TECHNICAL NOTE

New method to create a vascular arteriovenous fistula in the arm with an endoscopic technique

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We describe a new technique in which the basilic vein is transposed subcutaneously with endoscopic surgery to create a vascular access in the arm. The vein was harvested with the Endoscopic Vascular Surgery System (Olympus Co, Tokyo, Japan). We could harvest a vessel about 25 cm long with endoscopy. After vessel transposition, an arteriovenous fistula was created in the usual manner. In all 10 patients, we created an effective blood access as scheduled before surgery. We could use the arteriovenous fistula 6 days after surgery and get blood flow in all cases. (J Vasc Surg 2002;36:635-8.)

The Brescia-Cimino internal arteriovenous fistula continues to be the preferred initial vascular access in patients undergoing long-term hemodialysis.[1] When this type of fistula cannot be created in the forearm because no veins are available, we sometimes create a fistula in the arm with artificial grafts. The use of artificial grafts, however, is associated with quite a few complications.[2-5] On the other hand, if we have appropriate subcutaneous veins in the arm, usually the cephalic vein, the primary patency rate and results are superior to those obtained with artificial grafts.[5,6] However, some patients have no appropriate superficial autologous vessels found in the arm, and under such circumstances, we cannot create an effective blood access with autologous vessels.

Some authors have reported the arteriovenous fistula with transposed autologous basilic vein,[7-10] but a long longitudinal skin flap incision to transpose the vessels is necessary for this procedure. This procedure is invasive, and the results are not always satisfactory. Here we describe a new method in which the basilic vein is transposed subcutaneously with endoscopic surgical technique to create a vascular access in the arm, and we report the early results obtained in 10 patients.

TECHNIQUE

The procedure to transpose the vessel in the arm is performed as follows: a transverse skin incision about 4 cm is made in the antecubital region, and a basilic vein is identified. The Endoscopic Vascular Surgery System (Olympus Co, Tokyo, Japan), which was developed for the harvest of saphenous vein in cardiovascular surgery, is used for vessel harvest (Fig 1).

First, a 5-mm rigid endoscope with a sheath is inserted along the upper side of the basilic vein from the same wound made in the antecubital region (Fig 2, *A, B*). With endoscopic monitor guidance, we can recognize the vessel through the sheath, which has a translucent head at its end. After insertion of the endoscope about 25 cm from the skin incision into the antecubital region, another transverse incision of the same size is made at that end. Then, the sheath of the endoscope is left in the route, and dilation devices are introduced to dilate the route between the two transverse incisions. The dilation devices are composed of an introducer, which can connect with the sheath of the endoscope and five different sizes of dilation head (Fig 1). We can dilate the route gradually with introducing the different sizes of dilation heads (Fig 2 , *C*). After a subcutaneous tunnel of an appropriate size is created just above the vessel, a tunnel holding device is inserted to preserve the working space (Fig 3).

With endoscopic vision, the vessel is harvested with a special dissector and some instruments for laparoscopic surgery, such as a clipping device or knife (Fig 3). The branch vessels are clipped at the peripheral site only and dissected with a laparoscopic knife. The inner branches are ligated with direct vision with 4-0 silk afterward, when the vessel is pulled out through the tunnel. When the harvested vessel is completely free from surrounding tissue, with the distal end ligated and dissected and the proximal end untouched, it is pulled out through the working tunnel from the proximal incision. After confirmation of no signs of leakage or injury of the harvested vessel, a transposed new route is created subcutaneously with TUNNELER (GORE-TEX, W. L. Gore & Associates, Flagstaff, Ariz).

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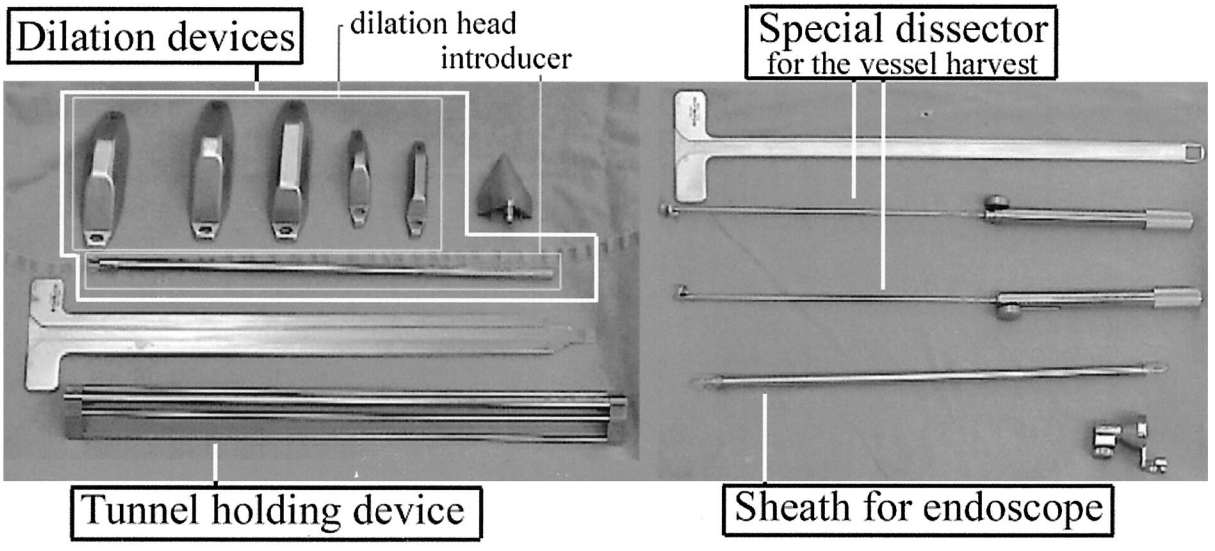

Fig 1. Devices for vessel harvest. Endoscopic Vascular Surgery System is used to harvest vessel.

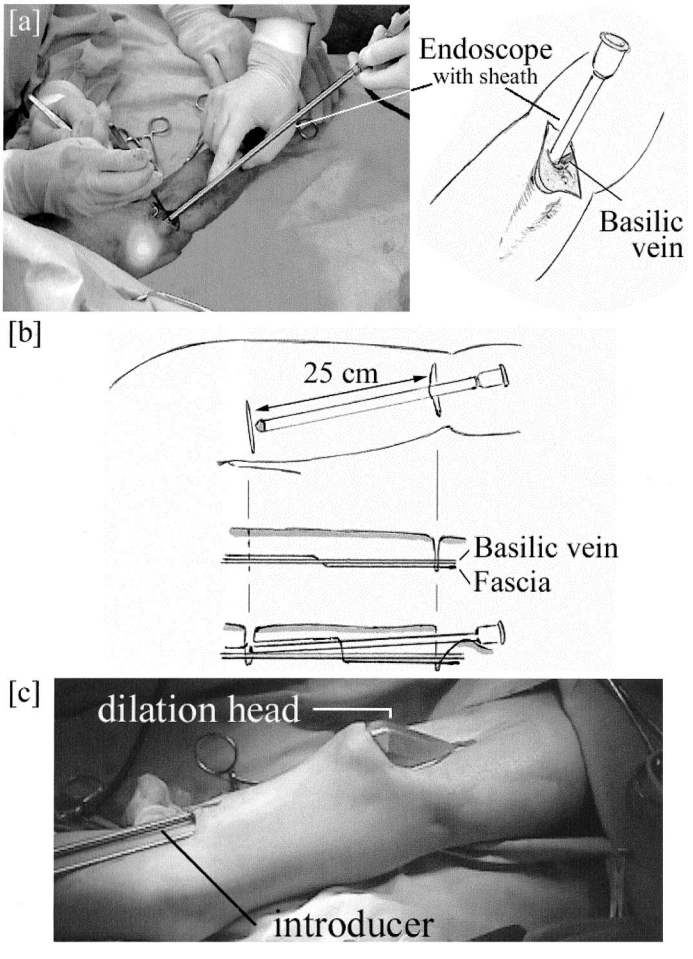

Fig 2. Procedure to harvest vessel. **A** and **B**, 5-mm rigid endoscope with sheath is inserted about 25 cm from skin incision into antecubital region along upper side of vessel. **C,** Route dilation is performed with dilation device, which is composed of introducer and dilation head.

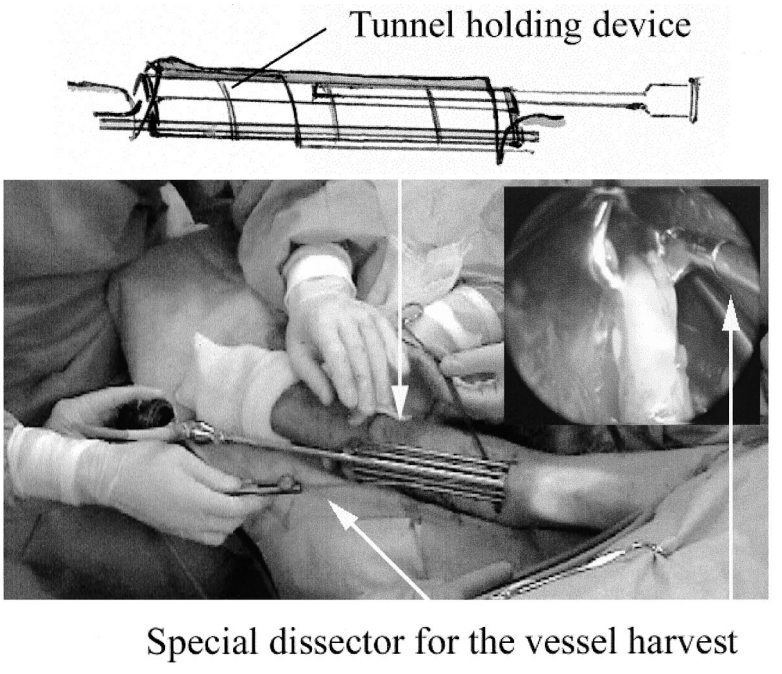

Fig 3. Procedure to harvest vessel. Tunnel holding device is inserted to preserve working space. Then, with endoscopic guidance, we can harvest vessel with special dissector.

Then, the harvesting vessel is introduced into the new route and anastomosed in an end-to-side fashion to the brachial artery to create an arteriovenous fistula in the same antecubital region where the endoscope was inserted (Fig 4).

RESULTS

Ten patients, seven of them women, whose ages ranged from 33 to 78 years (average, 66.6 years), underwent our procedure. They had undergone blood access reconstruction 3.4 times on average. All the subcutaneous peripheral vessels in their forearms were completely thrombosed, and those of the arm ran deeply under the subcutaneous tissue.

We had confirmed before surgery the patency and diameters of basilic veins in the arms with a radiologic study. The sizes of vessels in this study were 4 to 6 mm.

In all the patients, an effective blood access was successfully created in the arm. The mean operation time was 172.3 ± 12.1 minutes, and we needed 68.7 ± 7.1 minutes for the endoscopic procedure. The mean length of the transposed vessel was 21.5 ± 2.6 cm. In all the patients, we could use the arteriovenous fistula 6 days after surgery and could get a blood flow of 250 mL/min in the early period.

No painkiller agent was necessary during the hospitalization. No infection, postoperative bleeding, hematoma, or seroma was observed in any of the patients. The initial patency rate of the blood access was 100%, and six of the cases have kept patency for 12 months now.

DISCUSSION

In some arteriovenous fistulas in the arm with the cephalic vein and in many arteriovenous fistulas in the arm with the basilic vein, which usually runs deeply under the subcutaneous tissue or below the fascia in the arm, use as a puncture site for blood access is impossible. In such cases, the transposition of these veins is a useful method to create

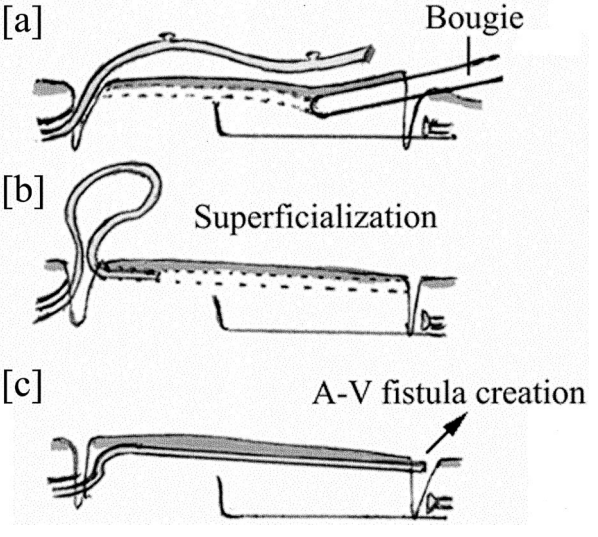

Fig 4. Procedure to superficialize vessel. **A,** After harvested vessel is pulled out through working tunnel from proximal incision, superficialized new route is created subcutaneously. **B,** Harvesting vessel is introduced into new route. **C,** Arteriovenous *(A-V)* fistula is created in end-to-side fashion in antecubital region.

an effective blood access,[7,8] but for the conventional procedure, a long longitudinal skin flap incision to transpose the vessels is necessary.

This conventional procedure is invasive, and the results are not always satisfactory. Actually, many of the complications associated with this type of blood access have been related to the long segmental skin flap. Some authors have reported troubles from the skin flap itself, such as necrosis and lymphorrhea around the flap.[7-9] In addition to these direct complications, it is generally recognized that the patency of this blood access is superior to that of artificial grafts but inferior to that of a conventional autologous blood access.[9,10] The cause of this inferiority is not clear, but the insufficient microcirculation of the skin flap is supposed to be one of the reasons.

In this study, we could use the arteriovenous fistula within 1 week in all the patients. Actually, the difficulty of early cannulation at the transposed vessel made with the conventional method depended on not only the edema around the transposed vessel but also the longitudinal skin incision wound, which ran near the vessel even if we tried to translocate as far as possible.

In our patients, because edema or subcutaneous hemorrhage was slight, we could puncture the transposed vessel as early as 1 or 2 days after the operation. However, we recommend waiting 5 or 6 days after the operation before using it as a blood access to allow time for the surrounding tissue to heal and thus hold the vessel in position.

In this study, we routinely evaluated the basilic veins before surgery with angiography, but we suppose the same information is possible with ultrasound scan studies. Although we need to evaluate a larger number of patients for a longer period to assess the long-term results, we think our procedure is superior to conventional methods not only from the point of surgical invasion and cosmetic aspect but also because the vessel is easy to access even in the early postoperative period.

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