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Reconstruction of the Posterior Tibial Artery with  
Subcutaneously Placed Saphenous Vein  
Autograft for Chronic Hemodialysis

by

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**Introduction**

Although the internal arteriovenous fistula, first created by Brescia et al<sup>1)</sup>, has been gaining popularity, the external shunt is sometimes invaluable when emergency hemodialysis is necessary or blood flow through the fistula is not sufficient for dialysis. However a major disadvantage of the external shunt is that its patency is limited by infection or thrombosis.

Three patients, whose external shunts at their legs became useless due to repeated failures, were subjected to the reconstruction of the posterior tibial artery using free saphenous vein autograft to secure further hemodialysis.

**Method and Results**

Under lumbar spinal anesthesia with appropriate premedication, a 5 cm long incision was made along the previous operative scar for arterial cannulation. The fascia was incised and the posterior tibial artery was then dissected free. Pulsation of the artery distal to the site of previous cannulation should be confirmed as the prerequisite. The cannula was then removed from the artery. With regional heparinization, blood was flushed out to clean the vessel wall. Fogarty catheter (3F) was used when necessary. A 10 cm long autogenous saphenous vein was grafted end-to-end to reestablish the posterior tibial artery flow (Fig. 1). The fascia was closed with interrupted sutures. The grafted portion was then displaced immediately under the skin so that the good pulsation should be palpable from outside in order to make direct puncture feasible. Further dialysis could be done by puncturing this grafted pulsating vein for drawing arterial blood and injection of dialyzed blood to any given vein (Fig. 2).

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Key words: reconstruction, chronic hemodialysis, posterior tibial artery, autograft, saphenous vein, shunt failure.

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Fig. 1. Posterior tibial artery end-to-end grafted with a saphenous vein.

FIGURE 2

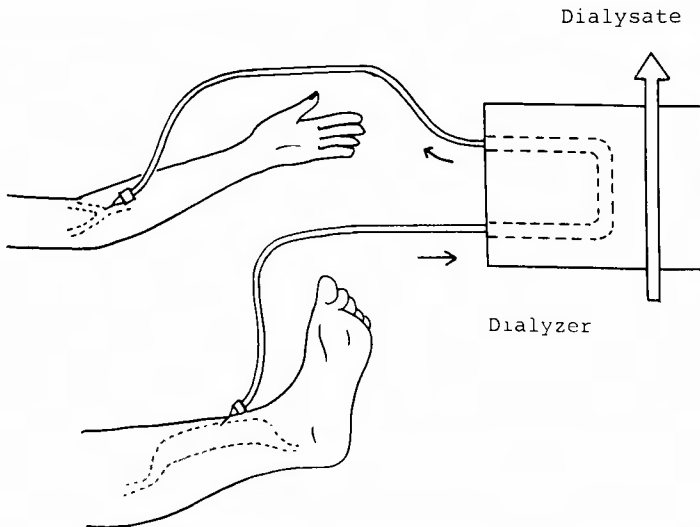


Fig. 2. Drawing-injecting diagram of the hemodialysis.

Of three patients who underwent this operation, one had a nicely functioning graft which was punctured twice a week for hemodialysis for 10 months until it thrombosed when his blood pressure was lowered to 110/70. In the second and the

third patients the vein graft thrombosed 2 and 4 months after surgery respectively with episodes of hypotension. The scar formation of the surrounding tissue may be another cause of it. The following case represents successful use of the vein graft for hemodialysis.

### Case report

A 42-year-old man was admitted in May 1972, with a history of chronic renal failure and hypertension. For the hemodialysis the external shunt was established in his left leg. In September 1972, when his physical status was improved and stabilized, the internal arteriovenous fistula was made in his right forearm. As troubles with the external shunt occurred frequently, reconstruction, instead of ligation, of the posterior tibial artery was performed at the end of November. The use of the internal fistula was planned. However, since it was found to provide flow insufficient for hemodialysis, the vein graft was punctured twice a week for hemodialysis from two weeks after the surgery. It was occluded in September 1973 when his blood pressure was lowered to 110/70 (Fig. 3).

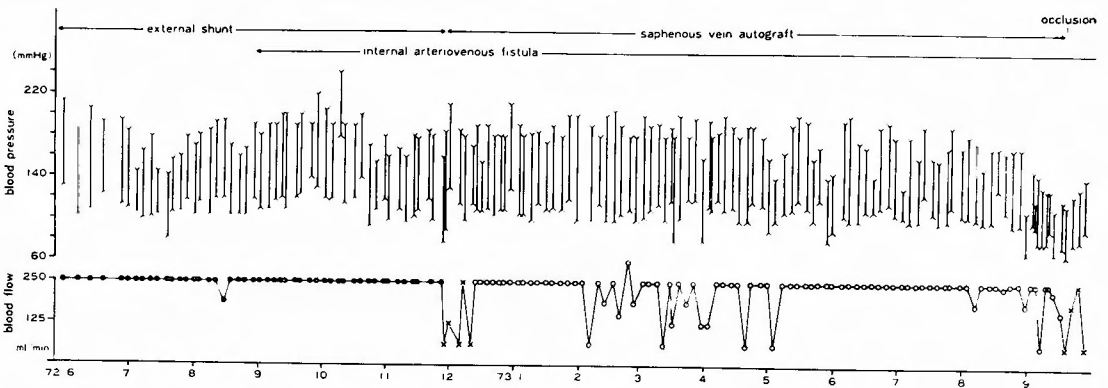


Fig. 3. Blood flow and blood pressure of the first patient during repeated hemodialyses.

### Discussion

To help patients with the problem of having so frequent shunt failures, use of a saphenous vein graft have been attempted in the forearm<sup>2)3)4)</sup>. These procedures provided several advantages including transformation of the external shunt into the internal arteriovenous fistula and anastomosis with distant vessels. However, the internal arteriovenous fistula placed in the leg has several disadvantages. It causes varices due to direct transmission of the arterial pressure to venous system or to valve insufficiency particularly when standing. Also, the amount of blood to be withdrawn for dialysis would be insufficient in lying position because of rich venous arborization through which the blood escapes. Therefore, switching the external shunt to the internal arteriovenous fistula in the leg is not advisable.

When a saphenous vein graft was placed in the subcutaneous tissue for the re-

construction of the posterior tibial artery, a pulsatile flow was easily palpable over the graft and there was no difficulty of puncturing it. As in case of arteriovenous fistula, this arrangement has less incidence of infection or hemorrhage, and needs less care.

In review of the cases, the thrombotic blockade of the graft seems to have been caused primarily by lowered arterial blood pressure beside probable scar formation around the graft. Therefore this procedure was recommendable to patients with high blood pressure. This operation may also deserve consideration in patients with the external shunt who suffered from an overload of the heart caused by the addition of the internal arteriovenous fistula.

### Summary

A Subcutaneous reconstruction of the posterior tibial artery using autogenous free saphenous vein graft was done on three chronically hemodialyzed patients whose superficial venous system in the leg was worn off after repeated shunt failures. This graft provided an adequate function so long as systolic blood pressure was maintained at high level.

### References

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## 和文抄録

## 血液透析を目的とした後脛骨動脈再建術

——自家大伏在静脈皮下移植による——

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腎不全患者に対する血液透析回路の作成には、最近ではカニューラ挿入によるいわゆる外シャントよりも皮下動静脈瘻すなわち内シャントが好んで用いられる傾向にある。日常管理や入浴等の点からみても当然であろう。しか、緊急透析や、確実な血流量確保のためには外シャントがしばしば有用とされている。

下腿に外シャントを持った患者で、感染や血栓のためにはしばしば閉塞を起し、下腿表在静脈系を使いつくしたため、やむなく後脛骨動脈の結紮を迫られた症例に対して、後脛骨動脈の両端を下腿皮下において約10 cmの自家大伏在静脈グラフトを用い端々吻合した。術

後、皮下で搏動する静脈グラフト部分は容易に穿刺でき、透析回路に導かれた動脈血は透析後、上肢又は反対側下肢の表在静脈系に還流された。

3例のうち2例は早期閉塞をみたが1例は週2回の穿刺を約10ヶ月間続けることができた。閉塞の一因は血圧の低下にあった。透析により一般状態が好転し、血圧が低下するとグラフトの保持が困難になるのは一種のジレンマといえるが、手術手技の改善、血圧の管理方式の工夫によっては有用な方法と思われる。また複数のシャントのために心負荷の増大を来した患者にも適用できるとと思われる。