Extra-anatomical arterial bypass of the aortoiliac segment: 15-year experience

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ABSTRACT

Background: Extra-anatomical bypass, which is an alternative procedure to classical surgery, aims at simplifying a complex procedure such as aortoiliac reconstruction.

Objectives: To analyze long-term outcomes of extra-anatomical bypass of the aortoiliac segment.

Methods: Longitudinal retrospective study including 79 extra-anatomical bypasses of the aortoiliac segment, performed in 75 patients between December 1991 and December 2006.

Results: Mean age was 64.2 years, and male gender was predominant (64%). Critical ischemia accounted for most indications for surgery (86.1%); crossover iliofemoral bypass represented 41.8% of all procedures. Mortality, patency and limb salvage rates were 28, 70.3 and 67.6%, respectively, at five years.

Conclusions: Extra-anatomical bypasses should remain as alternative procedures because of their lower patency rates in comparison to anatomic procedures and considerable morbidity and mortality rates. However, they are important procedures when anatomic revascularization cannot be accomplished due to clinical and local limitations. Crossover bypasses demonstrated better patency rates than axillofemoral bypasses, and crossover iliofemoral bypasses showed the best patency rates of all (77.3% at five years).

Keywords: Surgery, abdominal aorta, blood vessel prosthesis, amputation, mortality.

RESUMO

Contexto: As derivações extra-anatômicas, sendo procedimentos cirúrgicos alternativos à cirurgia clássica, têm como principal objetivo simplificar um procedimento de grande porte como a restauração aorto-femoral.

Objetivos: Analisar os resultados a longo prazo das derivações extra-anatômicas no segmento aorto-ilíaco.

Métodos: Estudo longitudinal retrospectivo envolvendo 79 derivações extra-anatômicas no segmento aorto-ilíaco, realizadas em 75 pacientes, no período de dezembro de 1991 a dezembro de 2006.

Resultados: Média de idade foi 64,2 anos, com predominância pelo gênero masculino (64%). A isquemia crítica foi a responsável pela maioria das indicações cirúrgicas (86,1%) e a derivação ilíaco-femoral cruzada representou 41,8% dos casos. Em cinco anos, as taxas de mortalidade geral, perviedade e salvamento do membro foram, respectivamente, de 28%; 70,3% e 67,6% em cinco anos.

Conclusões: As derivações extra-anatômicas devem permanecer como cirurgias alternativas, pois apresentam taxas de perviedade inferiores aos procedimentos que seguem as vias anatômicas naturais além de morbimortalidade considerável. Entretanto, são procedimentos importantes nos casos em que a limitação de ordem clínica ou de natureza local torna difícil ou impede a revascularização por via anatômica. As derivações cruzadas apresentaram perviedade superior às derivações axilo-femorais e as ilíaco-femorais cruzadas revelaram a maior perviedade entre todas (77,3% em cinco anos).

Palavras-chave: Cirurgia, aorta abdominal, prótese vascular, amputação, mortalidade.

Introduction

Extra-anatomical bypasses are surgical procedures performed at sites that do not correspond to the natural anatomy. The main objective of extra-anatomical bypass is to simplify a large surgical procedure, such as aortofemoral reconstruction, allowing a higher number of patients to be revascularized.[1-12]

The criteria for indicating such procedures are generally the same currently adopted for classical revascularizations: critical ischemia (ischemic pain at rest and/or ulcerations) and incapacitating claudication, whose conservative treatment is not successful. On the other hand, candidates to revascularization due to any of these alternative techniques are patients considered as high risk for the classical procedure, whether due to increased anesthetic restrictions, or due to cardiac limitations that would make aortic clamping a high risk procedure. There is also a group of patients that offers local difficulties to perform aortofemoral reconstruction, related to femoral anastomoses or due to presence of infection in the inguinal region of previous aortofemoral graft. Results of extra-anatomical bypasses range according to procedure and patients' general conditions.[8-12]

Classical aortoiliac revascularization surgery has well known results. Primary patency is 87.5% in 5 years and 81.8% in 10 years, with operative mortality rate of 3.3%.[13]

Nowadays, with a fast development of endovascular surgery, many patients have been benefited

from percutaneous transluminal angioplasty, with and without stenting.[13-20] Iliac artery angioplasties have shown the best results regarding patency and clinical outcomes, with low complication rates, although with high costs compared with extra-anatomical bypass surgery. In large series, balloon angioplasty patency ranges between 77-96% at the end of the first year of follow-up and between 34-85% in 5 years.[13-19] These rates are even better when stent placement is considered: 81-95% at 1-year follow-up and 63-72% in 5 years.[13,16-23]

This study aims at analyzing long-term outcomes of 15-year experience in extra-anatomical aortoiliac bypasses.

Methods

A longitudinal, observational and retrospective study was carried out in 75 patients submitted to 79 extra-anatomical aortoiliac bypasses for arterial revascularization of the lower limbs from December 1991 to December 2006. All bypasses were performed by the first author at three large hospitals in Porto Alegre, Brazil (Irmandade Santa Casa de Porto Alegre, Hospital Nossa Senhora da Conceição and Hospital Moinhos de Vento). Patients included in the study did not have adequate clinical or local conditions to be submitted to classical aortofemoral bypass surgery (anatomical position). Follow-up was performed at a private office and in outpatient clinics of the hospitals. All bypasses were performed using a Dacron graft. Assessed outcomes were bypass patency, limb salvage (lower limb amputation) and mortality, besides the following variables: gender, age, surgical indication, associated comorbidities and type of bypass performed. Thirty-day follow-up was considered operative; from 30 days to 12 months, short term; and from 12 to 60 months, long term.

Bypass patency was assessed by presence of pulsation in the graft and recipient artery during physical examination. Doppler vascular ultrasound was used in cases of difficult graft palpation. Limb amputation (transtibial or transfemoral) was considered as outcome when related to initial pathology and to the surgery performed. Deaths due to varied clinical causes were included, not necessarily related to the procedure. Deaths resulting from external causes were excluded. Deaths occurring within the first 30 days after the surgery were considered as operative mortality.

Outcome analysis was performed using the calculation of prevalence and Kaplan-Meier curve. Results for all bypasses were obtained as a group and femorofemoral and iliofemoral bypasses were individually crossed. For intragroup comparison, chi-square test with Fisher's correction was used. Confidence interval was set in 95%. Each procedure (bypass) accounted for a single case for statistical purposes.

Results

From December 1991 to December 2006 79 extra-anatomical bypasses were performed in 75 patients. Mean age was 64.2 years (standard deviation = 9.6). Male patients accounted for 64% (n = 48).

Diagnosis of critical ischemia was responsible for most surgical indications, being present in 86.1% (n = 68/79) of cases. Incapacitating claudication at a distance shorter than 20 m accounted for 8.9% (n = 7/79) of indications. Severe infection at the operative wound of a previous graft was the indication in 5.1% (n = 4/79) of cases. The most frequent associated comorbidities were hypertension, 75.9%; smoking, 64.6%; ischemic cardiopathy, 49.4%; chronic obstructive

pulmonary disease, 31.6%; diabetes mellitus, 22.8%; obesity, 16.5%; cerebrovascular disease, 10.1%; and neoplasm, 7.6%. In 81.3% (n = 61/75) of patients, there were multiple comorbidities (two or more).

Crossover iliofemoral bypass was the most frequently performed surgery, accounting for 33 cases (41.8%) (Table 1). Infection rate of extra-anatomical bypasses was 3.8% (n = 3/79) over the first 30 days, and there were no further additional cases of infection. All cases of infection occurred in axillofemoral bypasses and at inguinal site with previous surgery. Five patients (6.3%) were submitted to associated infrainguinal bypass for lower limb revascularization.

Table 1 - Types of bypasses performed

Bypass	n	%
Crossover iliofemoral	33	41.8
Crossover femorofemoral	19	24.0
Axillary-bifemoral	17	21.5
Unilateral axillofemoral	6	7.6
Unilateral axillopopliteal	1	1.3
Bilateral axillopopliteal	1	1.3

General mortality over the first 30 days in patients submitted to extra-anatomical bypass was 12% (n = 9/75). General cumulative mortality at the end of 5 years was 28% (n = 21/75), and can be seen in the survival curve of Figure 1.

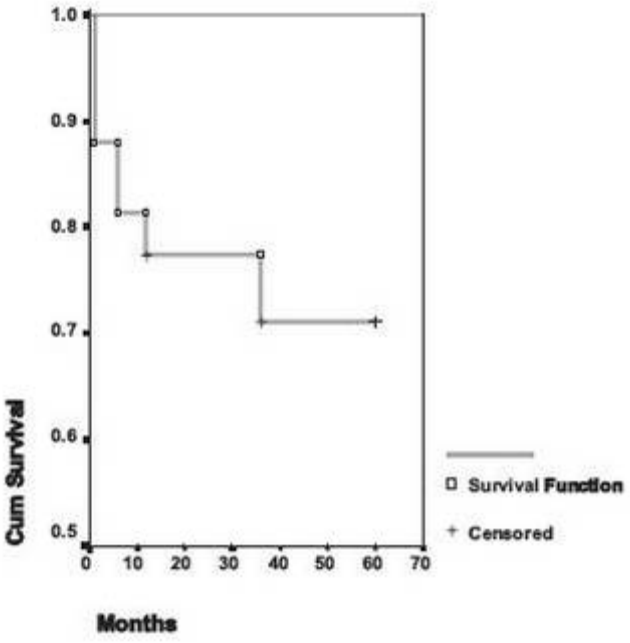

Figure 1 - Survival curve of patients submitted to extra-anatomical bypass

At the end of the first month (30 days), the patency rate of all bypasses was 92.9% (n = 65/70). Nine cases were included in which the bypass remained patent, but the lower limb was amputated. At the end of 60 months (5 years), we observed a patency rate of 70.3% (n = 26/37). Similarly, among patent cases, seven that remained with patent bypass, but had limb amputation were included (Figure 2).

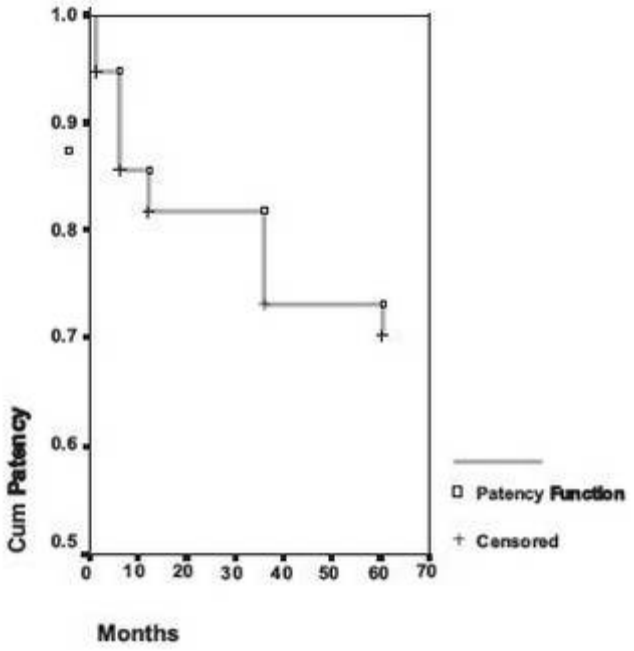

Figure 2 - Patency curve of extra-anatomical bypasses

Limb salvage rate was 67.6% (n = 25/37) in 5 years. Total amputation rate at the end of follow-up was 24% (n = 19/79) (Figure 3).

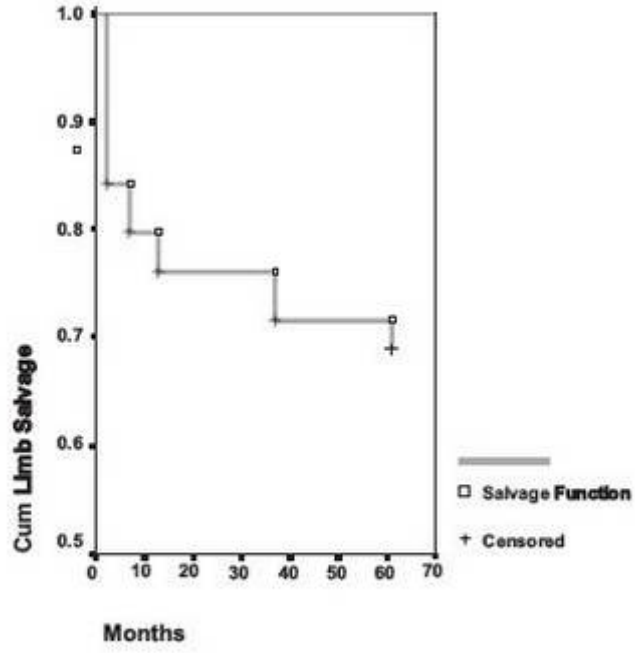

Figure 3 - Limb salvage curve of extra-anatomical bypasses

When comparing crossover femorofemoral and crossover iliofemoral bypasses, we observed, respectively, mortality of 33.3 *vs.* 26.7% (p = 0.7), patency rate of 37.5 *vs.* 77.3% (p = 0.02) and

amputation rate of 37.5 *vs.* 22.7% (p = 0.6) in 5 years. Patency rate of crossover iliofemoral bypass was significantly higher than that of crossover femorofemoral bypass. Patients submitted to crossover femorofemoral and iliofemoral bypasses had, respectively, the following associated factors: previous inguinal surgery, four and eight cases; and femoropopliteal obstruction, one and four cases.

At the end of 60 months, we registered follow-up loss of 20 cases (25.3%), most of them due to change in address and impossibility of contact.

Discussion

Most studies involving extra-anatomical bypasses were published around one decade ago.[24-32] Nowadays, with the development of endovascular surgery, due to enhancement in technique and equipment, improvement in clinical and anesthetic management of patients who are able to perform classical surgery and with better control of infections, extra-anatomical bypass has become an exception surgery. Despite its indication having become more restricted, it is still a technique of great value in our country, especially due to economic restrictions of endovascular procedures used and increasingly higher number of patients with older age and multiple comorbidities. In addition, it also has a very specific indication related to treatment of previous infected grafts.

This study showed high mean age (64.2 years) of patients submitted to extra-anatomical bypasses. Prevalent male gender follows the higher prevalence of atherosclerotic disease in men.[9-12]

According to most authors, indications for extra-anatomical bypass are the same of conventional surgery.[9-12,26,27] In our study we demonstrated a predominance of indication due to critical ischemia (86.1% of cases), incapacitating claudication being the indication in 8.9% of cases. Only 5.1% of patients were submitted to bypass due to inguinal infection in previous graft. Therefore, the data show that contraindication to anatomical surgery was one of the most important factors in indication, local factor being the least important, despite its precise indication in cases of infection.[33-40]

Associated comorbidities in patients submitted to extra-anatomical bypasses are frequently multiple, severe and determinant to indicate the procedure.[9,11,12,26,27] In this study, we found high prevalence rates of hypertension, smoking, ischemic cardiopathy, chronic obstructive pulmonary disease and diabetes; 81.3% of patients had two or more comorbidities.

The most frequently performed surgery in this study was crossover iliofemoral bypass, accounting for 41.8% of all procedures. Crossover femorofemoral and iliofemoral bypasses were performed in 24 and 21.5% of cases, respectively. Axillary-unifemoral bypass was performed in six cases, and axillopopliteal in only two cases (Table 1).

Result of extra-anatomical bypasses is dependent on type of revascularization and patient's clinical status. Crossover femorofemoral bypass has mortality rate of up to 6% in published series[25,26,41-47] and accumulated patency in 5 years ranging between 56 and 82%.[11,31,41-49] Axillofemoral and axillary-bifemoral bypasses, since they are a procedure in which the graft is longer, have less satisfactory results than crossover femorofemoral grafts. Mortality ranges between 2-10% and is usually related to basal clinical disease.[9,26,30,44,50-58] Results in 5 years range between 30-79% in axillofemoral bypasses[44,51,52,54,56,59] and between 33-77% in axillary-bifemoral bypasses.[11,30,44,51,52,56,58] Axillopopliteal bypass has mortality rate of 8% and accumulated

patency in 5 years of 40%, with limb salvage rate of 58%.[60] It is important to stress that the results of extra-anatomical bypasses are lower than those obtained with classical reconstructions.[13]

In the present study, general mortality over the first 30 days in patients submitted to extra-anatomical bypass was 12%, with general cumulative mortality of 28% in 5 years (Figure 1). Deaths unrelated to the surgery were included, except for deaths due to external causes, to demonstrate the high early and late general mortality rates of patients who are submitted to this therapeutic modality.

Patency rate of all bypasses, in this study, was 92.9% at the end of the first 30 days and 70.3% at the end of a 5-year follow-up (Figure 2). Decrease in patency rate can be attributed to severity of patients submitted to surgeries and to shorter durability of this type of bypass. Patency rate of crossover iliofemoral bypass was significantly higher than that of crossover femorofemoral bypass in 5 years: 37.5 *vs.* 77.3% ($p = 0.02$). There was no difference between these bypasses as to presence of factors of worse prognosis.

Total rate of amputation was 24% at the end of follow-up in this study, with limb salvage rate of 67.6% in 5 years. Such data reveal the severity and little favorable conditions of patients submitted to extra-anatomical bypasses. Maintenance of lower limb throughout time is demonstrated by the curve in Figure 3.

We conclude that extra-anatomical bypass should remain as an alternative surgical option, reserved for cases in which the patient has very high surgical risk or unfavorable local conditions, such as graft infection in the inguinal region. In cases in which the patient has favorable anatomical conditions, even at high surgical risk, the endovascular procedure should be chosen (angioplasty with or without stent placement), if it is available due to higher costs. Nowadays, in patients in which extra-anatomical bypass is indicated, we choose bypasses in the following order: crossover iliofemoral, crossover femorofemoral, axillary-unifemoral or axillary-bifemoral. Whenever possible, we try to perform crossover bypasses, since they have longer durability because they are shorter. In addition, with frequent use of crossover iliofemoral procedure, described in details in another publication,[8] we prefer this type of bypass, since it avoids approach to the femoral artery in at least one limb, reducing risk of infection without compromising patency.

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This study was approved by the Research Ethics Committee at ISCMPA.

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