Durability of saphenous vein grafts: 44-year follow-up of a saphenous vein interposition graft in a pediatric patient

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We report the 44-year follow-up of a 9-year-old girl who underwent a saphenous vein interposition graft in 1964 after suffering extensive pelvic trauma with complete disruption of the right common femoral artery. The patient recovered from this injury and experienced no disability or pain until 2008, when she suddenly developed numbness in the right leg. Evaluation at that time showed a new occlusion of the saphenous vein graft, and she underwent uneventful repeat revascularization with autogenous vein. To our knowledge, this 44-year patency is the longest reported for a saphenous vein graft. (J Vasc Surg 2012;56:216-8.)

CASE REPORT

The senior author (J.K.) published a case report in 1966 on the successful management of a 9-year-old girl who sustained blunt trauma with avulsion and thrombosis of her right femoral artery.[1] Herein, we report the status of this patient 44 years postoperatively.

In 1964, the child was struck by a heavy truck that ran obliquely across her pelvis and abdomen, producing extensive soft tissue injury. Her right leg was rendered cool and pulseless. Exploration of a large right groin wound revealed road debris ground into the tissue and the femoral artery to be "firm, bluish, and pulseless." Dissection was carried upward to the external iliac artery, which was in spasm but pulsatile. Free flow of blood was confirmed through an aspirating needle, so the external iliac artery was targeted proximally for revascularization.

In this young patient with complete disruption of the femoral artery and surrounding tissues, revascularization was pursued to avoid acute limb ischemia and developmental sequellae of chronic ischemia. An autogenous graft was preferred due to the contaminated field and her age. A segment of the ipsilateral saphenous vein (4 mm after harvest) was used for interposition graft and sutured in place in an interrupted fashion. The graft was approximately 6 cm long and a good match with the external iliac and common femoral arteries. Afterward, a forceful pulse was detected within and distal to the graft, and the leg regained normal color. Postoperatively, the patient was continued on antibiotics and underwent several other procedures to repair soft tissue injuries. She was playing as usual within a few months. The patient was followed by physical examination every 6 months for several years, which consistently demonstrated a strong dorsalis pedis pulse, normal sensorimotor function, and limbs that were otherwise symmetric.

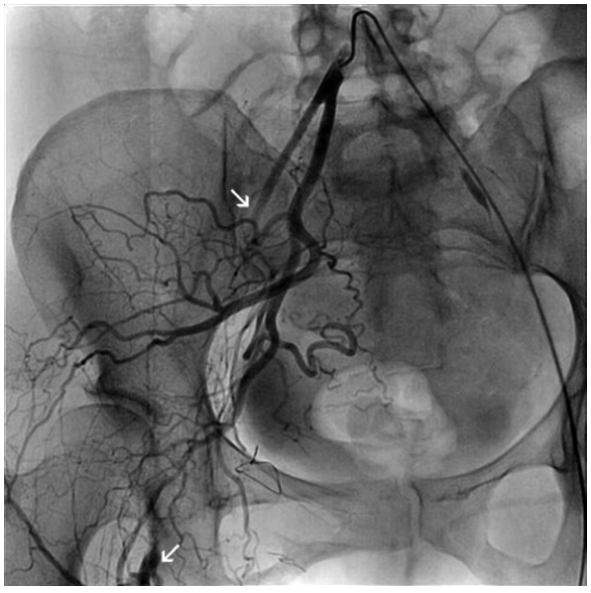

Fig 1. Arteriogram performed 44 years after the initial surgery demonstrated a normal aorta, normal common and internal iliac arteries, and occlusion of the external iliac artery (*upper arrow*) with reconstitution of the common femoral bifurcation (*lower arrow*).

The patient experienced no chronic symptoms of arterial or venous insufficiency and eventually became a nurse. She was in good health until 2008, when she experienced acute pain and numbness in the right leg. An angiogram confirmed that the interposition graft was occluded (Fig 1). The external iliac and vessels distal to the graft, including the superficial femoral and profunda femoris arteries, were patent (Fig 2).

On operation, the previous vein graft was confirmed to be occluded and it was removed. It was encased in dense scar tissue but not diminutive or aneurysmal. Tissue pathology demonstrated calcified atherosclerotic changes with ≥75% stenosis and thrombus

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in the lumen. A new segment of reversed saphenous vein was anastomosed end-to-end with the external iliac artery proximally and femoral bifurcation distally. Her postoperative course was uncomplicated and she has no ongoing symptoms of arterial insufficiency. An arterial duplex 6 months postoperatively confirmed graft patency and demonstrated no femoral, popliteal, or tibial stenoses.

DISCUSSION

Vascular trauma in children is generally managed by the same principles that have proven successful in the adult vascular trauma population. However, very few children are followed for more than 1 to 2 years and none of the recent large case series document long-term outcomes.[2-5] There are several reasons for the lack of data on children. First, vascular injury in children is uncommon, diagnosed in fewer than 2% of pediatric trauma cases, and even fewer patients require intervention.[2,6] After vascular repair, follow-up of the patients is scattered among multiple specialties.[3,4] There is also no standardized protocol for long-term follow-up after vascular repair, and surveillance imaging is rarely performed in the pediatric population.

Children tend to do well in the days to weeks after vascular trauma, so the attention turns to performing a durable vascular repair and maximizing functional outcome. Most mortalities after pediatric vascular trauma are secondary to the patients' other injures, particularly traumatic brain injury. Amputations are typically only needed for patients with mangled extremities (eg, lawn mower injury) and/or delayed presentation.[3,7]

Although there is a low risk of limb loss secondary to arterial trauma, there is concern for impaired growth of the affected limb if arterial insufficiency is not adequately treated. Children with arterial insufficiency related to Blalock-Taussig shunts and femoral artery injuries after cardiac catheterization have been observed to have decreased limb length on the affected side, which may be correctable by revascularization.[8] In a young child, such as the one described in this case report, a vascular repair optimally allows the limb to develop normally.

Although many of the strategies for treating vascular injuries in adults can reasonably be applied to children, there are some special diagnostic and treatment considerations. Vascular injuries can be more difficult to diagnose in children because they are more likely to be asymptomatic and vasospasm is common (26%-41% of cases).[2,9] Blunt trauma comprises about one-half of the pediatric vascular trauma cases, making the extent of the injury difficult to define and often prohibiting primary repair.[2,4] Angiography is not routinely used in young children due to the excessive risk of thrombotic complications, but in older children, it can be used to confirm the presence of a vascular injury and to define the anatomy for revascularization.[4,7] Duplex ultrasound scan carries less risk, but the equipment and/or technician may not be readily available at pediatric hospitals.

Primary repair is the most common treatment for arterial injuries in children but should only be attempted for short-segment injuries that can be repaired tension-free. Revascularization in a child requires the surgeon to match the current sizes of the graft and conduit and also to account for future growth. For the lower extremity, a reversed saphenous vein graft with anastomosis of interrupted suture is recommended. Expanded polytetrafluoroethylene grafts have shown to be relatively successful in adults for treatment of iliac or femoral arterial injuries, even in contaminated fields, but have a higher rate of late thrombosis.[10,11] The long-term patency of expanded polytetrafluoroethylene grafts in growing children has not been documented.

Fig 2. Arteriogram demonstrated reconstitution of the common femoral artery (*arrow*). The deep and superficial femoral arteries were visualized and there was normal three-vessel runoff to the foot.

Our case provides insight into the "ultra" long-term durability of vein grafts in children, far surpassing the follow-up reported in previous series. To date, the longest follow-up on revascularization after pediatric trauma was by Harris et al,[12] who reported on nine of 19 patients who received bypass procedures for traumatic vascular injury and were able to be reached for follow-up (maximum 52 months, mean 32 months). Seventy-eight percent of the patients reported eventual return to normal activities; all of the patients who reported residual disability had patent grafts but concomitant major lower extremity soft tissue and orthopedic injuries. None of the patients had limb-length discrepancy, graft thrombosis, or aneurysmal degeneration. Dalsing et al[7] reported on late follow-up of three patients with

reversed saphenous vein grafts (21-49 months), none of whom experienced graft stenosis or dilatation on duplex ultrasound scan. Dorweiler et al[13] reported excellent patency among adults receiving vein interposition grafts after arterial trauma; on follow-up of 23 to 139 months, there were no late thromboses. Based on our experience and the results reported by these authors, it would be reasonable to obtain a baseline arterial duplex and ankle-brachial index postoperatively and follow the patient every 3 months for 1 year, every 6 months for 2 years, and then annually as the surgeon feels is appropriate.

This is, to the best of our knowledge, the longest patency of a saphenous vein graft ever reported in the literature. Arguably, it is not possible to make broad conclusions based on a single case, but our case report demonstrates that for a young child, the "gold standard" saphenous vein graft with anastomosis of interrupted suture can last well into adulthood. For the inquisitive vascular surgeon, emergently called to revascularize the extremity of a young child but often unable to follow the child into adulthood, this report validates the durability of repair as that child grows through life.

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