Long-term results of cryopreserved arterial allograft reconstruction in infected prosthetic grafts and mycotic aneurysms of the abdominal aorta

Guy Lesèche, MD, Yves Castier, MD, Marie-Dominique Petit, MD, Patrick Bertrand, MD, Michel Kitzis, MD, Sacha Mussot, MD, Mathieu Besnard, MD, and **Olivier Cerceau, MD,** *Clichy, France*

Purpose: **This prospective, observational study determined the long-term outcome in patients with abdominal aortic infection (primary or prosthetic graft) who were treated with simultaneous aortic/graft excision and cryopreserved arterial allograft reconstruction.**

Methods: **From April 1992 to March 2000, patients with abdominal aortic infection underwent complete or partial excision of the infected aorta/prosthetic graft and cryopreserved arterial allograft reconstruction. Arterial allografts were harvested from multiple organ donors and cryopreserved at –80°C without rate-controlled freezing. The patients were observed for survival, limb salvage, persistence and/or recurrence of infection, and allograft patency. The results were calculated with life-table methods.**

Results: **During the 8-year study period, 28 consecutive patients (27 men, 1 woman; mean age, 64 years) underwent treatment for abdominal aortic infection (23 graft infections, including 7 graft-enteric fistulas and 5 primary aortic infections). Allograft reconstruction was performed as an emergency procedure in 13 patients (46%). The mean follow-up period was 35.4 months (range, 6-101 months). The overall treatment-related mortality rate was 17.8% (17% for graft infection, 20% for primary aortic infection). The overall 3-year survival was 67%. There was no early or late amputation. There was no persistent or recurrent infection, and none of the patients received long-term (> 3 months) antibiotic therapy. Reoperation for allograft revision, excision, or replacement was necessary in four patients (17%) who were available for examination, with no reoperative perioperative death. The 3-year primary and secondary allograft patency rates were 81% and 96%, respectively.**

Conclusion: **Our experience with cryopreserved arterial allograft in the management of abdominal aortic infection suggests that this technique seems to be a useful option for treating one of the most dreaded vascular complications. (J Vasc Surg 2001;34:616-22.)**

Abdominal aortic infection remains a major surgical challenge. Traditional surgical treatment of abdominal aortic infection includes excision and drainage of infection with oversewing of the infrarenal aorta and axillofemoral bypass grafting. Although this treatment is considered a "gold standard," it still results in significant mortality and morbidity rates related to aortic stump blowout and extra-anatomic bypass graft (EAB) failure from thrombosis, recurrent infection, or both.[1] In situ reconstruction is an alternative treatment in cases of aortic sepsis, because it has a theoretically better long-term patency rate and specific complications related to the extra-anatomic strategy can be avoided. However, in situ reconstruction with prosthetic materials has a high risk of persistent or recurrent infection and related mortality and morbidity.[2] As a result, in situ replacement with a conduit that is more resistant to infection than synthetic prostheses has been suggested as an alternative. On the basis of excellent long-term results reported by cardiac surgeons after cryopreserved allograft replacement for the management of infections of the ascending aorta,[3,4] we decided in the 1990s to investigate cryopreserved arterial allografts in the management of arterial infections. The aim of this prospective, observational study was to evaluate the safety and efficacy of cryopreserved arterial allograft reconstruction in the treatment of abdominal aortic infection (primary or prosthetic graft infection). The main variables studied were patient survival, freedom from persistent or recurrent infection, allograft patency, and avoidance of major amputation.

PATIENTS AND METHODS

From April 1992 to March 2000, data from patients with abdominal aortic infection (primary or prosthetic graft infection) in our Department of Vascular and Thoracic Surgery (Beaujon University Hospital, Clichy, France) were prospectively collected. These data included demographics, atherosclerotic risk factors, original procedures, modes of presentation, indications for allograft reconstruction, surgical details, perioperative morbidity, and bacteriologic findings. The diagnosis of abdominal aortic infection was made on the basis of clinical presenta-

From the Service de Chirurgie Vasculaire et Thoracique, Hôpital Beaujon.
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Reprint requests: Guy Lesèche, MD, Service de Chirurgie Vasculaire et Thoracique, Hôpital Beaujon, 100 Boulevard du Général Leclerc, 92110 Clichy, France (e-mail: guy.leseche@bjn-ap-hop-paris.fr).
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Table I. Clinical presentation of the 23 patients with infected aortic prosthetic graft

Events	*No.*
Sepsis (fever, leukocytosis, and tachycardia)	10
Severe gastroduodenal bleeding	5
Groin abscess	14
Aortic false aneurysm	3
Femoral anastomotic rupture	3
Acute limb ischemia	3

Table II. Types of arterial allograft reconstructions in 28 patients

Reconstructions	*No.*
Aortoaortic bypass grafting	6 (5 mycotic aneurysms)
Aortobi-iliac bypass grafting	1
Aortobifemoral bypass grafting	5
Aortounifemoral bypass grafting	2
Aortounifemoral and femorofemoral bypass grafting	4
Prosthetic graft limb—DFA	8
Prosthetic graft limb—SFA	2

DFA, Deep femoral artery; *SFA,* superficial femoral artery.

tion and computed tomographic scanning. Patients with abdominal aortic infection underwent complete or partial excision of the infected aorta or prosthetic graft, followed by cryopreserved arterial allograft reconstruction. The patients initially underwent treatment with broad-spectrum intravenous antibiotics. Preoperative arteriography of the aorta and lower extremities was routinely performed when possible.

Surgical technique. Abdominal aortic mycotic aneurysm and complete prosthetic graft infection were approached through a midline incision and excised in their entirety. Single-prosthetic graft limb infection was approached through a retroperitoneal incision, and the graft was partially excised. Bacteriologic culture tests were performed on the periprosthetic fluid, the infected prosthetic graft, or the infected aorta, and wounds were carefully debrided. The arterial allografts were implanted with polypropylene suture for proximal and distal anastomoses. Before allograft reconstruction, any open wounds or draining sinus tracts were isolated with adhesive sterile dressings. End-to-side femoral anastomoses were made through incisions at a distance from any infected areas. The common femoral artery was the preferred choice for the distal anastomosis when it was not involved with the infection. Distal anastomoses were constructed to the profunda or to the superficial femoral arteries beyond the inguinal region through lateral incisions when necessary. In patients with secondary aortoenteric fistulas, the bowel defect was repaired with lateral closure or bowel resection. Allograft reconstruction was covered with a pedicled omentoplasty in all patients except those with single-prosthetic graft limb infection. Retroperitoneal and inguinal drainage was routinely used.

Arterial allograft. Harvesting, preservation, and preparation of allografts have been described earlier.[5,6] Arterial allografts (descending thoracic aorta, aortic bifurcation, iliac and femoral arteries) were carefully harvested from brain-dead multiple organ donors. Informed consent was given by the donor's family, in accordance with French law. Bacteriology and virology tests (human immunodeficiency virus 1, 2; human T-lymphotrophic virus 1, 2; hepatitis C virus; hepatitis B virus; cytomegalovirus) were performed for all donors. After harvesting, arterial allografts were flushed with heparinized saline solution to eliminate any residual intra-arterial blood and stored at 4°C in M199 medium (Gibco Laboratories, Gaithersburg, Md) containing gentamycin (0.50 mg/mL) and amphotericin B (0.25 mg/mL). The delay before freezing did not exceed 18 hours in all cases. Allografts were permeated for 20 minutes at 4°C in M199 medium containing 12% dimethylsulfoxide and subsequently frozen at –80°C without rate-controlled freezing. The average storage duration was 76 days (± 60.8 days). On request from the vascular surgeon, the bag containing the artery was rapidly thawed by means of immersion in water prewarmed to 37°C. Once all the ice had melted, the allografts underwent successive washouts in heparinized saline solution at room temperature. The final washout fluid was sampled for bacteriologic culture. Because of the few available allografts, matching blood compatibility between recipient and donor was not possible in all cases. Twenty-two cryopreserved arterial allografts (78%) were ABO compatible with the recipient; six cryopreserved arterial allografts were mismatched. None of the patients received immunosuppression therapy.

Postoperative management and follow-up examination. Intravenous antibiotics were administered for 2 weeks, and culture-determined oral antibiotics continued to be administered for at least 6 weeks. All surviving patients underwent arteriography with digital subtraction before discharge from the hospital. After discharge, routine late follow-up included a clinical and duplex scanning examination at 1 month and every 6 months thereafter. Late computed tomographic scanning, arteriography, or both were performed, depending on the results of duplex scanning. Patients with underlying occlusive disease were routinely prescribed daily low-dose aspirin (100 mg/d). For the purposes of this report, the status of all survivors was updated in September 2000. Patency, limb salvage rate, and survival were determined with a standard life-table analysis by means of the Kaplan-Meier method.

RESULTS

Patients and initial procedures. During the 8-year study period, 28 consecutive patients (27 men, 1 woman; mean age, 64 years; age range, 44-82 years) underwent treatment for an abdominal aortic infection. These included 5 mycotic aortic aneurysms, including 3 that were ruptured (2 infrarenal, 1 juxtarenal), and 23 aortic prosthetic graft infections. Of the 23 patients with aortic prosthetic graft infections, 10 had prosthetic graft-enteric

Table III. Organisms grown from infected prosthetic graft or infected aorta in 28 patients

Organism	*No.*
Mycotic aneurysm (n = 5)	
Salmonella	2
Candida albicans	1
Staphylococcus aureus	2
Infected prosthetic graft (n = 23)	
S aureus	13
Staphylococcus epidermidis	2
Enterococci	2
Streptococcus viridans	1
Enterobacter cloacae	1
Escherichia coli	4
Proteus mirabilis	1
Streptococcus anginosus	1
Streptococcus mitis	1
Streptococcus intermedius	1

fistulas/erosions and 13 had prosthetic graft infection without bowel involvement. Of the 10 patients with bowel involvement, 7 had a true fistula and 3 had a prosthetic graft enteric erosion. Of the 13 patients with prosthetic graft infection without bowel involvement, 10 had a single-prosthetic graft limb infection. Seven of these 23 patients (30%) with aortic prosthetic graft infections had initially undergone surgery in our center; 16 patients (70%) were referred to us after undergoing one or more operations that were performed elsewhere. The initial operation had been performed for aortoiliac occlusive disease in 20 patients (87%) and for abdominal aortic aneurysm disease in three patients (13%). The mean interval from the aortic graft insertion to the diagnosis of graft infection was 43 months (range, 1-168 months). A mean of 2.8 ± 2.1 operations (range, 1-10) had been performed before allograft reconstruction. Configurations of the infected aortic grafts were aortoaortic in 2 patients, aortobifemoral in 18 patients, and aortounifemoral in 3 patients. Graft material was polyester fiber (Dacron) in 22 patients and polytetrafluoroethylene (PTFE) in one patient.

Manifestation and preoperative diagnosis. The clinical events in 23 patients with infected aortic prosthetic graft are described in Table I. Because of acute bleeding (n = 7), acute ischemia (n = 2), or both (n = 1) and ruptured mycotic aortic aneurysm (n = 3), allograft aortic reconstruction was performed as an emergency procedure in 13 patients (46%), whereas it was a planned procedure in 15 patients (54%).

Treatment and early outcome. The five patients with a mycotic aortic aneurysm underwent complete excision of the infected aorta, in situ aortoaortic allograft reconstruction, and coverage of the allograft with pedicled omentoplasty. Additional procedures, including left nephrectomy, reimplantation of the right renal artery in the allograft, and ablation of spine orthopedic material, were performed in one patient who had a ruptured juxtarenal mycotic aneurysm. The 10 patients with single-prosthetic graft limb infection underwent single-prosthetic graft limb removal and prosthesis-femoral allograft reconstruction without omentoplasty. The remaining 13 patients underwent complete prosthetic graft removal and in situ aortoaortic allograft reconstruction (1 case), in situ aortobi-iliac allograft reconstruction (1 case), in situ aortobifemoral allograft reconstruction (5 cases), in situ aortounifemoral allograft reconstruction (2 cases), or in situ aortounifemoral plus femorofemoral allograft reconstruction (4 cases; Table II). These 13 patients all underwent pedicled omentoplasty. In patients with graft-enteric fistulas, the bowel defect was repaired with lateral closure of the duodenum in 4 cases, right colectomy for a perforated carcinoma of the cecum in 1 case, and ileum resection in 2 cases.

Bacteriologic culture results were positive for infection in all cases (Table III). Infection was caused by a variety of organisms, the most frequent being *Staphylococcus aureus.* Five patients with prosthetic graft-enteric fistulas had multiple organisms from the graft on culture.

The perioperative mortality rate was 17.8% (5 of 28). All five patients who died in this series were from the group of 18 patients who underwent complete aortic or graft excision (27.8%). The perioperative mortality rate was 20% (1 of 5) in patients with mycotic aneurysm, 30% (3 of 10) in patients with prosthetic graft-enteric fistulas/erosion, and 7.6% (1 of 13) in patients with prosthetic graft infection without bowel involvement. There was no perioperative death in the 10 patients with single-prosthetic graft limb infection. Five patients died before hospital discharge on postoperative days 2, 8, 28, 42, and 62. Death was caused by sepsis (2 patients), multisystem organ failure (2 patients), and iatrogenic agranulocytosis (1 patient). Of these 5 patients, 3 had required an emergency procedure, 3 had a graft-enteric fistula with fecal peritonitis caused by a perforated carcinoma of the cecum in 1 case, 1 had a ruptured mycotic aneurysm, and 1 was an 80-year-old patient with cachectic condition and severe sepsis. Six of the 23 surviving patients (26%) had non–allograft-related complications. These included transient renal failure (2 patients), small bowel occlusion (1 patient), delirium tremens (1 patient), mucous enteritis (1 patient), and urinoma (1 patient). Normal patent allograft reconstructions were demonstrated in all 23 surviving patients by means of routine arteriography before hospital discharge. The mean duration of hospitalization was 22 days (± 10 days).

Late outcome. All surviving patients were followed up except one who did not continue follow-up after 6 months. The mean follow-up period for surviving patients was 35.4 months (range, 6-101 months). Five patients died during later follow-up in postoperative months 13, 14, 28, 41, and 55. None of the deaths were related to treatment. Causes of later deaths were myocardial infarction (n = 2), lung cancer (n = 1), rectum cancer (n = 1), and cardiac rhythm disorders (n = 1). The cumulative survival was 78% at 1 year and 67% at 3 years, including the perioperative deaths (Fig 1). One patient who underwent aortounifemoral plus femorofemoral

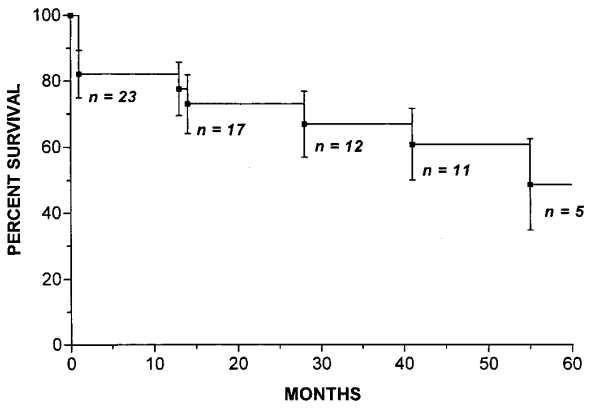

Fig 1. Percent survival rates with life-table analysis. *Error bars* represent SEM.

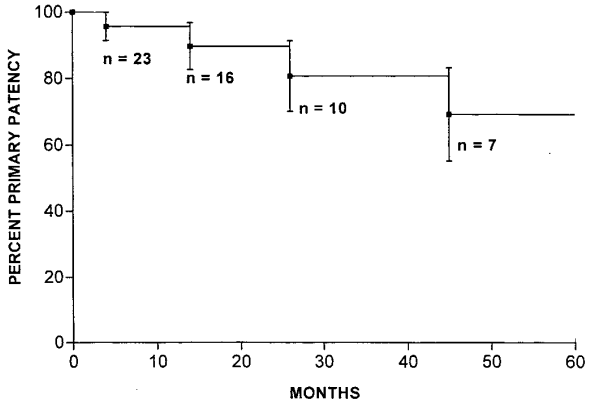

Fig 2. Primary patency rates with life-table analysis. *Error bars* represent SEM.

allograft reconstruction for prosthetic graft enteric fistulas had femorofemoral allograft thrombosis 4 months postoperatively. The femorofemoral allograft was totally replaced with a PTFE graft, and the patient had an uneventful recovery. This patient died of cardiac rhythm disorders 37 months after the "redo" procedure, and he had a patent infection-free graft at the time of death. Limited aneurysmal deterioration of the cryopreserved allograft occurred in three patients (2 prosthetic-femoral allograft reconstructions, 1 femorofemoral allograft) in postoperative months 14, 45, and 90. Two of these allografts were ABO compatible with the recipient, and one allograft was mismatched. Only the aneurysmal part of the allograft and 1 cm from both ends were removed and replaced with a PTFE graft. In each case, more than half the original allograft and the two original anastomoses were retained. These three patients were alive and infection free 78, 6, and 11 months after the "redo" procedure. One patient had a distal extension (femoropopliteal bypass grafting procedure with the saphenous vein) for disabling claudication 26 months after aortounifemoral plus cross femorofemoral allograft reconstruction. This patient was still alive and was infection free 37 months after the distal extension. Overall, reoperation for allograft revision, excision, or replacement was necessary in 4 patients (17%), in 3 cases for limited aneurysmal deterioration, and in 1 case for occlusion. The mean duration of surgery was 130 minutes for the four "redo" procedures, and the mean duration of hospitalization was 7 days (± 2 days). There was no early or late amputation in this series (100% limb salvage rate). There was no persistent or recurrent infection, and none of the patients received long-term (> 3 months) or indefinite antibiotic therapy. The 3-year primary and secondary allograft patency rates were 81% and 96%, respectively (Figs 2 and 3).

DISCUSSION

Our long-term experience with cryopreserved arterial allografts in the management of abdominal aortic infection suggests that this technique is a useful option for treating one of the most dreaded vascular complications.

The early mortality rate in our series was 17.8%, and there were no late deaths or complications caused by persistent or recurrent infection during a mean follow-up period of 35.4 months. Furthermore, one death occurred as a result of iatrogenic agranulocytosis in a patient who underwent successful surgery for a ruptured mycotic aortic aneurysm and who otherwise had an uneventful early postoperative recovery and an intact allograft with no signs of persistent infection at autopsy. Because 18 patients (64%) in this series had life-threatening aortic infections and 13 of these required emergency operations because of acute bleeding, acute ischemia, or a ruptured mycotic aortic aneurysm, we think that the mortality rate in this series is within the range reported in recent series with conventional methods.[7-12]

None of the patients in this series experienced persistent or recurrent infection. Although one obvious concern is whether a longer follow-up period will reveal recurrent infection, the mean follow-up period of 35 months, with all allografts observed for at least 6 months, is reassuring.[13] Furthermore, no reinfections occurred in any of the four patients who required implantation of a new prosthetic graft. The high resistance to infection of allografts in our series supports the results of experimental studies and clinical results of allograft replacement in infected fields.[14-18] However, we cannot generalize that in situ allograft replacement is safe for all types of infection. Indeed, caution should be used when planning in situ allograft replacement in patients with extensive infection and gross purulence or highly virulent gram-negative organisms. Thus, in four patients in this series who required complete graft removal and aortobifemoral reconstruction, an aortounifemoral plus femorofemoral replacement was performed after complete graft removal to avoid placement of the allograft on one side of an extensive contaminated bed. Moreover, careful wound debridement, the coverage of allografts with pedicled omentoplasty, and

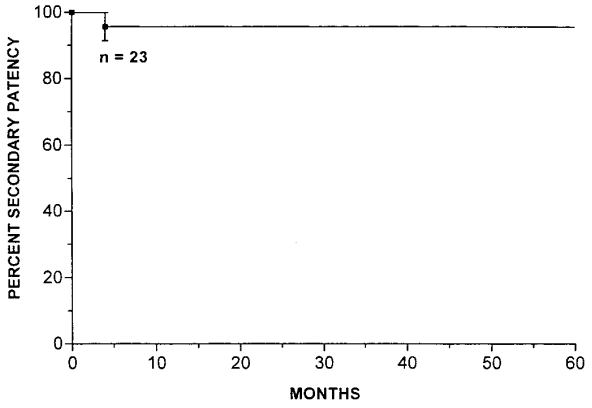

Fig 3. Secondary patency rates with life-table analysis. *Error bars* represent SEM.

the perioperative intravenous administration of appropriate antibiotics were routinely performed and were important factors for successfully eradicating infection in this series.

Seventy-one percent (20 of 28) of the patients in this series had severe underlying occlusive disease and were at high risk of limb loss. Therefore, it is important to note that there were no early or late amputations in our patients and that the 3-year primary and secondary allograft patency rates were 81% and 96%, respectively. Although the heterogenicity of patients and the general diagnosis of arterial graft infection make comparisons between series quite difficult, we think that the outcomes of the long-term follow-up in our series for patency, limb salvage, freedom from reinfection, and allograft-related morbidity compare favorably with other recent series that used conventional methods. Seeger et al[11] reported an 11% amputation rate, and 35% of the patients available for follow-up had EAB failure from thrombosis, infection, or both; one patient had late aortic stump disruption. Yeager et al[10] reported an 11.5% amputation rate; 27% of the patients available for follow-up had EAB failure, and the overall rate of freedom from graft failure was 68% at 3 years. Sharp et al[9] reported no early amputations. However, although 19 (70%) aortic replacements were performed for aneurysm disease, 33% of the patients available for follow-up had EAB failure. Furthermore, the 80%, 2-year primary patency rate reported in this study was obviously overestimated, because, to determine graft patency, they counted each axillofemoral bypass graft limb as a separate graft. Kuestner et al[19] reported a 12.1% amputation rate; 46% of the patients available for follow-up had EAB failure from thrombosis, infection, or both. Ricotta et al[8] reported 32 patients treated for aortic graft infection, eight with aortoenteric fistulas. Patients were treated by means of partial removal with (8 patients) or without (4 patients) revascularization or total removal with (18 patients) or without (2 patients) revascularization. Perioperative amputation, reoperation, and reinfection rates were 13%, 9%, and 6%, respectively. There was no reduction in operative mortality and morbidity rates in patients who underwent partial rather than total graft excision. The opposite trend was observed, although this was not statistically significant. Quinones-Baldrich et al[12] reported an 18% early amputation rate, a 23% late amputation rate, and a 20% reinfection rate requiring second operations. Primary and secondary patency rates at 3 years were 43% and 65%, respectively. Overall, 78 operations, including 35 thrombectomies, were performed in the group of 30 survivors to treat EAB failure from thrombosis, infection, or both. Abdominal aortic infection remains a major surgical challenge, and at present, there is no one unique treatment for all aortic graft infections. Clagett et al[20] and Nevelsteen et al[21] reported the use of superficial femoropopliteal vein for aortofemoral reconstruction in infected fields. They both reported good results, with postoperative mortality and early amputation rates of 10% and 7%, and 5% and 7%, respectively. However, in Clagett et al's study, the mean operative time was 7.9 hours, and postoperative morbidity occurred in 49% of the patients. In Clagett et al's study, only three of 41 patients had secondary aortoenteric fistulas, and they all died postoperatively. The authors admit that this procedure is long, difficult, and technically demanding. Finally, Clagett et al[20] did not recommend this technique for very ill or unstable patients, including patients with aortoenteric erosion or fistula. Other authors have recommended in situ prosthetic graft replacement for infrarenal aortic infection. Although this may be a rational treatment option for localized or circumscribed aortic infections caused by the *Staphylococcus epidermidis* species, as reported by Towne et al,[22] it is not a reasonable option for diffusely infected abdominal aortic prosthetic grafts.[23] In an evaluation of the Leicester experience (11 patients) with rifampycin-bonded prostheses, Hayes et al[24] recommend another strategy for early infections (< 3 months) or when preoperative culture tests are positive for methicilline-resistant *Staphylococcus.*

The use of fresh arterial allografts was abandoned 30 years ago because of late degenerative changes in the grafts.[25] However, improvement in organ-harvesting techniques, allograft storage, and cryobiology techniques have caused renewed interest in arterial allografts. In situ fresh allograft replacement of infected infrarenal aortic prosthetic grafts has been reported by Kieffer et al[14] and resulted in a mortality rate of 12%. After a mean follow-up period of 13.8 months (range, 1-42 months), 26% of the patients had had pathogenic changes on their allografts, and 9% of the patients required allograft-related reoperation. More recently, in situ repair of aortobronchial, aortoesophageal, and aortoenteric fistulas with cryopreserved aortic allografts has been reported by Vogt et al[16] and resulted in a mortality rate of 9%. After a mean follow-up period of 14.3 months (range, 6-31 months), no cases of allograft leakage, false aneurysm, or allograft stenosis (except in 1 case) were observed. In our series, after a mean follow-up period of 35.4 months, only 3 limited

aneurysmal dilatations occurred in 3 patent allografts, requiring 3 reoperations that were not technically demanding. This led to short operative times, short hospital stays, and no perioperative deaths. With a longer follow-up period, the incidence of degenerative changes in allografts may be expected to increase, making close surveillance of these allografts an obvious necessity. Our policy has been to replace the aneurysmal segment of the allograft, because, in our small series, aneurysmal allograft deterioration was limited and restricted to the extra-abdominal course of the allograft reconstruction.

We think that cryopreserved allografts offer several advantages over fresh allografts. First, they allow better management of available grafts and increase the availability of suitable conduits for emergency use. This important issue was applicable to the 13 patients in this series who had emergency surgery. Second, blood compatibility can be matched, and different types of vascular tissues can be stored and made available for human leucocyte antigen matching of donors and recipients before surgery. Third, storage for a few months allows the allografts to be guaranteed safe from viral transmission by means of observing changes in the humoral virology profile of recipients of vital organs (liver, kidney, heart) from the same donor.

Cryopreservation is generally accepted as a useful technique for the storage of vascular tissue. However, optimal cryopreservation methods are still being debated. Current cryopreservation protocols usually recommend rate-controlled freezing and storage at very low temperatures in liquid nitrogen vapor, mainly as a means of achieving long-term preservation of functional endothelial and smooth muscle cells. In our opinion, preservation of cellular viability, even if it is possible, is not necessary for obtaining good large-caliber allograft performance.[26] Moreover, because endothelial cells and smooth muscle cells may elicit, although variably, an immune response, preservation of the allograft's cellular compound could, theoretically and experimentally, have deleterious consequences by mediating immunological arterial wall remodelings.[27,28] More important, experimental and clinical data strongly suggest that current cryopreservation protocols probably result in making arterial allografts more brittle and could induce early graft dilatation and rupture.[29,30] Therefore, our unsophisticated cryopreservation method (which has been successfully used to supply allogenic veins and arteries for limb salvage in 57 patients who lack a suitable autologous saphenous vein[5,6]) was solely aimed at preserving the extracellular matrix of the media that is not known to bear allospecific transplantation antigens.[31,32]

Degenerative changes in the allograft are the major drawback of this technique. Numerous studies on arterial allograft rejection have identified the sequence of events in arterial wall immune injury and response that progressively leads to graft dilatation and rupture.[27,28,33] Although experimental data suggest that a low-maintenance dose of cyclosporine provides effective immunosuppression, thus preventing aneurysm formation,[26,33] we, like others, hesitate to administer a drug with serious potential adverse effects in elderly, critically ill patients. Future pharmaceutical developments,[34] modifications in allograft preparation,[31] or both may reduce the problem of antigenicity and reduce the late degenerative changes that have limited the long-term effectiveness of allografts in the past.

CONCLUSION

Athough this study presents a small series of patients with limited follow-up, in these patients, reconstruction with a cryopreserved arterial allograft seemed to be a useful option for treating one of the most dreaded vascular complications. In major aortic infections and in patients with severe underlying occlusive disease, the high operative mortality, reinfection, and amputation rates are still of major concern and could be reduced with the use of these allografts. At present, reconstruction with cryopreserved arterial allografts should be regarded as a safe temporizing maneuver to help eradicate infection and permit subsequent reconstructions with prosthetic material when necessary.

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