal cephalic vein (now thrombosed) was unwise and may require further surgery if complicated with inflammatory reaction. b) The few remaining neck vein collaterals are open, and much improved compared to the appearance in Figure 1a.

this point there are only cosmetic concerns. However, the vein may become inflamed which would require removal. The patient was offered elective removal. At the time of this publication he has not returned for further follow-ups.

Figure 18b depicts a close-up image of the remaining soft, but open vein collaterals the neck much improved from the appearance in Figure 1a. The patient continues to dialyze through the right upper arm transposed basilic vein.

## COMMENTS

This patient illustrates several dialysis access related issues.

1. The left central vein occlusion in this patient was caused by repeated remote use of an internal jugular vein dual lumen cuffed catheter. The inappropriate and overuse of dialysis catheters (sometimes for convenience) causing patient morbidity and sometimes mortality will be addressed elsewhere in the tunneled catheter CD production.
2. Short and long term planning for dialysis access is key for patient safety and survival. The nature of chronic dialysis makes these individuals patients for life.
3. Patient compliance or lack thereof plays an important role in dialysis access outcome and success. Compliance is increased when the access team is prepared, interested, confident and passionate in dealing with the patient and family.
4. Staged planned procedures for optimal outcome minimizing morbidity (in this case avoiding IJ

central vein dialysis catheter placement) should be a common strategy in the continuum of care of the ESRD dialysis population.

5. The author tries to follow the motto of **doing the right thing at the right time for the right reason**, etc. Sharing this proactive planning and making the patient and the family part of the decision thought process greatly improves compliance, and understanding of these so often complicated chronically ill dialysis patients.

Clearly this patient was chosen for demonstration because of his favorable venous anatomy. Most basilic vein transposition surgeries are undertaken under less optimal circumstances; morbid) obesity being perhaps the most common disadvantaging feature.

The basilic vein often joins one of the brachial veins (usually the most medial one) at mid upper arm level. Although one may transpose one of the brachial veins as a continuation of the basilic vein, the author cautions against extensive surgery in this uniformly multi co-morbid ESRD patient population.

The author tends to carefully select patients for the basilic vein transposition procedure. The selection process involves duplex Doppler examination (as in all other vascular access cases), guided by the surgeon present to take notes (that will be used to remind the surgeon at the time of surgery) and mark the skin and plan the surgery itself. This is indeed time consuming and laborious but in the author's view absolutely necessary to obtain optimal outcome.

The benefit of the brachio-basilic vein upper arm transposition over a PTFE graft has not been firmly

established, with a wide range of 50- 90% one-year cumulative patency for both procedures (2-4). In a recent series of 99 consecutive BAV from university of Michigan reported 1-year primary and cumulative secondary patency rates of only 42% and 61%, respectively (2). Also, this study reports a high incidence of early complications (i.e. steal, venous stenosis, and central vein stenosis) and a high failure rate requiring radiological and surgical interventions. In the authors view the outcome cited in the literature reflects the patients selection criteria, preoperative testing (or lack thereof), and surgical technical factors. Also the ESRD population (especially in the US) is plagued with old age, obesity, type 2 diabetes and cardiovascular disease, placing patents at risk after any surgical procedure (2).

It is the author's view that preoperative evaluation for basilic vein evaluation must include duplex Doppler examination with the surgeon present to guide the examination and to gain maximal information to make optimal decisions and plan the surgery itself. Both upper arms must be examined. First, determine that the basilic vein is present, of adequate size, and length; ideally it extends below the antecubital fossa with a diameter of 3 mm or more. Also one should look for a vein bifurcation that can be used as vein "patch" to artery anastomosis, greatly improving the ease by which the BAV anastomosis is created.

Often the basilic vein is missing or inadequate, which can be determined during the Doppler examination. To blindly explore, looking for a vein and determine its adequacy at time of surgery is not an acceptable surgical practice. The author tends to be somewhat cautious not to expose a multi comorbid patient to extensive surgery, especially if other less invasive options are present. Duplex Doppler examination also will establish the status of the brachial artery. Often there is a high bifurcation sometimes in the axilla leaving two arteries to choose from. One should then use the larger for anastomosis, usually the ulnar or deeper of the two.

Without Doppler examination this important technical aspect would be missed and the smaller (inadequate) radial artery used for anastomosis.

Using these principles the last 26 BAV cases include one early failure and one vein stenosis successfully revised with combined radiology and surgical revision. Therefore the basilic vein transposition, as a dialysis access is a superb long-term alternative in select patients.

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## REFERENCES

1. Davidson I. Access for dialysis: surgical and radiologic procedures, 2nd Ed. Vademecum, Landes Bioscience, 2002.
2. Kayler LK, Segal JH, Henke P, et al. The transposed brachio basilic arteriovenous fistula: First 99 Cases. In Vascular Access for Hemodialysis - VIII. Ed: M Henry. Access Medical Press, 2002.
3. Buchley CJ, Jaffers GJ, Neese PA, Lee S. Comparison of primary and transposed upper arm hemodialysis fistulae with expanded PTFE bridge grafts in a single-center dialysis unit unit. Access for hemodialysis-VIII. Ed M Henry. Access Medical Press, 2002.
4. Schuman ES, Standage B, Heintz P, Ragsdale J. Comparison of transposed fistulae, direct fistulae and grafts. Access for hemodialysis-VIII, Ed M Henry. Access Medical Press, 2002.