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In-Situ Revascularisation for Secondary Aorto-enteric Fistulae: The Success of Silver-coated Dacron is Closely Linked to a Suitable Bowel Repair

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WHAT THIS PAPER ADDS

- This report presents a monocentric homogeneous series of patients treated for secondary aorto-enteric fistulae by in-situ reconstruction using the same conduit material, that is, a silver-coated Dacron prosthesis. Findings show that successful treatment depends on the quality of both vascular reconstruction and visceral repair. The latter step is a determinant for postoperative mortality and recurrence of graft infection.

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ABSTRACT

Objectives: The purpose of this study was to assess short- and mid-term results of in-situ revascularisation (ISR) using silver-coated Dacron prostheses and bowel repair for management of secondary aorto-enteric fistulae (SAEF).
Design: Single-centre retrospective chart review.
Material and methods: This study includes all the patients treated by ISR using silver-coated Dacron for SAEF between 2006 and 2010. Primary end points were mortality and survival rates. Secondary end points were reinfection-free survival and secondary patency rates.
Results: Eighteen male patients with SAEF with a median age of 64 years were operated by ISR using silver-coated Dacron during the study period without operative death. The 30-day mortality was 22% and the in-hospital mortality rate was 39%. Indeed, during hospitalisation, a duodenal leak was observed in four patients including three who died. Four others patients died due to multi-system organ failure. Median follow-up was 16 months (range 1–66). The survival rate at 12 months was 55%. One duodenal leak was observed leading to death. The reinfection-free survival and the secondary patency rates at 12 months were 60% and 89%, respectively.
Conclusion: In-situ revascularisation with silver-coated Dacron provides acceptable results in terms of mortality. This treatment may be useful for simple vascular reconstruction and allow greater attention to bowel repair that is a determinant in short- and mid-term survival.

Secondary aorto-enteric fistulae (SAEF) are observed after aortic reconstruction in 1–2% of cases.[1] They constitute one of the most life-threatening complications in the field of vascular surgery. During the last decade, *in-situ* revascularisation (ISR) has been preferred to extra-anatomic reconstruction (EAR), providing similar results in terms of survival and prevention of reinfection but with better long-term patency and limb salvage.[2] However, the ideal conduit material for ISR remains a matter of debate. Recent reports have shown that silver-coated Dacron (SCD) prostheses provide similar results to fresh or cryopreserved arterial allografts in terms of early mortality and mid-term survival.[3,4]

For frail patients, prosthetic grafts offer two major advantages over femoral veins, that is, immediate availability and shorter procedure time. The main drawback of prosthetic material is an

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enhanced risk of reinfection,[2] which can be due to direct contamination. Moreover, we could think that this risk is particularly high if the prosthesis is located in proximity to the site of bowel repair. In this regard, duodenal leak has been identified as an independent risk factor for mortality.[5] The aim of this study was to evaluate the short- and mid-term results of *in-situ* revascularisation using a silver-coated Dacron prosthesis with duodenal repair for management of SAEF in a homogeneous single-centre patient population.

Material and Methods

Patients

This retrospective study is based on the medical records of patients treated for a secondary aorto-enteric fistula between January 2006 and December 2010 in the vascular surgery department of the Bordeaux University Hospital, France. Revascularisation using a silver-coated Dacron was retrospectively analysed form a database prospectively fulfilled collecting patient characteristics, clinical findings, microbiological test results, radiological features and operative outcomes. Aortic reconstructions using femoral veins ± cryopreserved allografts or ex situ revascularisation were analysed from medical charts, collecting patient characteristics and operative outcomes.

Diagnosis

Computed tomography angiography (CTA) was performed to confirm diagnosis in all patients (Fig. 1). Diagnosis was based on signs of aortic graft infection: pseudoaneurysm at the proximal anastomosis, graft thrombosis, fluid build-up around the graft and the presence of gas bubbles and/or retroperitoneal abscess. Indications for ISR were determined based on patient's general condition, clinical signs of infection and CTA findings. The decision to perform ISR using an SCD prosthesis rather than femoral veins or cryopreserved allografts was taken at a multidisciplinary meeting based on concurrent disorders and technical considerations.

The patients who were stable at the time of presentation were hospitalised and investigated in the surgical unit. All of them were operated during the week following their admission. It was considered urgent to operate the patients when they were haemodynamically unstable at the time of admission due to bleeding or septical shock.

Surgical technique

The operation was performed by a transperitoneal approach under general anaesthesia. After control of the aorta proximally and distally to the anastomosis and of the prosthetic limbs, the fistula was dissected and opened (Fig. 2). If vascular control was optimal, the intestinal defect was repaired first to reduce enteric contamination. Bowel repair was achieved by direct suture (DS) for small defects. For extensive lesions, duodenal reconstruction (DR) was performed using the following technique. After resection of the injured duodenum, generally the third and fourth segments, the remaining duodenum was completely sutured and left in place on the right side of the radix mesenterii. The jejunum was brought in contact with the duodenum through a hole in the right mesocolon and anastomosed side to side or side to end to the jejunum (Fig. 3) in order to isolate intestinal repair site from vascular reconstruction site. In most cases, this technique was performed in association with cholecystectomy with external drainage and with jejunostomy for postoperative enteral nutrition. In the second phase of the procedure, the infected aortic graft was excised either entirely or partially if the infection seemed to be limited to one part of the graft, particularly in cases involving well-encapsulated graft limbs. The infected graft and tissues were sent for Gram stain, aerobic, anaerobic and fungal culture. The surrounding tissue and tunnels were excised followed by irrigation with serum and Rifampicin. Vascular reconstruction was performed using an SCD graft (Inter Gard Silver prosthesis; Inter Vascular, La Ciotat, France) pre-soaked for at least 30 min in 600 mg Rifampicin powder solution (Merrell Dow Pharmaceutical, Kansas City, MO, USA) diluted in 500 cc of normal saline (2.4 mg ml^{-1}). The limbs of the graft were placed in a new tunnel if dissection was not prevented by fibrosis or in the old tunnel if dissection was not possible. The new graft was then

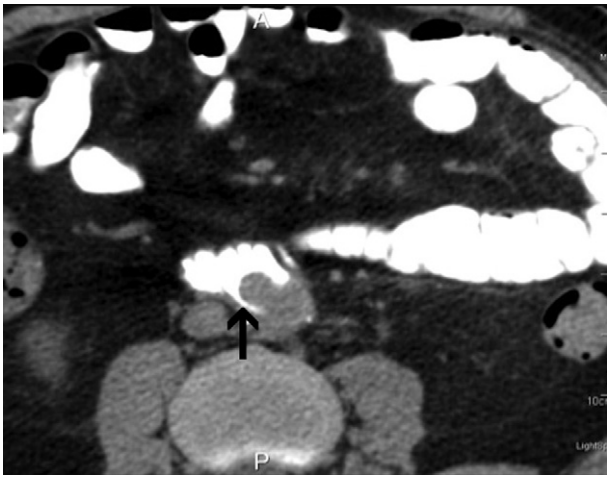


Figure 1. Bowel contrast CT depicting a fistula (black arrow) involving the right graft limb and the third portion of the duodenum.

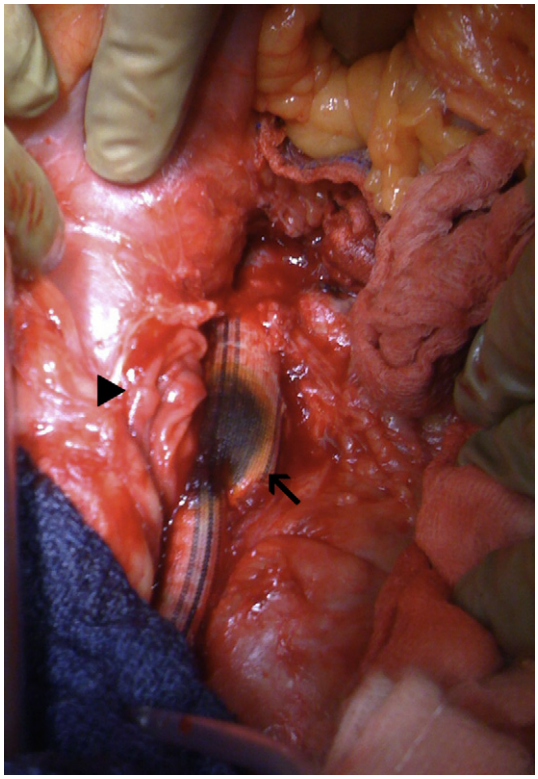


Figure 2. intra-operative view showing the large duodenal defect (arrow head) and the graft contaminated by the biliary secretion (arrow).

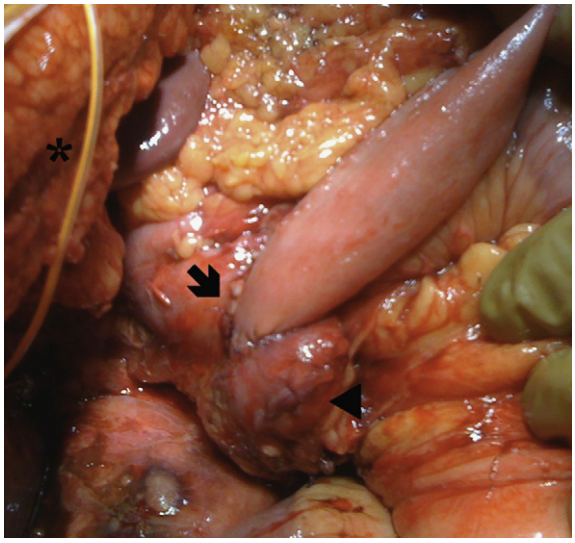


Figure 3. Duodenal reconstruction by 4th duodenal segment resection (arrow head) and duodenal uncrossing with side to end anastomosis (arrow). An external biliary drainage (asterix) is placed after cholecystectomy.

covered either preferentially by omental wrapping or by simple closure of the retroperitoneum. Multiple suction drains were placed in all cases. All patients received intravenous antibiotherapy during the procedure.

Postoperative management

Following the procedure, all patients were transferred initially to the critical care unit and then to the vascular department. Choice and duration of antibiotherapy were determined by the infectious diseases department based on the microbiological findings and patient condition. In patients presenting complications or signs of persistent infection, CTA was performed prior to discharge.

Follow-up

No patients were lost from follow-up. Follow-up included examination in our department at 3, 6 and 12 months and yearly thereafter. Examination included clinical and laboratory tests. CTA was ordered only for patients with signs of recurrent infection, as the presence of clinical signs of infection with fever and chills or sepsis and biological markers with elevated C-reactive protein (CRP) and white cell count when others causes of infection have been excluded. The PET-CT was done only if some doubts persisted after the CT scan and with high clinical suspicion of reinfection.

Definitions and end points

The 30-day mortality rate included deaths in the first 30 post-operative days. In-hospital mortality included all deaths occurring during the procedure, and during the hospitalisation following the procedure. Recurrent graft infection was defined as a reinfection with clinical and biological findings as explained before associated with the presence of radiological signs of graft infection as defined in the manuscript, in patients who have been previously and successfully operated for SAEF and discharged from the hospital. The patients who died of sepsis or multiple organ failure (MOF) were not considered as reinfected. Primary patency was defined as the period of uninterrupted graft patency after revascularisation. Secondary patency was defined as the period of graft patency following re-do for occlusion. The in-hospital mortality rate and Kaplan–Meier estimate of the survival rate were considered as primary outcomes. Kaplan–Meier estimates of the reinfection-free survival rate and of the primary and secondary patency rates were defined as secondary outcomes.

Statistics

Statistical analysis was carried out using SAS 9.1 statistical software. Descriptive statistics were used to show the distribution of variables in the population. Values are expressed as median and interquartile range for quantitative variables and as number and percentage for qualitative variables. Survival rate, recurrent graft infection-free survival rates and primary and secondary patency rates were estimated with the use of the Kaplan–Meier method.

Results

Study population and pre-operative findings

During the study period, 18 male patients with a median age of 64 years (interquartile range, 61–68) underwent ISR with SCD prostheses for SAEF in our department. Patient characteristics are described in Table 1. Median time from the initial reconstruction to the diagnosis of the SAEF was 5.5 years (interquartile range, 5–9). All patients were symptomatic at the time of presentation and the majority had hyperthermia (Table 2). In addition to the CT scan (Table 2), gastrointestinal endoscopy was performed in the eight patients with gastrointestinal bleeding and confirmed SAEF in two.

Surgical procedure

Five patients (28%) were operated within the 6 h following admission to the hospital due to haemodynamic instability. Three of them presented with haemorrhagic shock due to rectal bleeding or haematemesis and the two remaining patients were septic. The other 13 patients underwent elective surgery within 1 week after admission. Total excision of the infected graft was achieved in 14 patients (78%). In the remaining four cases involving aortobifemoral bypass grafts, limb encapsulation prevented total excision. Vascular reconstruction consisted of aortoiliac bypass in nine cases

Table 1
Patients demographics: (%) or median (interquartile range). ASA: American Society of Anaesthesiologists. SCD silver-coated Dacron. ISR *in-situ* reconstruction. EAR extra-anatomic reconstruction.

Variables	ISR with SCD	ISR without SCD	EAR without SCD
Male	18 (100)	6 (100)	2 (100)
Age	64 (61–68)	64 (59–73)	70 (68–72)
Comorbidities			
Smoking	9 (50)	2 (33)	1 (50)
Coronaropathy	6 (33)	3 (50)	1 (50)
Dyslipidemia	7 (39)	2 (33)	0
Hypertension	10 (56)	4 (66)	2 (100)
Diabetes mellitus	1 (6)	2 (33)	0
ASA score			
II	6 (33)	1 (17)	0
III	9 (50)	4 (66)	1 (50)
IV	3 (17)	1 (17)	1 (50)
Initial aortic reconstruction			
Indication			
Occlusive disease	11 (61)	4 (67)	2 (100)
Aortic Aneurysm	7 (39)	2 (33)	0
Configuration			
Aortobifemoral	13 (72)	4 (67)	2 (100)
Aortobiliac	4 (22)	2 (33)	0
Aortic tube	1 (6)	0	0

Table 2
Clinical presentation and pre-operative exams findings for the 18 patients treated by ISR with SCD.

	Number (%)
Clinical signs	
Hyperthermia	9 (50)
Cellulitis	5 (28)
Groin	2 (11)
Calf (septic embolus)	2 (11)
Knee (arthritis)	1 (6)
Gastrointestinal bleeding	8 (44)
Maelena	2 (11)
Rectal bleeding	3 (17)
Haematemesis	3 (17)
Acute limb ischaemia	2 (11)
CT scan findings	
Perigraft fluid	17 (94)
Retroperitoneal abscess	5 (28)
Perigraft gas	14 (78)
Graft thrombosis	5 (28)
Proximal pseudoaneurysm	3 (17)
Pre-operative gastrointestinal endoscopy	8 (44)
Positive pre-operative bloodstream cultures	7 (39)

(50%), aortobifemoral bypass in eight (44%) and aortic tube in one (6%). Repair of the intestinal defect consisted of DS of the left colon in one patient (5%), DS of the duodenum in seven patients (39%) and duodenal reconstruction in 10 patients (55%). Median procedure duration was 360 min (interquartile range, 240–435). No operative death was recorded.

Bacteriology and antibiotherapy

Broad-spectrum intravenous antibiotherapy was administered prior to surgery in 14 patients (78%) on the basis of blood cultures in seven. It consisted in an association of tazobactam, piperacillin and vancomycin for 8/14, tazobactam, piperacillin and gentamycin for four and ceftazidim and amikacin for two. In the remaining four cases, antibiotherapy was initiated during the procedure; it consisted in an association of tazobactam, piperacillin and vancomycin. Cultures of tissue and graft samples collected during the procedure were positive in 17 cases (Table 3). Antibiotherapy was prescribed for at least 6 weeks after the operation, with secondary adjustment based on antibiogram findings in all positive cases.

In-hospital morbidity and mortality

The median duration of critical care was 9 days (interquartile range, 6–16). Ten patients presented complications requiring at least one re-operation (Table 4). During hospitalisation, four patients (22%) required major amputation due to septic embolus in one and acute limb ischaemia in the remaining three. During this period, four patients presented a duodenal leak (three after a DR and 1 after a DS). One of these four patients underwent gastro-jejunal anastomosis but died from septic shock. The second patient, with a small duodenal leak, was successfully treated by external drainage under CT scan guidance and discharged at 44 days. The remaining two patients received only medical treatment due to poor general condition and died from septic shock. Four additional patients died from lethal MOF unrelated to bowel repair. The 30-day mortality rate was 22% (4/18) and the in-hospital mortality rate was 39% (7/18).

Follow-up

Median follow-up was 16 months (interquartile range, 12.5–21). During this period, graft infection recurred in four cases. In two of these recurrences, the patients presented with graft limb thrombosis at 10 and 12 months. In both of these cases, diagnosis was confirmed by CTA showing gas and fluid around the graft. In one of these patients (patient # 11), repeat duodenal reconstruction was necessary due to duodenal leakage and associated with thrombectomy of one limb that was not replaced. In the other patient (patient #2), excision of both the infected limb and leg amputation was required after several failed revascularisation attempts. No other case of graft thrombosis was observed. The Kaplan–Meier estimate of the primary and secondary graft patency at 12 months was 60.5 and 89%, respectively. The other two recurrent graft infections were diagnosed at 5 and 13 months after lethal septic rupture of the proximal anastomosis. Emergency laparotomy confirmed graft reinfection in both cases. One of these patients had undergone successful medical treatment for a small duodenal leak 4 months earlier (patient #5). It was not possible to have some samples in the two patients with septic rupture of aorta who died in the follow-up. The other two patients with reinfection had positive cultures with *Escherichia coli*. Kaplan–Meier estimates of reinfection-free survival (Fig. 4) and overall survival rates (Fig. 5) at 12 months were 60% and 55%, respectively.

Table 3
Bacteriological findings for the 18 patients treated by ISR with SCD.

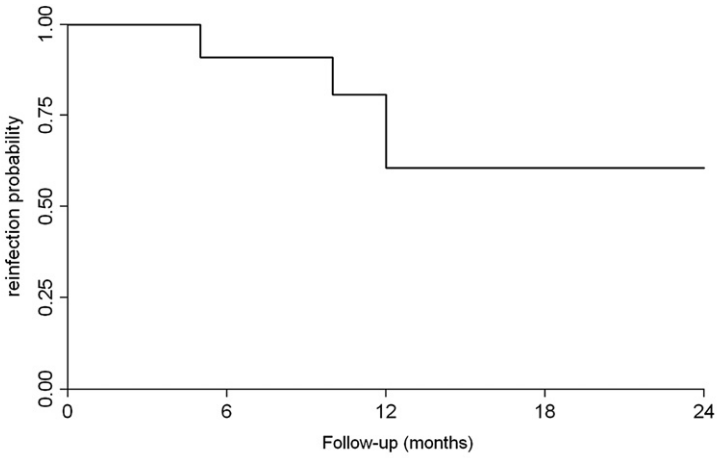
	pre-operative blood culture (%)	Postoperative tissue and graft samples culture (%)
Patients with		
1 micro-organism cultured	7 (39)	12 (67)
2 micro-organisms cultured	0	3 (17)
>2 micro-organisms cultured	0	2 (11)
Sterile culture	6 (33)	1 (5)
Tests not realised	5 (28)	0
Organism cultured		
Gram-negative		
Escherichia coli	2 (11)	3 (17)
Pseudomonas aeruginosa	0	2 (11)
Bacteroides fragilis	0	2 (11)
Enterobacter cloacae	1 (5)	1 (5)
Proteus mirabillis	0	1 (5)
Gram-positive		
Streptococcus alpha	2 (11)	3 (17)
Streptococcus anginosus	0	2 (11)
Methicillin-resistant *Staphylococcus aureus*	1 (5)	2 (11)
Enterococcus faecalis	1 (5)	2 (11)
Corynebacterium	0	1 (11)
Fungus		5 (28)
Candida albicans	0	4 (22)
Candida kefyr	0	1 (5)
Anaerobes	0	1 (5)

Patients not treated by silver-coated Dacron

During the same period, eight male patients with a median age of 68.5 years (interquartile range, 60–73) underwent a different treatment: four reconstructions with femoral veins (two DR and two DS), two reconstructions with a combination of femoral veins and cryopreserved allografts (two DS) and two aortic ligations with an axillo-bifemoral revascularisation (one DS and one DR). Patient characteristics are listed in Table 1. The 30-day mortality rate and the in-hospital mortality rate were 50% (1/2) for ex situ reconstruction (one MOF at day 26) and 50% (3/6) for *in-situ* reconstruction (one intra-operative death, two graft disruptions at day 4 and 14). Among the four patients alive at day 30, the patient with ex situ reconstruction was lost from follow-up at 3 months, one died at 25 months from unknown cause and the remaining two are still

Table 4
Details of in-hospital and follow-up complications and mortality for the 18 patients treated by ISR with SCD. D:Day; M:month; GO: Graft occlusion; BGO: Below graft occlusion; MSOF: Multi-system organ failure.

			In-hospital			Follow-up				
Patient	Responsible micro-organism	Type of graft	Surgical complications	Reintervention	Cause of death	Recurrent graft infection	Graft thrombosis	Reintervention	Cause of death	Last follow-up
1	*Prevotella buccae*	AI								Alive (M37)
2	*Bacteroides fragilis*	AF	Acute limb ischaemia: BGO (D0)	Femoro-popliteal bypass		Graft limb (M12)	Graft limb (M12)	Thrombectomy + Bypass Leg amputation + excision of infected graft limb (M12)		Alive (M18)
3	SARM	AI				Proximal pseudoaneurysm (M13)		Urgent laparotomy (M13)	Rupture of proximal pseudoaneurysm (M13)	Dead
4	*Candida albicans*	AI	Duodenal leak (D28)	Gastro-jejunal anastomosis	Septic shock (D41)					Dead
5	*Proteus mirabillis*	AF	Duodenal leak (D15)	No reintervention: external drainage		Proximal pseudoaneurysm (M5)		Urgent laparotomy (M5)	Rupture of proximal pseudoaneurysm (M5)	Dead
6	*Streptococcus anginosus*	AI								Alive (M66)
7		AF	Acute limb ischaemia: BGO (D2)	Leg amputation	MSOF (D4)					Dead
8	*Streptococcus alpha*	AI	Acute limb ischaemia: GO (D1)	Graft thrombectomy						Alive (M16)
9	*Candida albicans* *Streptococcus alpha*	AI								Alive (M17)
10	*Enterococcus faecalis* SARM *Pseudomonas aeruginosa* *Bacteroides fragilis*	AF	Acute limb ischaemia: BGO (D15)	Femoro-popliteal bypass thrombectomy						Alive (M20)
11	*Pseudomonas aeruginosa* *Enterobacter cloacae*	AI				Graft limb (M10)	Graft limb (M10)	Thrombectomy + new duodeno-jejunal anastomosis (M10)		Alive (M22)
12	*E. coli*	AF	Acute limb ischaemia: GO (D0) Acute limb ischaemia: BGO (D7)	Graft thrombectomy Leg amputation	Multi system organ failure (D60)					Dead
13	*Candida kefyr*	AF								Alive (M16)
14	*Candida albicans* *Streptococcus alpha* *Corynebacterium*	AF	Left colonic necrosis (D15)	Left colectomy	Multi system organ failure (D26)					Dead
15	*Enterobacter faecalis* *Streptococcus anginosus*	AI	Duodenal leak (D7)		Septic shock (D12)					Dead
16	*E. Coli*	Aortic tube	Leg abscess after initial septic embolus (D9)	Leg amputation						Alive (M5)
17	*E. Coli*	AI	Acute limb ischaemia: GO (D1)	Graft thrombectomy	Multi system organ failure (D9)					Dead
18	*Candida albicans*	AF	Acute limb ischaemia: BGO (D1) Acute limb ischaemia: BGO (D4) Duodenal leak (D4)	Femoro-popliteal bypass thrombectomy Leg amputation	Septic shock (D38)					Dead



	T0	T6	T12	T18	T24
N at risk	18	11	8	3	2
Reinfection probability	1	0.90	0.60	0.60	0.60
Standard Error	0	0.09	0.15	0.15	0.15

Figure 4. Kaplan–Meier estimates of reinfection-free survival rate for the 18 patients treated by ISR with SCD.

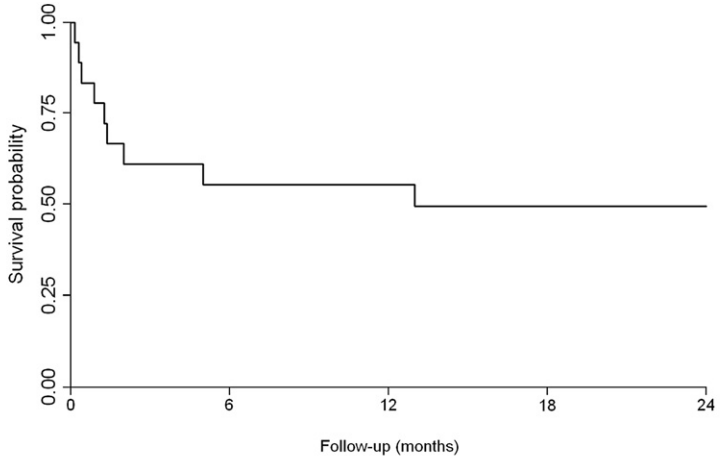
alive and remained not infected at 15 and 72 months. All grafts were patent during the study period.

Discussion

In this study, 18 patients underwent bowel repair and in-situ revascularisation using silver-coated Dacron to treat SAEF. There were seven in-hospital deaths (39%), due to duodenal leak in three cases and the estimate of survival rate at 12 months reached 55%. The estimate of recurrent graft infection-free survival at 12 months was 60% and the estimates of primary and secondary patency rates were 60.5% and 89%, respectively.

For many years, EAR has been the gold standard for the treatment of infected aortic grafts, especially in association with SAEF. Indeed, EAR provides acceptable rates of mortality and graft reinfection while avoiding challenging aortic reconstruction in a septic field.[6,7] However, some authors have reported elevated mortality rates due to rupture of the aortic stump after EAR[8] and axillofemoral bypass has been associated with graft thrombosis and lower limb amputation.[9] Because of these disadvantages, several surgical teams have proposed ISR to improve long-term results in cases involving infected aortic grafts. The use of this alternative was supported by the Oderrich[10] et al., 2006 study with a 40-month follow-up showing a statistically higher graft patency rate after ISR than EAR with no difference in operative mortality and reinfection rates. The secondary patency rate in the present study was 89%.

Despite numerous reports in the literature, controversy remains concerning the best conduit material for ISR. Comparison of data is difficult because most previous series describing management of aortic graft infection have included patients with or without SAEF and the use of a wide range of vascular substitutes.[2,11–15] In cases



	T0	T6	T12	T18	T24
N at risk	18	11	11	5	3
Survival probability	1	0.55	0.55	0.49	0.49
Standard Error	0	0.12	0.12	0.12	0.12

Figure 5. Kaplan–Meier estimates of survival rate for the 18 patients treated by ISR with SCD.

involving large abscesses, diffuse infection or virulent bacteria such as *Pseudomonas aeruginosa* or methicillin-resistant *Staphylococcus aureus* (MRSA), femoral veins and cryopreserved allografts have been vaunted as the best alternative to reduce the risk of reinfection.[11,15–17] In a meta-analysis in 2006, O'Connor et al.[2] showed that autogenous veins remained the best material to avoid reinfection, and also reported complications at site of graft harvesting. Similarly Ali et al.[15] observed wound complications in 34% of the patients. Modrall et al.[18,19] described two other circulatory complications, that is, deep venous insufficiency in 15% and requirement for fasciotomy to prevent compartment syndrome after aorto-femoral reconstruction in 21%. Another dreaded complication is graft disruption that was the cause of death in 4% of patients in the Kieffer et al. series using allografts[11] and in 5% of patients in the Ali et al. series using femoral veins.[15] It is interesting to note that most rupture-related deaths in patients treated for SAEF occurred early after the intervention. In our experience, 2/6 patients treated by ISR using femoral veins died at day 4 and 14 from graft disruption. In sharp contrast with these findings, no patient in our study using SCD prostheses required reintervention for major bleeding.

Other advantages of SCD prostheses include immediate availability, long-term durability and better protection against infection.[13] Indeed, although it is generally thought that the use of foreign material in an infected field is risky, a recent study[4] comparing fresh allografts and silver-coated grafts showed no difference in terms of reinfection. In our series, reinfection-free survival at 1 year was 60% and only four patients developed late reinfection. This is in accordance with Oderich et al.[20] who reported an even lower reinfection rate of 4% using Rifampicin-soaked graft. The same authors concluded that prosthetic grafts should be used in cases of limited graft infection.

Unlike previous studies describing implantation of femoral veins, cryopreserved allografts, specific soaked or coated grafts for aortic reconstruction,[2,11–13,15] our study focusses on the use of silver-coated grafts for ISR in a homogeneous population of patients presenting SAEF. It should be noted that the underlying physiopathology of SAEF and diffuse infection seems quite different. Indeed, SAEF is caused by bowel erosion caused by the pulsatile movement of the prosthesis. In this context, graft infection is usually confined to the zone in contact with the bowel lesion[20] (Fig. 2). In our study only five patients presented perigraft effusion involving the whole retroperitoneal space. Because the extent of infection was limited, we were able to perform partial graft resection in four patients, thus avoiding the need for difficult dissection to remove the heavily encapsulated graft segments. Only one of the four patients who underwent partial resection developed late reinfection. Other authors have reported similar good results after partial graft resection.[5,21,22]

Another argument in favour of the use of prosthetic grafts such as SCD for management of SAEF involves reducing the complexity and invasiveness of the procedure, especially in frail patients. The in-hospital mortality rate of 39% in this study is equivalent to rates reported by other series describing SAEF management.[5,16] It should be noted that most deaths in our series occurred during the initial hospitalisation period (7/9) and that more than half were due to MOF early after the procedure. The most likely explanation is inflammatory response related to procedure duration and surgical trauma. This finding underlines the need to reduce the duration and invasiveness of the procedure, especially for the aortobifemoral reconstructions. Graft infection associated with SAEF seems to be often limited to the graft segment in direct contact with the bowel lesion as reported by Oderich et al., who reported partial replacement of the infected graft in 80% of their cases of SAEF due to localised infection.[20] Moreover, SAEF is associated with lower rate of reinfection as compared to primary graft infection, probably due to lowest virulence of the graft infection that is often partial.[10] Therefore, selective ISR using an SCD prosthesis is a feasible alternative to more invasive and time-consuming replacement with autologous material. In this regard, it can be noted that the mean procedure duration in the study of Ali et al.[15] using femoral veins was 560 min as compared to 360 min in our study using selective prosthetic reconstruction. Regarding these considerations, a new alternative to conventional open surgery has been recently described and analysed. Kakkos et al. reported better mid-term outcomes using an endovascular approach with reduced early mortality and morbidity without any difference in recurrence of infection.[23] However, further trials are required to confirm these results and to find the exact place of this treatment.

Another important factor for successful management of SAEF is effective visceral repair. In a recent study, Batt et al.[5] noted a higher incidence of lethal graft reinfection after direct suture of the duodenal defect even if complete graft resection was achieved. The lack of correlation between recurrence of graft infection and revascularisation technique underlines the importance of bowel repair. Protecting the revascularisation is a major factor in avoiding direct contamination and reducing the risk of reinfection in case of intestinal leakage. In addition to omental wrapping of the prosthesis,[20] other revascularisation protection techniques such as complex duodenal reconstruction and uncrossing can be used. Although all of our patients with postoperative duodenal leaks finally died, we can assume that the incidence of leakage and complications would have been higher if direct duodenal suture had been routinely performed. Our experience confirms the findings of Valentine et al.[24] who reported severe digestive complications in 10/38 patients with fatal outcome in 90% of cases and identified gastrointestinal complications as an independent predictor for death. Although the latter investigators performed DS of the duodenal defect in 26 of 30 cases, they underlined the crucial importance of managing the intestinal defect. Based on these findings and our experience, we recommend direct duodenal suture for small lesions but prefer resection and duodeno-jejunal anastomosis for larger ones.

The main drawback of this study is retrospective design. Other limitations include small patient population and short follow-up.

Conclusion

In-situ revascularisation with silver-coated Dacron provides acceptable results in terms of mortality. This study shows that SAEF still poses a difficult surgical challenge associated with high mortality. The use of SCD grafts may be useful for simple vascular reconstruction and allow greater attention to bowel repair that is a major factor in short- and mid-term survival.

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