Long-Term Results of Obturator Bypass

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Objective: We evaluated the long-term outcomes of obturator bypass.

Material and Methods: A total of 16 patients (13 males and 3 females; 17 limbs) who underwent obturator bypass surgery at our department between April 1995 and March 2008 were included.

Results: Their ages ranged from 50 to 90 with a mean of 74 years. Inguinal infections observed in the 16 patients consisted of vascular graft infections in 13 patients, hemostatic device infections following endovascular therapy in two patients, and femoral artery infections following coronary angiography in one patient. The cumulative patency rate was 69% for 3 years and 43% for 5 years. The cumulative survival rate was 64% for 3 years and 55% for 5 years.

Conclusion: Obturator bypass surgery was successfully performed with favorable results for arterial infections and vascular graft infections in the inguinal region.

Keywords: obturator bypass, inguinal arterial infections, infections of femoro-popliteal artery bypass grafts

Introduction

Infections of both native and prosthetic vessels are most frequently seen in the region of the groin. The main predisposing factors for vascular groin infection are infected lymph glands or surgical division of lymphatic channels, the proximity of the groin to the perineum, the relatively superficial location of vascular grafts in the groin, and the development of wound infection adjacent to a vascular graft. While a variety of protocols are designed to treat such infections, we proactively perform obturator bypass surgery to treat them. The obturator bypass we used in this study has a number of advantages, including less graft infections thanks to deep graft routes and shorter graft lengths than other bypasses. We evaluated the long-term outcomes of this operative procedure.

Materials and Methods

A total of 16 patients (13 males and 3 females; 17 limbs) who underwent obturator bypass surgery at our department between April 1995 and March 2008 were included. Their ages ranged from 50 to 90 years with a mean of 74. Therapeutic outcomes obtained during a follow-up of 1592 days on average were examined (Table 1).

Operative procedure

Although we initially performed surgery via laparotomy, a retroperitoneal approach is currently used. In inguinal arterial infections, the external iliac artery is taped, after which the superficial femoral artery is exposed slightly proximal to the right femoral center. After the obturator foramen is identified, a tunneler for femoral shunt dialysis is inserted into it from the proximal side while being careful not to damage the obturator artery, and a 6 mm ringed expanded polytetrafluoroethylene (ePTFE) graft (Distaflo™) is passed through.

In infections of femoro-popliteal artery bypass grafts, the distal artery is exposed from the distal anastomotic site, and because this is a lengthy bypass, a long tunneler for the bypass is inserted into the obturator foramen from the distal side, and a graft is passed through in the same manner as described above. After administration of heparin, an anastomosis is made distally, and the right external iliac artery is then dissected; an end-to-end anastomosis is made, the distal external iliac artery is sutured and closed, and each wound is sutured and closed.

Next, indigo carmine is injected into the infected inguinal site, and the tissue, including the infected skin, is resected, and the infected artery and vascular graft are reached. The common femoral artery and superficial and deep femoral arteries are partially resected. Thereafter, the
Table 1  Previous operative procedures, causative organism and outcome

<table>
<thead>
<tr>
<th>Case</th>
<th>Previous operative procedure</th>
<th>Bacteria</th>
<th>Interval</th>
<th>Approach</th>
<th>Graft</th>
<th>Graft patency</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 75y, M</td>
<td>A-biF</td>
<td>B-hemolytic streptococci</td>
<td>32 M</td>
<td>transperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 5 months): cerebral infarction, pneumonia</td>
</tr>
<tr>
<td>2. 79y, M</td>
<td>F-P</td>
<td>MRSA</td>
<td>4 M</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 12 months): Myocardial infarction</td>
</tr>
<tr>
<td>3. 83y, M</td>
<td>F-F</td>
<td>MSSA</td>
<td>20 M</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 90 months): Senility</td>
</tr>
<tr>
<td></td>
<td>Ax-F</td>
<td>MRSA</td>
<td>24 M</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Alive (after 116 months)</td>
</tr>
<tr>
<td>4. 50y, M</td>
<td>GR of FA</td>
<td>MRSA</td>
<td>8 M</td>
<td>transperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 70 months): cancer</td>
</tr>
<tr>
<td>5. 75y, M</td>
<td>A-biF, F-P</td>
<td>MRSA</td>
<td>20 day</td>
<td>transperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 70 months): pneumonia</td>
</tr>
<tr>
<td>6. 68y, M</td>
<td>PCI</td>
<td>MRSA</td>
<td>45 day</td>
<td>transperitoneal</td>
<td>ringed ePTFE</td>
<td>O</td>
<td>Alive (after 114 months)</td>
</tr>
<tr>
<td>7. 72y, F</td>
<td>IABP insertion</td>
<td>MRSA</td>
<td>1 M</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Deaths (after 2 months): pneumonia</td>
</tr>
<tr>
<td>8. 90y, F</td>
<td>F-F</td>
<td>MRSA</td>
<td>21 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 30 months): senility</td>
</tr>
<tr>
<td>9. 83y, M</td>
<td>PTA,Stent</td>
<td>MRSA</td>
<td>40 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 42 months): senility</td>
</tr>
<tr>
<td>10. 77y, F</td>
<td>Internal shunt</td>
<td>MRSA</td>
<td>15 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 35 months): pneumonia</td>
</tr>
<tr>
<td>11. 84y, M</td>
<td>GR of FA</td>
<td>unknown</td>
<td>8 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Alive (after 37 months)</td>
</tr>
<tr>
<td>12. 75y, M</td>
<td>PCI</td>
<td>MRSA</td>
<td>15 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>O</td>
<td>Alive (after 15 months)</td>
</tr>
<tr>
<td>13. 82y, M</td>
<td>PCI</td>
<td>MRSA</td>
<td>15 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Alive (after 7 months)</td>
</tr>
<tr>
<td>14. 59y, M</td>
<td>Ax-biF</td>
<td>MRSA</td>
<td>22 day</td>
<td>retroperitoneal</td>
<td>Rifampicin</td>
<td>P</td>
<td>Alive (after 5 months )</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>soaked Dacron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. 57y, M</td>
<td>A-F</td>
<td>MRSA</td>
<td>2 M</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Alive (after 2 months)</td>
</tr>
<tr>
<td>16. 81y, M</td>
<td>F-P</td>
<td>MRSA</td>
<td>28 day</td>
<td>retroperitoneal</td>
<td>ringed ePTFE</td>
<td>P</td>
<td>Death (after 4 months)</td>
</tr>
</tbody>
</table>

M: male; A-biF: aorto-bilateral femoral bypass; ePTFE: expanded polytetrafluoroethylene; P: patent; F-P: femoropopliteal bypass; MRSA: methicillin-resistant Staphylococcus aureus; F-F: femorofemoral cross over bypass; MSSA: methicillin-sensitive Staphylococcus aureus; Ax-F: axillo-femoral bypass; GR: graft replacement; FA: femoral artery; PCI: percutaneous coronary angioplasty; O: occlusion; F: female; IABP: intra-aortic balloon pumping; PTA: percutaneous transluminal angioplasty; Ax-biF: Axillo-bilateral femoral bypass
areas surrounding the affected sites are subjected to debridement and washed with iodine-containing physiological saline. The stumps are sutured and closed with Prolene 3.0 and double ligated, and the skin and subcutaneous tissue are single-layer sutured with #2 nylon thread to complete the surgery. We make it a rule not to reconstruct the deep femoral artery. We administered antiplatelet drug semipermanently after operation.

The data on the patency rate and survival rate were statistically analyzed using the Kaplan-Meier method.

Results

Inguinal infections observed in the 16 patients consisted of vascular graft infections in 13 patients, hemostatic device infections following endovascular therapy in two patients, and femoral artery infections following coronary angiography in one patient. The previous operative procedure was performed at our hospital for 9 of the 16 patients, and at other hospitals for the remaining seven patients. Fourteen patients underwent emergency surgery.

Identified causative organisms were methicillin-resistant Staphylococcus aureus (MRSA) in 13, β hemolytic streptococci in one patient, methicillin-sensitive Staphylococcus aureus (MSSA) in one patient and unknown in one patient.

In case 3, identified causative organisms were MRSA in the contralateral groin region at four months after first surgery. The length of period from preceding surgery or procedure to disease onset ranged from 8 days to 32 months, with a mean of 5 months. The method of approaching the obturator foramen used was the retroperitoneal approach in 12 subjects and laparotomy in four subjects. Fourteen ringed ePTFEs (1 with 8 mm diameter and 13 with 6 mm diameter) and two ringed rifampicin-soaked vascular grafts were used as bypass grafts (Table 1). The patient receiving the 8 mm graft had coxalgia.

Bypass obstruction occurred in two subjects. In one subject, obstruction was caused by failure to take antiplatelet drugs after surgery, and secondary patency was achieved with thrombectomy. In the other subject, the cause of the obstruction was unknown, and femoro-femoral arterial crossover bypass surgery was performed for distal anastomosis from the distal anastomotic site of the obturator bypass. The cumulative patency rate was 69% for 3 years and 43% for 5 years (Fig.1).

Major amputation was performed in one patient. This patient underwent surgery to construct a femoro-above-knee-popliteal artery bypass with vascular grafts and a popliteal artery-ankle posterior tibial artery bypass with autologous veins; however, vascular graft infection occurred in the inguinal region. Although obturator bypass surgery was performed, crus infection expanded, resulting in above-knee amputation despite a good blood flow.

Two hospital deaths occurred; both patients, in a poor general condition, experienced sepsis from infections and eventually died of disseminated intravascular coagulation (DIC). Six deaths occurred due to various causes long
after hospital discharge: senility in three subjects, cerebral infarction and pneumonia in one subject each, myocardial infarction in one subject, and pneumonia in one subject. The cumulative survival rate was 64% for 3 years and 55% for 5 years (Fig. 2).

The following is a rare case (Patient 3) of bilateral bypass surgery. An 83-year-old male presented with the chief complaint of reddening and swelling in the left inguinal region. At 81 years, he underwent femoro-femoral arterial crossover bypass surgery for arteriosclerosis obliterans. Initially, the inguinal region was washed with Povidone iodine for about 1 month. Because of the lack of improvement, however, the femoro-femoral arterial crossover bypass graft was removed, and a right axillo-femoral bypass and left obturator bypass were constructed. Although the patient had a good postoperative course, reddening and swelling developed in the right inguinal area, with no inducers, two years later. For this reason, the right axillo-femoral bypass graft from the right flank to the right femoral artery was removed, and a bypass was constructed from the right axillo-femoral bypass flank stump through the obturator foramen to the superficial femoral artery at the femoral center via the retroperitoneum, using an ePTFE graft 6 mm in diameter (Fig. 3). The postoperative course was good with no recurrent infection.

Discussion

The incidence rate of inguinal infections, including those associated with vascular graft, observed at our facility was 0.7%.

A wide variety of treatments are performed for vascular graft infections and inguinal arterial infections at the inguinal region, including (i) topical lavage and coverage with pedunculated fascia lata or sartorius muscle or rectus femoris muscle, (ii) laterally detouring extra-anatomical bypass, (iii) trans-osseus ilio-femoral bypass, and (iv) obturator bypass. In the case of (i), cure has been reported in a number of studies; however, the condition did not ameliorate in many cases, as in our Patient 3. This treatment seems to be unrecommended because of possible massive bleeding and other unwanted events associated with unnecessarily prolonged implementation. In the case of (ii), a graft is subcutaneously exposed from the common iliac artery or external iliac artery medially to the iliac crest, and a detour is made over the site laterally to the femur. Because of the involvement of a subcutaneous passage, reinfection is possible. In the case of (iii), a hole is made in the ilium, and a graft is guided laterally to the superficial femoral and inferior arteries. This treatment is thought to be suitable for use in deep inguinal infections for which obturator foramen bypass surgery is not allowed and for femoro-popliteal artery bypass graft infections. Because of the involvement of a subcutaneous passage, however, reinfection is possible.

The obturator bypass we used in this study has a number of advantages, including less graft infections thanks to deep graft routes and shorter graft lengths than other bypasses. However, a drawback is that this method cannot be used in the case of deep inguinal infections. Of the 16 subjects, 13 had MRSA as the causative organism, with no localized reinfections observed.

Although autologous veins usually serve as the best graft, we used vascular grafts in all cases because all patients had no suitable autologous veins. Vascular graft size was 8 mm for one graft and 6 mm for the other grafts. The patient receiving the 8 mm graft had coxalgia, suggesting that the obturator nerve might be compressed by the vascular graft because of its overly large size for the obturator foramen; therefore, 6 mm vascular grafts were then used in all cases.

With regard to the choice of vascular grafts, 14 ringed ePTFEs and two rifampicin-soaked gelatin-sealed grafts were used. Typically, ringed ePTFEs are chosen; however, if a duration of one day or longer to surgery is available and in the case of severe infections, it may be better to use rifampicin-soaked gelatin-sealed grafts. Indeed, questions remain regarding the utility of rifampicin-soaked artificial vessels in infection-free routes. In the presence of sepsis, however, we think that rifampicin-soaked grafts are beneficial when deep infections cannot be ruled out.

Of the 16 subjects, one died of pneumonia in the hospital following surgery, and one underwent above-knee amputation; however, no patient experienced reinfection. With regard to outcomes long after hospital discharge, the cumulative patency rate was 74% for 3 years and 56% for 5 years, and these figures were thought to be likely satisfactory since the cumulative survival rate was 69% for 3 years and 59% for 5 years.

Patel et al. performed obturator bypass surgery on 12 patients with inguinal infections (vascular graft infections in nine patients and infections following endovascular therapy in three patients), and reported two operative deaths and re-surgery for major complications in four patients.

According to the study of Rudich et al., one of seven patients died of aspiration pneumonia, one of the remaining six patients experienced femoral necrosis due to a lack of blood flow for the deep femoral artery following popliteal artery ligation, and hip disarticulation, and three patients suffered crus amputation due to distal progression of arteriosclerosis long after hospital discharge.

Geroulakos et al. reported graft obstruction in 2 of 11 limbs in eight patients long after hospital discharge; one of the two limbs suffered crus amputation, and the other 9 limbs had favorable outcomes.

In the report of Lai et al. one of six patients experienced ascending progression of distal infectious embolization causing graft infection, and underwent above-knee
amputation, with favorable outcomes obtained for the other five patients.

As stated above, obturator bypass surgery not to reconstruct the deep femoral artery often causes a lack of blood flow, which is likely to lead to major amputations because it is caused by infections. While bearing this in mind, it is important to choose the appropriate surgical method and implement careful perioperative management.

Conclusion

Obturator bypass surgery was successfully performed with favorable results for arterial infections and vascular graft infections in the inguinal region. This surgery is considered to be a valuable operative procedure to master.

Disclosure Statement

The authors declare that they have no conflicts of interest.

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Analysis: Hisao Masaki, MD, PhD
Investigation: Hisao Masaki, MD, PhD, Takeshi Honda, MD, Hiroki Takiuchi, MD, Takahiko Yamasawa, MD, PhD, Hiroshi Furukawa, MD, PhD, Masahiko Kuinose, MD
Writing: Hisao Masaki, MD, PhD

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Critical review and revision: all authors
Final approval of article: all authors
Accountability for all aspects of the work: all authors

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