

CASE REPORT

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Use of the autologous spiral vein graft: a two-stage iliac bypass in a potentially fatal case of pelvic trauma and contaminated tissues

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ABSTRACT

Serious problems may be encountered in arterial or venous reconstruction in cases of severe trauma and contaminated tissues. We report the use of a spiral venous graft (SVG) in a case of two-stage bypass aimed at saving first life, and then the extremity.

Severe open and contaminated injury was present in the lower abdomen and pelvic region of 29-year-old woman brought to the emergency department following a traffic accident. The patient was in shock, and was taken for emergency surgery jointly with the relevant departments. Interposition bypasses with synthetic graft were performed in the first stage. The synthetic grafts were subsequently removed due to problems developing secondary to infection at subsequent follow-up, and revascularization was established with autologous grafts together with SVG.

SVGs are alternative grafts in cases with contaminated tissues and requiring major vessel reconstruction. This technique can add to the therapeutic options available.

Keywords: pelvic trauma, contaminated tissue, iliac bypass, spiral venous graft, autologous graft

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INTRODUCTION

Pelvic traumas can result in life- or extremity-threatening iliac vessel injuries.¹ Serious problems may be encountered in arterial or venous reconstruction in cases in which tissues are contaminated. Autologous grafts should be employed in such cases. Autogenous vessels compatible with the diameters of iliac vessels prepared from the autologous great saphenous vein are referred to as spiral venous grafts (SVG).^{2,3} We describe the use of an SVG in a case involving two-stage iliac bypass intended to save, first life, and then the extremity.

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CASE PRESENTATION

A 29-year-old woman was brought to the emergency department following a traffic accident. She had been hit by a reversing truck, and her abdominopelvic region was crushed under the wheels. Her blood pressure was 60/30 mmHg, and her heart rate was filiform at 130 beats/min. Her hemoglobin level was 4.7 g/dl, and her hematocrit level was 18%, and the patient was in a confused state. A 30-cm transverse irregular incision involving the abdomen, right hip and pelvic region, and crush areas in the pelvic region were observed. The pelvic bones on the right were also fractured. The colon and ileum protrude from the abdomen, and contaminated open injuries and crush areas containing foreign matter were present (Figure 1). Active bleeding was present from the iliac region. No femoral or distal pulses were detectable on the right side. The patient was immediately admitted to the operating theater for emergency surgery. Arrest occurred, following which resuscitation and surgical exploration were performed. The iliac artery and iliac vein were observed to be completely severed. The hemorrhaging vessels were clamped, and resuscitation continued. In the emergency room and during the intraoperative period, a total of 10 units of erythrocyte suspension, two units of fresh whole blood, and four units of fresh frozen plasma were infused. When hemodynamic stability was achieved, revascularization was established with interposition bypasses using 8-mm polytetrafluoroethylene grafts (Atrium PTFE Vascular Graft, Maquet, Merrimack, New Hampshire, USA) and separate end-to-end anastomoses to the right iliac artery and vein (Figure 2). Interventions were performed on other traumatized organs and tissues in other areas of the abdomen and pelvis. After surgery, the patient was taken to the intensive care unit for life support therapy. She was removed from the mechanical ventilator on the postoperative second day, and good lower extremity peripheral circulation was observed. On the postoperative sixth day, the patient was again taken for surgery for revision due to hematoma and active bleeding in the injury site. Infection had developed in the injury site and around the grafts. The prosthetic grafts applied to the vein and artery were removed, and debridement was performed. The saphenous vein was harvested from the contralateral side. Next, an interposed bypass was performed by reversing a 12-cm autologous saphenous graft between the right common iliac artery and the right distal external iliac artery. The autologous great saphenous vein brought into panel form with a longitudinal incision was wrapped around a 12-mm bougie (a medical instrument used during esophageal dilation). A 10-cm tube-shaped SVG was formed by continuing to suture along the margins with 6/0 prolene (Figure 3). The interposition bypass between the right common iliac vein and the distal right external iliac vein was then performed using the SVG. Both arterial and venous patency was thus re-established with the use of these autologous grafts (Figure 4 – Figure 5A-B). Both the popliteal and distal pulses were pulsatile postoperatively. No venous edema was present in the lower extremities. On postoperative day six, *Staphylococcus epidermidis* and *Escherichia coli* were detected, and antibiotics including tigecycline, imipenem and ciprofloxacin with the appropriate sensitivity were administered. Three further operations were performed by a plastic surgeon due to infection and wound problems in the superficial and deep tissues. The patient was discharged on the 34th day with pulsatile lower extremity distal pulses and fully complete wound healing. She subsequently received physiotherapy rehabilitation and was able to walk unaided by the second year. No edema was observed in the extremities, and her peripheral circulation was also good.

This case report is a good example of the use of SVG in patients with great vessel insult after contaminated open injury.

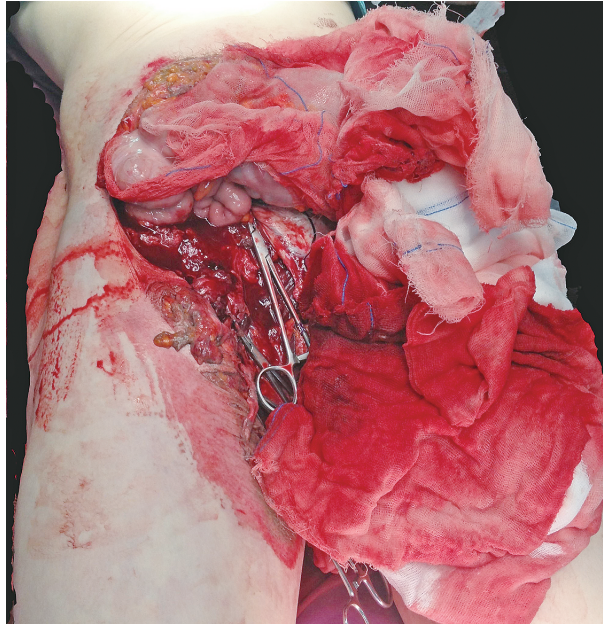


Fig. 1 Preoperative appearance of open and contaminated injury in a trauma patient following a road accident. Her abdominopelvic region was heavily crushed under the wheels. Bleeding in the large vessels was brought under control by the use of clamps in the emergency room.

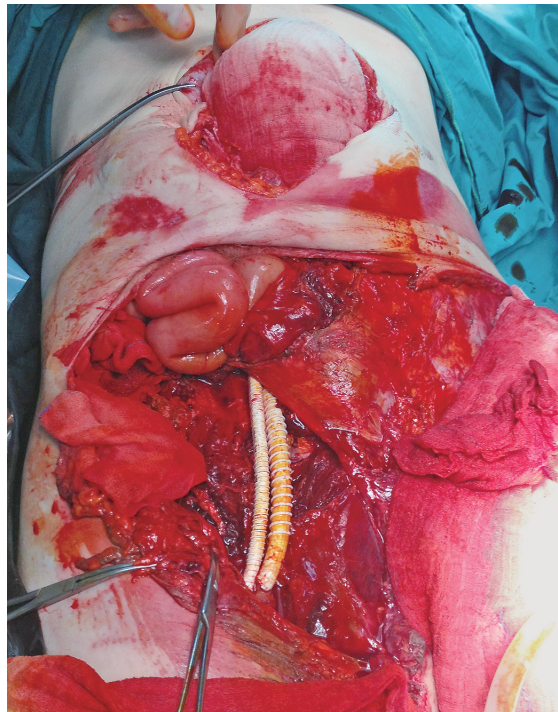


Fig. 2 Intraoperative image. Arterial and venous continuity with interposition grafts were established using a PTFE vascular graft in the first operation.



Fig. 3 Intraoperative appearance of the 10 cm spiral venous graft formed from the autologous saphenous vein wrapped around a 12-mm bougie.

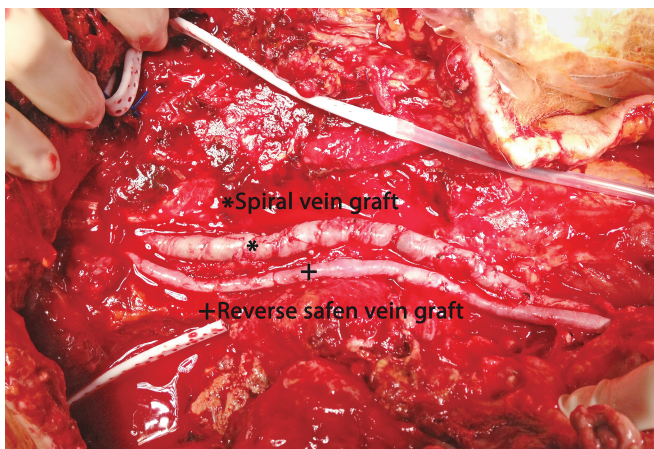


Fig. 4 Intraoperative appearance of the autologous venous grafts applied as interposition bypasses to the iliac vessels in the second operation. An autologous saphenous vein graft interposition bypass was performed on the iliac artery, and an autologous spiral vein graft bypass to the iliac vein.
*Spiral vein graft + Reversed saphenous graft.

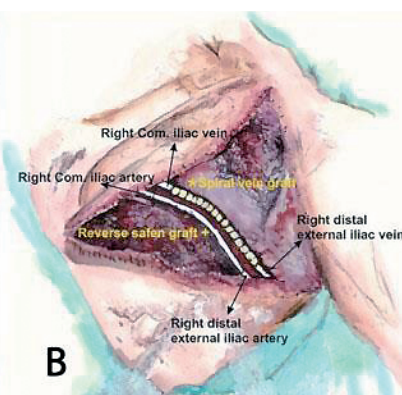
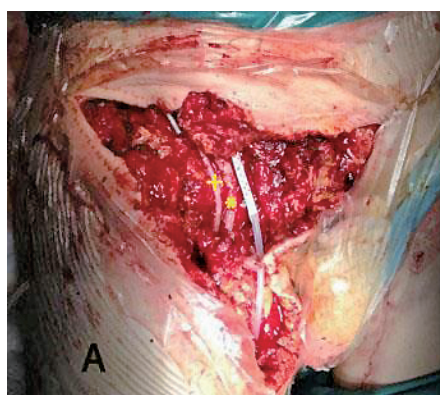


Fig. 5A: Intraoperative photograph showing arterial and venous continuity with the reversed saphenous graft and spiral vein graft.

Fig. 5B: Simplified illustration showing anastomotic sites in the second operation. *Spiral vein graft + Reversed saphenous graft.

DISCUSSION

Injuries resulting from high-energy traumas have high mortality rates in the event of hemodynamic instability. Mortality can rise as high as 40–60% in some series involving pelvic trauma.^{4,5} Acute blood losses are the most frequent cause of death in the first 24 h, and multi-organ failure in the later period.⁴ The primary aim of treatment in patients with multiple trauma and vascular injury is therefore to establish hemodynamic stability by bringing bleeding under control.³ Once survival has been ensured, the secondary aim must be to save the extremities. Treatment must be planned on a multi-disciplinary basis due to the characteristics of the organs and tissues in the region of the injury.

Our patient experienced severe trauma to the lower abdomen and was intraoperatively evaluated by the orthopedics, general surgery and plastic and reconstructive surgery departments. Our primary aim in treatment was to improve vital functions as quickly as possible. We therefore supported resuscitation by bringing the bleeding in the traumatized vessels under control. Continuity of circulation was then established with interposition bypasses to the iliac artery and vein using prosthetic grafts. The factors affecting our graft selection were our severe time pressures due to the patient's poor condition and the graft types available in our operating theatre at the time. Injured organs and tissues were repaired by other departments. The patient was then transferred to intensive care.

Bleeding from the grafts secondary to infection occurred due to wound contamination on the postoperative sixth day. Revision was again performed in this new emergency situation. Our aim in the secondary operation was to renew the bypasses using autologous grafts, which are resistant to infection, once the bleeding had again been brought under control. Once the infected tissues had been removed, an interposition bypass was performed to the iliac artery with an autologous saphenous vein graft, since there was no incompatibility between their diameters. However, a difference in diameter was observed between the iliac vein and the saphenous graft, and venous continuity was therefore established with the prepared SVG.

Composite venous grafts prepared from the autologous saphenous vein were first described for vena cava pathologies.³ Subsequently, they were recommended in both arterial and venous reconstructions if the diameter of the prosthetic graft is not optimal or in the presence of infected tissues.^{6,9} Composite venous grafts are prepared in panel or spiral forms.¹⁰ The use of the SVG is more common in the literature than that of autologous panel vein grafts.

The SVG makes it possible to obtain an autologous graft appropriate to the desired diameter in cases of incompatibility between vessels. Preparation of the SVG following removal of the saphenous vein grafts takes approximately 15 min for an experienced surgeon. This yields a tube graft that is more resistant to infections and with low thrombogenicity due to native endothelialization.^{6,8}

The short- and long-term outcomes of SVG therapy have been discussed in a number of studies, and the available literature indicates a high success rate, high patency, and continuing success at short-, mid- and long-term follow-ups, the long term representing a period of approximately 10 years.^{6,11}

CONCLUSION

SVGs represent alternative options in cases with contaminated tissues and requiring major vessel reconstruction. This technique can thus add to the therapeutic options available to the surgeon. It is essential for correct decisions to be taken at the correct time, with aggressive

perioperative management and a multidisciplinary approach, in the treatment of patients with severe trauma and multi-organ injury.

CONFLICT OF INTEREST

All the authors confirm that they have no financial and personal relationships with other people, or organizations, that might inappropriately influence (bias) this work.

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