Review

A Reappraisal of Saphenous Vein Grafting

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Autologous saphenous vein grafting has been broadly used as a bypass conduit, interposition graft, and patch graft in a variety of operations including cardiac, thoracic, neurovascular, general vascular, vascular access, and urology surgeries, since they are superior to prosthetic veins. Modified saphenous vein grafts (SVG), including spiral and cylindrical grafts, and vein cuffs or patches, are employed in vascular revascularization to satisfy the large size of the recipient vessels or to obtain a better patency. A loop SVG helps flap survival in a muscle flap transfer in plastic and reconstructive surgery. For dialysis or transfusion purposes, a straight or loop arteriovenous fistula created in the forearm or the thigh with an SVG has acceptable patency. The saphenous vein has even been used as a stent cover to minimize the potential complications of standard angioplasty technique. However, the use of saphenous vein grafting is now largely diminished in treating cerebrovascular disorders, superior vena cava syndrome, and visceral revascularization due to the introduction of angioplasty and stenting techniques. The SVG remains the preferable biomaterial in coronary artery bypass, coronary ostioplasty, free flap transfer, and surgical treatment of Peyronie disease. Implications associated with saphenous vein grafting in vascular access surgery for the purpose of dialysis and chemotherapy are considerable. Vascular cuffs and patches have been developed as an important and effective means of enhancing the patency rates of the grafts by linking the synthetic material to the recipient vessel. In addition, saphenous veins can be a cell source for tissue engineering. We review the versatile roles that saphenous vein grafting has played as well as its current status in therapy.

Saphenous vein (SV) grafting has been broadly employed in a variety of operations including cardiac, thoracic, neurovascular, general vascular, vascular access, and urologic surgeries as a bypass conduit, interposition graft, and patch graft, with acceptable results, comparable to or better than for prosthetic materials.1,2 A modified SV graft (SVG) conduit such as a spiral SVG,3 a cylindrical SVG,4,5 or vein cuffs and patches,6 sometimes became a necessity for large recipient vessels, or to obtain a potentially good patency. Nowadays, an SVG is the preferable biomaterial in coronary artery bypass, especially for the right coronary system,7 coronary aneurysm or a rupture treated with SVG-covered stents,8,9 free flap transfer,10 and surgical treatment of Peyronie disease.11 However, the availability of new flexible intravascular stents, allowing access even to tortuous vessels, provides a new therapeutic approach for patients with vascular problems in diverse specialties. There have been significant declines in the use of SV grafting for the treatment of coronary ostioplasty,12 cerebrovascular disorders,13 superior vena cava syndrome,14 and visceral revascularization15 due to the introduction of angioplasty and stenting techniques. The percutaneous transluminal angioplasty and stenting, however, may develop complications or recurrent symptoms, which may eventually warrant surgical intervention.15 Surgical repair and percutaneous transluminal angioplasty become complementary and adopted in combination in selected patients. This review describes the versatile roles that SV grafting has played as well as the current use of this biomaterial.

Roles for the Saphenous Vein Graft

Vascular reconstruction of the extremities

Autologous SV grafting is popularly used in vascular surgery as a bypass graft, for the relief of hand and forearm ischemia,16 reconstruction of the axillary ar-
tery, or the brachial artery in an upper extremity, and femoropopliteal, femorotibial, planar or lateral tarsal, tibioperoneal, and dorsalis pedis artery bypasses in a lower extremity. A femoropopliteal and femorotibial SVG bypass on 594 patients rendered a 5-year cumulative patency rate of 39.5% versus 64.9%. Comparing the results of 568 primary infrageniculate bypass procedures using SV grafting, polytetrafluoroethylene (PTFE), and PTFE-SVG, the 5-year limb salvage rate was 80% for composite grafts and 88% for SVGs. The primary and secondary patency and limb salvage rate for PTFE grafts was 24%, 31% and 40%, respectively. Arterial reconstruction of vessels of the foot and ankle using SV grafting as well as the arm vein for the management of extensive tibial and peroneal occlusive disease and patent pedal arteries showed 5.7% deaths and 4.2% graft failures within 30 days. Cumulative primary and secondary patency was 79.0% and 81.6% at 36 months, and limb salvage was 87.5% at 36 months.

Palma and Esperon originally described a crossover femorofemoral bypass with an autologous SV grafting for the treatment of femoro-iliac venous occlusion, which was subsequently termed the Palma operation. This procedure is generally indicated for postphlebitis syndromes, postthrombotic syndrome, venous injury, pelvic tumor, and others. Menyhei et al. reported a remarkable patency rate of 29/42 (69%) and excellent long-term results with the Palma operation performed for chronic venous insufficiency caused by unilateral iliac vein occlusion. A more recent report on the clinical results of five patients undergoing the Palma operation showed 4 patients with good patency, for whom the surgical indications were secondary to severe suprapubic and scrotal varicosities in 3, symptomatic pain and swelling in 1, and acute severe deep vein thrombosis in 1.

Compliance mismatch between the graft and the recipient artery along with hemodynamic factors constitute the major causes of graft failure associated with thrombosis and the development of subintimal hyperplasia at the anastomotic site. In an attempt to obtain better patency, several vein patches and cuffs were developed by incorporating a segment of vein between the graft and the receipt vessel. Seigman suggested linking a Dacron tube to an artery with an interposed cylinder vein segment. Miller et al. introduced this technique, which was later termed the Miller vein cuff, into clinical use as to build up the connection between rigid PTFE graft and the friable crural arteries, as a result, with higher patency rates. A multicenter randomized prospective study on 133 vein cuff and 128 uncuffed bypasses showed there was no differences in patency between cuff and non-cuff groups in the above-knee bypasses, but the vein cuff resulted in a better patency rate at 12 months, and a 20% higher limb salvage in the blow-knee patients at 24 months. Taylor patch is a modification to the conventional operative technique, involving a vein patch covering the elliptical defect between the anterior surface of the graft and the distal artery. Taylor et al. obtained 5-year patency rates of 71% for popliteal and 54% for infrapopliteal grafts, respectively. Linton’s patch is a vein patch sutured to the artery, and a proximal venotomy is made on the patch and the PTFE material is sutured to the proximal venous tissue. The St. Mary’s boot (or vein collar) technique utilizes a similar arteriotomy and venous patch is modified into a collar shape and is sutured to arteriotomy.

**Visceral revascularization**

Arterial reconstruction with an autologous SVG patch or conduit is a method of choice for the surgical treatment of hepatic artery aneurysm. Successful hepatic vein reconstruction, or hepatic venoplasty was also performed by the use of an SVG in patients with hepatic malignancies. Reconstruction of the hepatic artery, hepatic vein, or portal vein in orthotopic liver transplant was usually performed as a standard procedure, using either an autologous, or cryopreserved third-party donor’s, or same donor’s SVG. Reconstruction of the celiac circulation in patients undergoing radical pancreaticoduodenectomy was often accompanied by an SVG bypass to relieve celiac artery occlusion of a congenital or secondary etiology.

The repair of a long bile duct defect in a left hepatectomy for hepatocellular carcinoma may resort to a saphenous vein patch. Successful repair of iatrogenic common bile duct injuries has been achieved by SVGs in two patients with cystic duct avulsion, in one patient whose duct was split by a balloon catheter, and in one patient where a segment of the duct was resected. The grafts remained patent at a 5-year follow-up.

SV grafting was also employed in visceral revascularization for variceal hemorrhage, hepatic cirrhosis, and acute mesenteric ischemia. Deen et al. evaluated an autologous SVG anastomosed to the peritoneum in the management of patients with resistant ascites, 70% of whom did not require paracentesis any more.

**Aortorenal bypass**

Aortorenal bypass was a standard technique for revascularization of the kidney with a compromised arterial...
circulation, such as in renovascular disease with severe hypertension, renal artery aneurysms, and renal artery dissection. The indications for an aortorenal bypass with a branched SVG were renovascular disease extending to two or more arterial branches, or having fibrous dysplasia, atherosclerosis, saccular aneurysm or stenosing disease involving multiple main renal arteries. The branched SVG was created by end-to-side anastomosis of a sidearm to the main graft. The search for a site of origin for renal artery bypass grafting other than the inclusion aorta has resulted in a variety of regimens, including use of the splenic, hepatic, gastroduodenal, and superior mesenteric arteries and even retrograde bypass grafts originating from the iliac artery.

Aortorenal bypass was not only indicated for renovascular hypertension, renal failure due to stenotic arterial lesions, but also for acute anuria. Cole and Rabin performed a hepato-right renal arterial bypass with a reversed SVG in a patient with acute anuria 16 days after admission. The amount of urine excretion returned to normal, and the serum creatinine level stabilized without dialysis.

When the aorta cannot be used for a standard renal bypass because of a previous aortic operation, severe degenerative atherosclerosis or complete aortic thrombosis, a unilateral (hepatic) or bilateral (hepatic or splenic) visceral bypass should be considered. A right hepato renal artery SVG bypass and a splenorenal artery anastomosis on the left plus a hepatorenal artery SVG bypass on the right side were performed in two patients with degenerative abdominal aorta, respectively.

Other operations
SV grafting has even been useful when remodeled into a cylinder configuration for a size-match purpose for the construction of either jugular or portal veins. Urayama et al and Sakamoto et al respectively utilized such remodeled SVGs where the saphenous vein was split longitudinally and sutured side-to-side (Figure 5) with good results. SV grafting added its versatility as catheter conduit for arterial infusion chemotherapy to treat hepatocellular carcinomas and metastatic liver cancer after hepatectomy or in unresectable patients with satisfactory perfusion.
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It is well known that a reversed autologous SVG remains a preferable conduit for a coronary artery bypass, with an independent graft (a single graft with two anastomoses as an outflow and an inflow) being the classic fashion. The sequential graft (a graft with one inflow anastomosis and more than one outflow anastomoses in single or different receipt coronary arteries) was introduced in an aim to decrease the number of anastomoses, shorten the operative time, and improve graft patency.\textsuperscript{60} A long SVG was once proposed to complete circular sequential bypasses with as more as five distal anastomoses, to posterior descending right coronary artery, two marginal branches, diagonal branch, and a left anterior descending artery.\textsuperscript{61} Naturally formed Y-branches 2 cm in length made it possible to perform Y-grafts, sequential grafts, or a combination of the two, or more complex configurations for quadruple and quintuple bypasses by a single SVG.\textsuperscript{62} Nonreversed valvotomized SVG has additionally been recommended for coronary artery bypass.\textsuperscript{63} In the operation, the femoral end of the vein is attached to the aorta and the pedal end is attached to the coronary artery, and it assured a large proximal anastomosis and satisfactory patency rate. Besides, composite arterial grafts (a complex graft configuration composed of at least two segments of one artery or two different arteries) were developed under the requirement of complete arterial revascularization.\textsuperscript{64} Modified bypass configurations as composite mixed arterovenous grafts (a composite graft composed of the artery and vein, usually internal mammary artery and SVG) were also developed in case arterial graft could not reach the anastomosing site.\textsuperscript{65}

An SVG can also function as a hood of a second graft (Figure 6). The indication for anastomosing a second vein or arterial graft onto a vein graft hood is an inadequate length of the second graft or the avoidance of proximal anastomoses on an atheromatous ascending aorta.\textsuperscript{66} John\textsuperscript{67} suggested the second surgical option for the mismatch between aortotomy and SVG size is to disconnect the vein from the aortotomy, and then to anastomose it in an end-to-side manner to another SVG that has already been joined to the aorta.

**Coronary ostioplasty**

Coronary ostioplasty with an autologous saphenous vein patch is an alternative approach to standard bypass for the patients with isolated coronary ostial stenosis.\textsuperscript{68} Dihmis and Hutter\textsuperscript{69} modified the technique of left coronary angioplasty by insertion of a gusset of long SVG into the left main coronary artery and adjacent aorta. This technique was then extended to patients with atherosclerotic or nonatherosclerotic coronary artery disease.\textsuperscript{70} Jegaden et al\textsuperscript{71} extended this surgical technique into the coronary trunk angioplasty in 12 patients, the first two of which were performed with saphenous vein patch. All procedures were successful. Surgical ostioplasty should be considered in the treatment of patients who have isolated ostial stenosis but no distal coronary disease. Careful patient selection seems to be a prerequisite for surgical success.\textsuperscript{68}

**Aneurysmorrhaphy**

Aneurysmorrhaphy with SVG patch reconstruction is a preferred approach for the treatment of coronary artery aneurysms, thereby maintaining the antegrade flow, preserving the important perforator branches, and avoiding bypass grafting to the distal segment.\textsuperscript{72-74} Postoperative coronary angiography revealed disappearance of the aneurysm and no stenosis of the repaired coronary artery.\textsuperscript{74}

**Other procedures**

SV grafting has additional uses in cardiac surgery.
Axillary cannulation can be achieved by placing the arterial cannula into an SVG that had been anastomosed end-to-side to the axillary artery. This provides a natural, inexpensive, and more hemostatic alternative to the use of prosthetic grafts. A homologous SVG can be used as a conduit to replace the malignancy-invaded inferior vena cava, to create an aortopulmonary communications, or to construct modified Blalock-Taussig shunts in patients with cyanotic congenital heart disease who have satisfactory patency.

Interventional Cardiology

Obliteration of coronary thrombus or aneurysm
The implantation of covered stents has emerged as a strategy for treatment when traditional conservative approaches, such as prolonged balloon inflation and reversal of anticoagulation, fails. Like other harvested vascular segments, including autologous cephalic vein and antecubital vein, an autologous SVG was used as a cover for the stents to obliterate coronary artery thrombus, aneurysms of the coronary artery, or SVG, for immediate exclusion of the aneurism as well as thrombus and maintaining patency compared to conventional stents. The experimental studies have shown a beneficial effect with covered stents on biocompatibility, endothelialization, and vascular injury.

Thoracic Surgery

Surgical treatment of superior vena cava syndrome
Saphenojugular anastomotic technique was adopted as an effective treatment for malignant or benign superior vena cava syndrome since the early 1960s, with promising results. To avoid graft kinking and compression, Panetton et al modified the saphenojugular bypass by tunneling an externally supported ePTFE graft subcutaneously to protect the SVG, in that the ipsilateral SVG was turned cephalic and tunneled through an ePTFE graft and anastomosed end-to-end in a spatulated manner with the contralateral SVG tunneled down from the internal jugular vein. The graft patency was promising as confirmed by duplex ultrasound scanning.

In 1962, Benvenuto et al proposed a spiral vein graft for replacement of the superior vena cava. Doty and Baker extended this technique for reconstruction of the occluded superior vena cava in 1976. A composite spiral vein graft was constructed from the patient’s own saphenous vein, split longitudinally and wrapped around a stent in spiral fashion. The edges of the vein were sutured together to form a large conduit ranging in diameter from 9.5 to 15.0 mm. Dotty et al reported that seven of nine grafts remain patent for up to 15 years and all but one patient was free of superior vena caval syndrome. A spiral vein graft showed favorable clinical outcomes for caval replacement as other autologous conduits. The disadvantage may include tedious and time-consuming construction of the spiral vein, and potential thrombosis that might be caused by the long suture line. In addition, reversed autogenous SVGs could be used in patients with superior vena caval obstruction secondary to mediastinal fibrosis.

Neurosurgery

Cerebral revascularization
The use of an SVG for a bypass or reconstructive purpose was a preferable treatment of choice in neurosurgery for the management of extracranial atherosclerotic disease, extra- and intracranial aneurysms, and tumors involving the carotid artery at the skull base or cervical regions. Cerebral revascularization was established in three ways: a superficial temporal artery to middle cerebral artery bypass; a long interposition SVG between the carotid artery in the neck and the branches of the middle cerebral artery, or a short SVG from the intrapetrous to the supraclinoid carotid. In 1969, Yasargil performed the first extracranial-to-intracranial bypass with ligation of the middle cerebral artery for the treatment of a complex cerebral aneurysm. This surgical technique was then employed widely in the treatment of giant intracranial aneurysms. When the middle cerebral artery is not suitable for intracranial anastomosis, the supraclinoid internal carotid artery can be a recipient vessel. Cervical-to-petrous internal carotid artery anastomosis in cases of upper cervical or petrous internal carotid artery aneurysms or tumors, vertebral artery (extracranial)-to-vertebral artery (intracranial), vertebral artery-to-posterior cerebral artery,
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and internal carotid artery-to-basilar artery bypass were also established by using an SVG.\textsuperscript{92} A long vein bypass graft used for the treatment of a giant aneurysm was first described by Iwabuchi et al.\textsuperscript{93} in 1979. The long SVG was made popular by Sundt et al.\textsuperscript{94} for atheromatous disease and for giant aneurysms involving the anterior and posterior circulation. In a series of 20 patients with internal carotid artery aneurysms unsuitable for clipping or coiling, long venous bypasses were interposed between the internal carotid artery at the neck and the intrapetrous carotid, from the internal carotid artery at the neck to a branch of the middle cerebral artery, or from the external carotid artery to a branch of the middle cerebral artery. The surgical results were admirable with a 95% patency rate at a follow-up of 1-12 years (mean 3.7 years).\textsuperscript{95} An SVG was generally one of the bypass grafts in the tandem bypass (a long extracranial-to-intracranial bypass with two grafts of different materials).\textsuperscript{96}

A short graft may be placed between the petrous portion of the internal carotid artery and the intradural portion of internal carotid artery or middle cerebral artery. Short vein grafts have some disadvantages compared to long ones in poor exposition of the petrous carotid artery, sacrifice of the great petrosal nerve, technical difficulty, and discontinuation of blood flow of the internal carotid artery for 30-60 minutes. A long saphenous vein graft proved more effective and safe in providing high-flow bypass in the anterior circulation.\textsuperscript{97}

Initial experiences with interposed SVGs for ischemic and traumatic occlusion of the internal carotid artery and intracranial aneurysm obtained encouraging results with an overall patency rate of 80% at a 12-month follow-up.\textsuperscript{98} In cases of distal vertebral artery disease, the SVG was placed either from the C2 transverse foramen to the intradural portion of the vertebral artery, or from the extradural C1 portion to the intradural artery beyond the posterior inferior cerebellar artery.\textsuperscript{99} Morgan et al.\textsuperscript{100} reported 57 interposition SVG bypasses between the common carotid artery and the intracranial internal carotid artery in 55 patients, with which early graft occlusion was 5%.

The literature on cerebrovascular venous reconstruction is rare. Steiger et al.\textsuperscript{101} reported a 48-year-old female with who developed a hemangiopericytic meningioma involving the middle third of the superior sagittal sinus, which was replaced with a 6 cm SVG, harvested from the thigh to select a segment with a side branch for anastomosis with the left Rolandic vein. The sagittal sinus was replaced with the SVG. The left Rolandic vein was sutured to the SVG side branch, and the right Rolandic vein was anastomosed end-to-side to the lateral wall of the sagittal sinus behind the graft. The patient recovered uncomplicated after operation.

**Plastic and Reconstructive Surgery**

**Free flap transfer**

Free flap transfer for the treatment of tissue defect caused by trauma,\textsuperscript{102} tumor resection,\textsuperscript{103} irradiation therapy,\textsuperscript{104} or a chronic lumbosacral wound,\textsuperscript{105} anywhere in the head and neck, trunk, or extremities, was usually accomplished by an SVG. Salibian et al.\textsuperscript{104} described a 2-stage transfer of a latissimus dorsi musculocutaneous flap for coverage of a radiation ulcer of the sacral area. Nahai and Hagerty\textsuperscript{106} performed the same procedure for the similar case by using SVGs in one stage. Meanwhile, a short SVG was taken into use in free flap transfer for defects of the lower extremity,\textsuperscript{107} traumatic tissue defects of the trunk,\textsuperscript{102} and the wounds caused by tumor resection.\textsuperscript{103} Chang et al.\textsuperscript{108} anastomosed two flaps to a single autologous SVG for both a primary arterial conduit in an end-to-end fashion and a secondary end-to-side recipient site in the microsurgical reconstruction of a complicated head and neck defect, which survived perfectly. An SVG arteriovenous loop in a free-flap transfer for the treatment of a chronic lumbosacral wound,\textsuperscript{105} and cryopreserved SVG was used on an emergency basis for lower extremity reconstruction\textsuperscript{109} were respectively reported. Citrin and Dasmahapatra\textsuperscript{110} advocated using the spiral SVG bypass of the internal jugular vein when bilateral radical neck dissections were performed with the sacrifice of both internal jugular veins. They performed such procedures in six patients without significant swelling or facial edema in any patient.

**Urology**

**Lengthening shortened penis caused by Peyronie disease**

The penile deep dorsal vein, inferior tibial vein, and saphenous vein are the grafts of choice in the surgical treatment of shortened penis caused by Peyronie disease.\textsuperscript{111} The plaque incision with saphenous vein grafting, known as a Lue procedure is now the standard operation for treating penile shortening due to Peyronie disease.\textsuperscript{112} The technique involves an H-shaped tunical incision to release the contracture followed by defect repair with the use of an assembled SVG segments.\textsuperscript{113} Clinical investigations have shown that an excellent or satisfactory result was obtained in 92% to 93% of patients\textsuperscript{114,115} and the penis was completely straightened in 82% to 96% at a mean follow-up of 12-18 months.\textsuperscript{112,115,116} The application of a W-shaped SVG,
which was molded according to the tunica defect, was associated with a straightened penis in 87.5% of the patients at a mean follow-up of 13 months.\textsuperscript{117} For patients with severe penile shortening due to Peyronie disease, circumferential grafting was performed using SVGs.\textsuperscript{118}

Vascular Access Surgery

In 1972, Lawton and Sharzer\textsuperscript{119} started the use of SV grafting in the construction of an arteriovenous fistula for patients needing prolonged hemodialysis. Construction of subcutaneous arteriovenous fistulae for hemodialysis with autologous SVGs used to be done in five ways: straight radial artery-cephalic vein, loop brachial artery-cephalic vein, straight brachial artery-axillary vein, straight axillary artery-basilic vein, and femoral artery-saphenous vein stump fistulas. It was noted that the loop arteriovenous fistula in the forearm was inferior to the straight in terms of short- and long-term patency rates.\textsuperscript{120} Cimochowski et al\textsuperscript{121} reported their successful experience with the use of a spiral vein in vascular access in a single patient who had undergone 16 prior access operations with no more adequate access for dialysis. In this case, a spiral saphenous vein graft was constructed from the left saphenous vein and used as a straight arterial conduit in the groin as the sole dialytic route for the next consecutive 750 dialysis procedures over nearly 6 years without any complication. Gagne et al\textsuperscript{122} used a Tyrell vein collar at the venous anastomosis of forearm loop arteriovenous grafts in 17 patients undergoing hemodialysis, but noted a premature graft failure with a 9-month primary patency of 17% compared to 80% for the control group with a standard end-to-side graft-vein anastomosis.

The vascular access for chemotherapy was always wrist radiocephalic or elbow cephalic, basilica or medial cubital vein to branchial fistula. Wobbes et al\textsuperscript{123} suggested, when suitable vessels were unavailable in the upper extremities, an arteriovenous fistula be performed in the inguinal region using the long SVG. In 100 consecutive patients with various malignancies, 142 operations were performed to establish an arteriovenous fistula giving vascular access for chemotherapy. Radiocephalic fistula was established in 88 operations on 76 patients and functioned well in 64%. In 13 patients whose arms offered no alternative possibility, 15 long SVGs were implanted in the inguinal region. Guba et al\textsuperscript{124} successfully administered chemotherapy agents, blood products and hyperalimentation solutions and recurrent diabetic ketoacidosis via vascular access procedures in 13 patients. Vascular access for chemotherapy by an autologous SVG fistula was also reported by Levey et al,\textsuperscript{125} who created in infants and children with malignancy, a loop fistula from the SVG to the superficial femoral artery. Such access could provide with rapid dilute chemicals and last as long as 3 years.

Tissue Engineering

The saphenous vein can be a source of tissue engineering. Studies have shown that that cells isolated from the saphenous veins, or from veins and arteries of the umbilical cord might be feasible cell sources for tissue engineering of heart valve for the pulmonary position.\textsuperscript{126}

Discussion

When an autologous saphenous vein is unavailable, a homologous saphenous vein under different preservation methods, such as frozen, denatured, lyophilized, cryopreserved, and fresh, can be an alternative in creating vascular access. Preserved vein homografts tolerate repeated puncture by large dialysis needles. Similarly, when satisfactory autologous SVGs are not available, cryopreserved homologous SVGs, either cryopreserved or denatured, can be an alternative conduit to the autologous ones in coronary artery bypass,\textsuperscript{127} construction of aortopulmonary communication,\textsuperscript{128} a modified Blalock-Taussig shunt,\textsuperscript{78,79} and complex limb-salvage procedures.\textsuperscript{128,129} Some authors\textsuperscript{127,130,131} have suggested that use of such conduits should be limited due to poor patency. Despite various types of stents that have been used to treat atherosclerotic stenoses of coronary, renal, and superficial femoral arteries, open surgery is still the treatment of choice when the angioplasty fails and the patient develops recurrent symptoms.\textsuperscript{15} Straight spiral SVG remains the conduit of choice for surgical reconstruction, with results superior to those with bifurcated veins and ePTFE. Endovascular treatment is effective over the short term, with a frequent need for repeat interventions.\textsuperscript{14} The use of an SVG bypass in neurosurgery has decreased largely because of improved endovascular therapies in many circumstances. The “gold standard” for the treatment of giant aneurysms remains surgical clipping. Nevertheless, a small but consistent number of SVG bypass procedures will be required for the treatment of complex cerebrovascular disease.\textsuperscript{13} Arterialized venous free flap transfers with the long saphenous vein will be favorable in the reconstruction of major arteries of the injured skin and soft tissues.\textsuperscript{132} Generally, synthetic materials are no longer used in grafting procedures in Peyronie surgery because of
their antigenicity and inappropriate functional properties. Small intestinal submucosa may be associated with a high rate of operative failure and complications. SV grafting is the preferred autologous graft with acceptable outcomes. Arteriovenous grafts remain an important vascular access option for dialysis, and interventions to prevent progression of stenosis are being explored. Recent data indicate that the majority of patients on hemodialysis in the United States have prosthetic graft fistulas. The most frequent complications of prosthetic graft fistulas are thrombosis and stenosis. Endovascular interventions have replaced surgical repair as the primary treatment of the failing or thrombosed vascular access. Angioplasty is a fast, easy, and safe procedure that can extend the patency of a hemodialysis graft.

In conclusion, SV grafting plays an important role as a material superior to the prosthesis in bypass grafting, interposition conduit, patch repair, loop creation, vein cuff, stent cover, catheter route in many circumstances, and has shown excellent outcomes as evidenced by the patent rates of the autologous graft. Percutaneous transliminal angioplasty and stenting techniques have largely substituted vascular repair and reconstruction procedures with admirable results. The use of SV grafting has dwindled with the introduction of percutaneous transliminal angioplasty and stenting techniques, but in indicated cases the use of SV grafting can be unavoidable. Hence it is each surgeon's responsibility to husband every centimeter of the SVG during harvestment, as we have seen even the varicose SVG put into use.

REFERENCES

1. Kavanagh EG, O'Riordan DS, Buckley DJ, O'Donnell JA. Long-term results of polytetrafluoroethylene in above knee femoropopliteal bypass for critical ischaemia. Ir J Med Sci 1996;167:221-4.
2. Klinkert P, Post PN, Breslau PJ, van Bockel JH. Saphenous vein versus PTFE for above-knee femoropopliteal bypass. A review of the literature. Eur J Vasc Endovasc Surg 2004;27:357-62.
3. Leafstedt SW, Rubenstein RB, Pallanch JF, Wilder WH. Spiral saphenous vein graft for replacement of internal jugular vein: a series of case reports. Angiology 1985;36:827-31.
4. Urayama H, Katada S, Matsumoto I, Ishida F, Ohmura K, Watanebe Y, Muruki T. Reconstruction of jugular and portal blood flows using remodelled great saphenous vein grafts. Surg Today 1989;23:939-8.
5. Sakata Y, Yama-moto J, Saiia A, Koga R, Kusuda N, Kosuge T, Yamaguchi T, Muto T, Makau-chi M. Reconstruction of hepatic or portal veins by use of newly customized great saphenous vein grafts. Langenbecks Arch Surg 2004;389:110-3.
6. Anderson BA, Neville R. Distal venous patch improves results in PTFE bypasses to tibial arteries. Acta Chir Belg 2006;106:372-7.
7. Paz Y, Lev-Ran O, Locker C, Shapira I. Right coronary artery revascularization in patients undergoing bilateral internal thoracic artery grafting: comparison of the free internal thoracic artery with saphenous vein grafts. Interact Cardiovasc Thorac Surg 2002;13:8-9.
8. Colombo A, Itoh A, Di Mario C, Maelio D, Arena G. Successful closure of a coronary vessel rupture with a vein graft stent: case report. Cathet Cardiovasc Diagn 1996;38:172-4.
9. Kereiakes DJ, Broderick TM, Howard WL, Anderson LC, Wiener M, Mittle DL. Successful long-term therapy following saphenous vein-covered stent deployment for atherosclerotic coronary aneurysm. Catheter Cardiovasc Interv 2002;55:100-4.
10. Deepritch RA, Naujoks CD, Meyer U, Köhler NR, Handschel JG. Ateriovenous subclavia-shunt for head and neck reconstruction. Head Face Med 2008;4:27.
11. Chang JA, Gholami SS, Lue TF. Surgical management: saphenous vein grafts. Int J Impot Res. 2002;14:375-8.
12. Haridas KK, Kumar V, Rajesh T, Kumar MV, Pannekal B. Percutaneous transliminal angioplasty with cutting balloon and stenting for isolated bilateral sorta-cornary ostial stenosis in a young female. Indian Heart J. 2001;53:490-2.
13. Friedman JA, Piepras DG. Current neurosurgical indications for saphenous vein graft bypass. Neurosurg Focus. 2003;14:e1.
14. Kaila M, Glowiucki P, Andrews JC, Cherry J, Bowar TC, Parmenton JM, Bjarnason H, Noel AA, Schieck D, Hammsen WS, Cantor LG, Paridoro PC. Open surgical and endovascular treatment of superior vena cava syndrome caused by nonma-lignant disease. J Vasc Surg. 2003;38:215-23.
15. Storey GS, Marks MP, Dake M, Norbash AM, Steinberg GK. Vertebral artery stenting following percutaneous transliminal angioplasty. Technical note. J Neurosurg. 1996;84:863-7.
16. Katz SG, Kohl RD. Direct revascularization for the treatment of forearm and hand ischaemia. Am J Surg 1992;165:312-6.
17. Tzok O, Yikl L, Besir Y, Can A, Obek C, Akcay A, Gurbuz A. Surgical treatment of axillary artery aneurysm. Tex Heart Inst J 2005;32:186-8.
18. Yektin U, Gurbuz A. Post-traumatic pseudoaneurysm of the brachial artery and its surgical treatment. Tex Heart Inst J 2003;30:293-7.
19. Hiemer W, Uy J, Geiser C, Gruss JD. Popfo-riplectomy and femorobiliary great saphenous vein “in situ” reconstructions in non selected patients. Life table analysis. J Cardiovasc Surg (Torino) 1993;34:303-5.
20. Davidson JT 3rd, Callis JT. Arterial revascularization of vessels in the foot and ankle. Ann Surg 1993;219:899-710.
21. Bastounis E, Georgopulos S, Maltezos C, Alexiou D, Chiotopoulos D, Bramis J. PTFE-vein composite grafts for critical limb ischaemia: a valuable alternative to all-autogenous infragenicu-late reconstructions. Eur J Vasc Endovasc Surg 1999;18:127-32.
22. Palma EC, Esperon R. Vein transplants and grafts in the surgical treatment of the postphlebitic syndrome. J Cardiovasc Surg (Torino) 1980;1:94-7.
23. Askherkhoanov RP, Arastakhian AM. Comparative evaluation of results of corrective surgery of the blood flow in post-phlebitis syndromes of the leg. Phlebologie 1975;28:603-9.
24. Brummer U. Postthrombotic syndrome 1978. Langenbecks Arch Chir 1978:347:293-7.
25. Kavasha A, Kavasha V, Fajer S, Eyal A, Carmeli R. Palmco procedure for acute intra-abdominal major venous injury. EJVES Extra 2006;11:1-4.
26. Ahuja S, Gaunt M, Crawford R. The use of Palma’s procedure in the salvage therapy for a leiomyosarcoma of the right pelvic sidewall: an intraoperative multidisciplinary approach. Int J Gynecol Cancer 2005;15:175-9.
27. Menyhei G, Szabo M, Kollar L. Late results of the Palmco operation. Orv Hetil 1995;136:1713-6.
28. Lee SK, Lee KB, Oh SK, Kim YW, Kim DI. Cross femoro-femoral venous bypass for illofemoral venous occlusion using autogenous vein graft. J Korean Soc Surg Vasc Surg 2008;24:45-48.
29. Schultz H. Flanged graft for end-to-side anasto-mosis. United States Patent 6273912. [cited 2009 May 17]. Available at: http://www.freepatentson-line.com/6273912.html.
30. Siegman FA. Use of the venous cuff for graft anastomosis. Surg Gynecol Obstet 1979;148:930.
31. Miller JH, Foreman RK, Ferguson L, Faris I. Interposition vein cuff for anastomosis of prosthesis to small artery. Aust N Z J Surg 1984;54:265-2.
32. Stonebridge PA, Prescott RJ, Buckley CV. Randomized trial comparing infraluminal polytetrafluoroethylene bypass grafting with and without vein interposition cuff at the distal anastomosis. The Joint Vascular Research Group. J Vasc Surg 1997;26:543-50.
33. Taylor RS, Loh A, McFarland RJ, Cox M, Ches-ter JR. Improved technique for polytetrafluoroethyl-ene bypass grafting: long-term results using anas-tomotic vein branches. J Vasc Surg 1992;19:348-54.
34. Butson RC, Sotturai VS, Craighead CC. Linton patch angioplasty. An adjunct to distal bypass with polytetrafluoroethylene grafts. Ann Surg 1984;199:684-93.
35. Tyrrell MR, Wolfe JH. Myointimal hyperplasia in vein collars for ePTFE grafts. Eur J Vasc Endo-vasc Surg 1997;14:33-6.
36. Rutter AP, Sikkenk PJ. Aneurysm of the he-patic artery: reconstruction with saphenous vein-graft. Br J Surg 1971;58:262-4.
37. Rudich SM, Kinkhabwala MM, Murray NG, See DM, Busuttil RW, Imagawa DK. Successful
treatment of mycotic hepatic artery pseudoaneurysms with arterial reconstruction and liposomal antifungal therapy. J Vasc Surg 2010;52:73-81.

53. Nakaoka K, Saito T, Nakao M, et al. Surgical reconstruction of renal artery pseudoaneurysms with arterial reconstruction and liposomal antifungal therapy. J Vasc Surg 2010;52:73-81.

54. Kang JH, Lee YH, Lee SY, et al. Surgical management of renal artery pseudoaneurysms and intracranial occlusive disease. J Neurol Neurosurg Psychiatry 2004;75:1039-42.

55. Jafar JJ, Russell SM, Wool HT. Treatment of giant aneurysmal aneurysms with saphenous vein extraluminal-to-intraluminal bypass grafting: indications, operative technique, and results in 29 patients. Neurosurgery 2002;50:327-31.

56. Ikawachi K, Kozak P, Abe T, Sawai T. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

57. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

58. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

59. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

60. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

61. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

62. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

63. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

64. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

65. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

66. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

67. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

68. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

69. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

70. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

71. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

72. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

73. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

74. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

75. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

76. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

77. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

78. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

79. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

80. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

81. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.

82. Abe T, Sawai T, Ikawachi K, Abe Y, Kozak P, Sawa M. Saphenous vein graft patch angioplasty for a discrete saccular aneurysm in a patient with chronic renal failure. J Vasc Surg 2005;41:595-600.
middle cerebral artery bypass with Dacron and saphenous vein grafts. Technical case report. Surg Neurol 2001;56:164-9.
97. Ramina R, Meneses MS, Pedrozo AA, Arruda WD, Borjes G. Saphenous vein graft bypass in the treatment of giant cavernous sinus aneu-
rysm: report of two cases. Arq Neuropsiquiatr 2000;58:162-8.
98. Samson DS, Gewertz BL, Beyer CW Jr, Hodosh RM. Saphenous vein interposition grafts in the mi-
crosurgical treatment of cerebral ischemia. Arch Surg 1981;116:1578-82.
99. Iwai Y, Sekhar LN, Goel A, Cass S. Vein graft replacement of the distal vertebral artery. Acta Neurochir (Wien) 1993;120:81-7.
100. Morgan MK, Ferch RD, Little NS, Harrington TJ. Bypass to the intracranial internal carotid ar-
tery. J Clin Neurosci 2002;9:418-24.
101. Steiger HJ, Reulen HJ, Huber P, Bull J. Radical resection of superior sagittal sinus menin-
gioma with venous interposition graft and reimpl-
plantation of the rolled vein cases. Case report. Acta Neurochir (Wien) 1989;100:108-11.
102. Earle AS, Feng LJ, Jordan RB. Long saph-
enous vein grafts as an aid to microsurgical re-
construction of the trunk. J Reconstr Microsurg 1990;6:165-9.
103. Karanas VL, Yim KK, Johannet P, Hui K, Lin-
eaweaver WC. Use of 20 cm or longer interposition vein grafts in free flap reconstruction of the trunk. Plast Reconstr Surg 1998;101:1262-7.
104. Tannenbaum AH, Tesoro VR, Wood DL. Staged transfer of a free microvascular latisimus dorsi myocutaneous flap using saphenous vein grafts. Plast Reconstr Surg 1983;71:943-7.
105. Rechnic M, Edelson RJ, Fosburg RG. Single-
anastomosis femoral arteriovenous shunt as re-
cipient vessels for free-flap reconstruction of a massive lumbosacral wound. Plast Reconstr Surg 1977;59:242-4.
106. Naih F, Hajgary R. One-stage microvascular transfer of a latisimus flap to the sacrum using vein grafts. Plast Reconstr Surg 1986;77:312-5.
107. Vlasic G, Earle AS. Short saphenous vein grafts as an aid to microsurgical reconstruction of the lower extremity. J Reconstr Microsurg 1989;5:145-54.
108. Chang KP, Lee HC, Lai CS, Lin SD. Use of single saphenous interposition vein graft for pri-
mary arterial circuit and secondary recipient site in head and neck reconstruction: a case report. Head Neck 2007;29:412-5.
109. Liang MD, Narayanan K, Ramasasy SS, Stofman G. Lower extremity reconstruction using a long-cryopreserved venous allograft for free flap
venous outflow. Microsurgery 1992;13:59-61.
110. Citrin P, Dasamahapata KS. Interposition spiral saphenous vein graft bypass in bilateral si-
multaneous radical neck dissection. Surg Gynecol Obstet 1988;167:79-80.
111. Sasso F, Gulino D, Falabella R, D’Addessi A, Sacco E, D'Orofio A, Bassi PF. Peyronie’s disease: lights and shadows. Urol Int 2007;78:1-9.
112. Adenyi AA, Goorney SR, Pryor JP, Ralph DJ. The Lue procedure: an analysis of the outcome in Peyronie’s disease. BJU Int 2002;90:404-8.
113. Lue TF, El-Sakka AI. Venous patch graft for Peyronie’s disease. Part I: technique. J Urol 1998;160:Pt 1:2047-9.
114. Kalsi J, Minhas S, Christopher N, Ralph D. The results of plaque incision and venous grafting (Lue procedure) to correct the penile deformity of Peyronie’s disease. BJU Int 2005;95:1029-33.
115. El-Sakka AI, Rashidwan HM, Lue TF. Venous patch graft for Peyronie’s disease. Part II: outcome analysis. J Urol 1998;160:Pt 1:2050-3.
116. Melin A, Kayigil O, Ahmed SI. Plaque incision and venous patch grafting for Peyronie’s disease. Int Urol Nephrol 2002;34:225-7.
117. De Stefano S, Savoca G, Ciampalini S, Gattuc-
io C, Scari F, Belgrano E. Saphenous vein harvest-
ing by ‘stripping’ technique and ‘W’-shaped patch covering after plaque incision in treatment of Pey-
ronie’s disease. Int J Impot Res 2000;12:299-301.
118. Lue TF, El-Sakka AI. Lengthening shortened penis caused by Peyronie’s disease using circular venous grafting and daily stretching with a vacu-
um erection device. J Urol 1999;161:1141-4.
119. Lawton RL, Sharzer LS. Vascular access for patients on maintenance dialysis. Surg Gynecol Obstet 1972;135:279-83.
120. Haimov M, Burrows L, Baez A, Neff M, Silkin R. Alternatives for vascular access for hemodi-
alysis: experience with autogenous saphenous vein autografts and bovine heterografts. Surgery 1974;75:457-462.
121. Cimochowski GE, Rutherford WE, Blondin J, Harter H. Use of the spiral vein graft as an arterial substitute for secondary access. Am J Nephrol 1991;11:64-8.
122. Gagne PJ, Martinez J, DeMassis R, Gregory R, Parent FH, Gayle R, Meier GJ 3rd, Philpott C. The effect of a venous anastomosis Tyrell vein collar on the primary patency of arteriovenous grafts in patients undergoing hemodialysis. J Vasc Surg 2000;32:1149-54.
123. Wobbes T, Slooff MJ, Steijger DT, Mulder NH, Postma A. Five years’ experience in ac-
cess surgery for polychemotherapy. An analysis of results in 100 consecutive patients. Cancer 1983;52:978-92.
124. Gaba UM, Collins DJ Jr, Rich NM, Kozloff L, McDonald PT. Nondialysis use for vascular ac-
cess procedures. Ann Surg 1979;180:72-4.
125. Levey RH, Sallen S, Weinstein H, Jaffe N. Surgical techniques for vascular access for che-
motherapy in infants and children. J Pediatr Surg 1978;13:724-8.
126. Schaefdermeier PK, Cabeza N, Besser JC, Lohse P, Daebritz SH, Schmitz C, Reichart B, So-
dian R. Potential cell sources for tissue engineer-
ing of heart valves in comparison with human pulmonary valve cells. ASAIO J 2009;55:88-92.
127. Laub GW, Muralidharan S, Clancy R, El-
dredge WJ, Chen C, Adkins MS, Fernandez J, Anderson WA, McBrath LB. Cryopreserved al-
lograft veins as alternative coronary artery by-
pass conduits: early phase results. Ann Thorac Surg 1992;54:826-31.
128. Buckley CJ, Abemathy S, Lee SD, Arko FR, Patterson DE, Manning LG. Suggested treat-
ment protocol for improving patency of femoral-
infrapopliteal cryopreserved saphenous vein al-
lografts. J Vasc Surg 2000;32:731-7.
129. Martin RS 3rd, Edwards WH, Mulherin JL, Jr, Edwards WH Jr, Jenkins JM, Hoff SJ. Cryo-
preserved saphenous vein allografts for below-
 knee lower extremity revascularization. Ann Surg 1994;219:664-72.
130. Iaffaldano RA, Lewis BE, Johnson SA, Piffare-
T, McKiernan TL. Patency of cryopreserved sa-
phenous vein grafts as conduits for coronary ar-
tery bypass surgery. Chest 1995;108:725-9.
131. Sellke FW, Stanford W, Ross P. Failure of cryopreserved saphenous vein allografts follow-
ing coronary artery bypass surgery. J Cardiovasc Surg (Torino) 1991;32:826-3.
132. Kim JS, Choi TH, Kim NG, Lee KS, Han KH, Son DG, Kim JH. Flow-through arterialised ve-
nous free flap using the long saphenous vein for salvage of the upper extremity. Scand J Plast Re-
constr Hand Surg 2008;42:218-23.
133. Kadioglu A, Sanli O, Akman T, Ersay A, Gu-
ven S, Mammadov F. Graft materials in Peyronie’s disease surgery: a comprehensive review. J Sex Med 2007;4:581-95.
134. Vasquez MA. Vascular access for dialy-
sis: recent lessons and new insights. Curr Opin Nephrol Hypertens 2009;18:116-21.
135. Windsu DW. Permanent vascular ac-
cess: a nephrologist’s view. Am J Kidney Dis 1993;21:457-71.
136. Vesely TM. Endovascular intervention for the failing vascular access. Adv Ren Replace Ther 2002;8:99-108.