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# REVASCULARIZATION OF HIGH-RISK AORTOILIAC OCCLUSIONS

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**Summary**. *Chronic renal failure, severe cardiac disease, pulmonary insufficiency, morbid obesity or any uncontrolled malignant or other systemic disease that limits the performance of extensive transperitoneal operative treatment induce extra-anatomic forms of reconstruction for aortoiliac occlusive disease. Within the period 1999-2003, we operated 37 such patients by methods of extra-anatomic bypasses. We performed femorofemoral bypass in 30 patients, axillounifemoral in 3 patients, and axillobifemoral in 4 patients. The satisfactory patency rate of extra-anatomic bypasses, the absence of hospital mortality, well-accepted intervention and its technical attractiveness were the fundamental reasons due to which the methods of extra-anatomic reconstruction have found their place in our everyday work and utterly proved their worth.*

**Key words**: *Extra-anatomic bypass, aortoiliac occlusion, revascularization*

## Introduction

The term extra-anatomic bypass has been applied to grafts that pass through an anatomic pathway significantly different from that of the natural blood vessels they bypass (1). Ordinarily, the use of such a bypass implies deliberate avoidance of the natural location of vascular supply, either because a hostile pathologic condition is present there or because entering the area significantly adds to the risk of operation (as in entering the abdomen) (1, 2). The term extra-anatomic bypass commonly applies to an axillofemoral (AxF) or a femorofemoral bypass (FF) or their combination, the so-called axillobifemoral (AxFF) bypass (3). Other extra-anatomic arterial bypasses, such as carotid-subclavian, axilloaxillary, splenorenal, and crossover femoropopliteal bypasses, are extra-anatomic to a greater or lesser degree.

This paper focuses on those extra-anatomic routes used to bypass aortoiliac occlusive disease under those circumstances in which (a) the natural inflow has already been or must of necessity be interrupted and (b) direct arterial reconstruction, such as aortobifemoral grafting, is precluded either by a "hostile" abdominal disease or by the prohibitive operative risk of this approach as a result of impaired function of one or more vital organs (2).

In 1952, Freeman and Leeds described the use of a superficial femoral artery to carry blood directly from one femoral artery to another subcutaneously. In 1958, McCaughan sutured a polyester (Dacron) prosthesis to the left external iliac artery, brought it preperitoneally across to the right groin, and anastomosed it side-to-end to the right profunda femoris artery and end-to-side to the right popliteal artery, bypassing occlusions of the right iliac, common femoral, and superficial femoral arteries (3, 4).

In 1962, Vetto reported 10 transabdominal subcutaneous femorofemoral graft operations to bypass unilateral iliac occlusive disease in poor-risk patients. In the same year, as reported almost simultaneously by Blaisdell and Hall and by Louw, Dacron grafts were placed between the axillary and ipsilateral femoral arteries for occlusive disease. The obturator bypass was introduced in 1962 by Shaw and Baue as a means of bypassing graft sepsis localized to the groin (1, 2, 5).

## Material and Methods

This paper presents our experience in applying 37 extra-anatomic bypasses (ExBy) in the operative treatment of high-risk aortoiliac occlusive disease, in the period 1999-2003. All the patients were elderly males in the seventh decade of their life.

The diagnosis of symptomatic aortoiliac occlusive disease was determined by detailed general examination, laboratory analyses, and additional noninvasive (plethysmography, Doppler) and invasive (angiography) diagnostic methods.

Extra-anatomic bypasses were performed in the patients under light general or balanced endotracheal anesthesia (5FF, 4AxF and 3AxFF). In a majority of cases, femorofemoral bypasses were performed with the use of spinal (22FF) or local anesthesia (3FF).

We performed a femorofemoral bypass by making two vertical incisions over the femoral vessels and anastomosed the graft in the standard fashion on each side after tunneling it in a gentle upward convex curve through the subcutaneous tissue above the pubis and anterior to the rectus sheath. If there were problems with post-irradiation changes or subcutaneous infection or if

the patient was morbidly obese, we incised the external oblique aponeurosis and passed the graft in a retrofascial plane.

In the case of axillobifemoral bypass, after completion of axillofemoral anastomoses, the first anastomosis of the femorofemoral crossover was usually made into the side of axillofemoral graft distally. We used double-velour knitted Dacron and PTFE prostheses for these operations.

All the patients were interoperatively heparinized with 5000 IU before artery clamping. Twenty-six Dacron and 11 PTFE grafts were implanted. Incisions were closed in 2 layers (32 with two-day drainage and 5 without drainage).

For the bypassing of joined occlusive lesions on femoral superficial artery and for improvement of run-off, additional autovenous and femoro-popliteal bypasses above and under the knee were performed in 2 patients after FF and AxF bypass.

In the postoperative period, as well as an hour before the operation, all the patents were given a high prophylactic dosage of antibiotics of wide spectrum and received antiaggregate therapy postoperatively. All the patients were carefully followed in the early postoperative period for general condition and vital parameters, local state of the donor's and recipient's extremities (pulse control, temperature and Doppler).

Before discharge, the patients were given printed hygienic and diet instructions for the purpose of graft protection and elimination of risk factors (avoidance of sudden hand movements and belt wearing - in the cases of AxF by-passes).

Control was done in the ambulance on a weekly, monthly, one- and five-year basis.

## Results

Serious forms of lower extremities ischemia (the third and fourth degree, according to Fontain) in the form of ischemic rest pains, ulcerations and localized gangrenes were detected in 29 (78.4%) patients. Serious forms of functional ischemia (IIb according to Fontain), presented as handicapped claudications, were found in 8 (21.6%) patients.

Clinical characteristics and the most frequent risk factors in patients operated by EXBY methods are shown in Table 1.

Indications for performing EXBY in our patients are shown in Table 2.

Early postoperative complications were detected in 11 (29.7%) patients: 1 hematoma in femoral region (spontaneously absorbed), 2 hematomas in the ribcage wall and abdomen (spontaneously absorbed), 3 early graft thromboses, due to technical errors (2 were successfully operated using thrombectomy and anastomotic reconstruction and 1 underwent additional femoro-popliteal autovenous bypass).

Two superficial infections of postoperative wounds were successfully treated by antibiotics and local measures. "Steal" syndrome of a mild form on lower extremities was found in 3 patients after FF bypass.

Successful wound healing of additional interventions on feet in the form of necrectomy, finger amputations or transmetatarzal amputations was present in 12 (32.4%) patents.

Four patients (10.8%) underwent massive femoral amputations due to the unsuccessful attempt of revascularization and acute ischemia caused by late graft thrombosis.

None of the patients died in the early postoperative period.

The results for mortality rate and late graft patency are shown in Table 3.

Table 1. Operative risk factors in patients with symptomatic aortoiliac occlusion

| The risk factors | Number | % |
|---|---|---|
| Severe cardiac disease (recent myocardial infarction, intractable heart failure, or significant angina pectoris) | 29 | 78.4 |
| Chronic renal failure (creatinine clearance rate < 40 ml/hr or the need for hemodialysis) | 18 | 48.6 |
| Diabetes mellitus | 8 | 21.6 |
| Severe pulmonary insufficiency (dyspnea at rest, oxygen dependency, or a forced expiratory volume < 1 L/sec) | 4 | 10.8 |
| Morbid obesity | 7 | 18.9 |
| Smoking | 36 | 97.3 |

Table 2. Indications for extra-anatomic reconstruction in our patients

| | Number | % |
|---|---|---|
| 1. Femorofemoral bypass | | |
| Unilateral iliac artery occlusion and good donor's artery* | 24 | 64.8 |
| Secondary reconstruction after occlusion of the branch of Y graft in obese patients with several laparotomies | 6 | 16.2 |
| 2. Axillounifemoral bypass | | |
| Unilateral iliac artery occlusion with poor donor's artery * | 2 | 5.4 |
| M. Leriche with unilateral limb-threatening ischemia * | 1 | 2.7 |
| 3. Axillobifemoral bypass | | |
| M. Leriche * | 3 | 8.1 |
| Infections in the abdomen and retroperitoneum | 1 | 2.7 |
| Total | 37 | 100 |

* Patients at high operative risk

Table 3. Results for extra-anatomic bypass

| Procedure | Operative mortality rate (%) | Patency rate (%) | |
|---|---|---|---|
| | | One Year | Five Years |
| Femorofemoral bypass | 0 | 80 | 75 |
| Axillofemoral bypass | 0 | 62 | 53 |
| Axillobifemoral bypass | 0 | 75 | 75 |

## Discussion and Conclusions

Liberal application of extra-anatomic bypass results in lower mortality and higher patency rates (3, 4), as confirmed by this evaluation (Table 3). Johnson et al. offered a axillobifemoral bypass "to anyone over the age of 65, regardless of risk" (2, 6).

Femorofemoral bypass has the best overall patency rate of all the extra-anatomic bypasses (Table 3). It is the operation of choice for unilateral iliac artery occlusion in older patients (5, 6). This is a safe operation that results in good patency in a patient with good runoff, and it may be performed even for disabling claudication in such a patient. When superficial femoral artery occlusion is present, this bypass should not be performed for claudication but it may be performed, with concomitant profundaplasty, for limb salvage in low-risk patients (7-9). When forefoot ulceration, gangrene, or infection is present, concomitant distal bypass is preferable to profundaplasty regardless of the proximal bypass used (6, 7). Finally, femorofemoral bypass is an acceptable means of handling unilateral occlusion of a bifurcation graft limb that is not amenable to thrombectomy, although it must be kept in mind that the patency rate of the procedure in this setting is definitely inferior to that of a primary bypass (10). Because the axillounifemoral bypass has relatively much poorer 5-year patency rates (Table 3), its application should be limited to use in patients (a) who are clearly in a unilateral limb salvage situation, (b) in whom the abdominal approach is strictly prohibited either by a severe anesthetic risk or by intra-abdominal disease (e.g., sepsis, irradiation, malignant tumor, stomas), and (c) in whom a closer donor artery is not available or cannot be made suitable by PTA (11-14).

Axillobifemoral bypass has an overall 5-year patency rate ranging from 33% to 85% (10-12). It should be only exceptionally performed for claudication; instead, it should be used in chronic critical ischemia or other situations in which femoral inflow is mandatory and direct transabdominal reconstructive approach is clearly contraindicated either by a prohibitive risk or by a hostile intra-abdominal pathologic condition. Such a condition may consist of an infected aortic graft, aortoenteric fistula, mycotic aneurysm, enteric sources of contamination (diverticulitis, ileocolitis, or stoma), failure of high endarterectomy or bypass with juxtarenal occlusion, irradiation, retroperitoneal fibrosis, metastatic malignant disease, multiple abdominal operations with extensive adhesions, complex ventral hernia, massive obesity, and cirrhosis with ascites (3, 13, 14-17).

"Prohibitive anesthetic risk" as an indication for choosing the extra-anatomic bypass often requires a decision that is subjective but that should be based as much as possible on objective criteria. The following conditions qualify patients for this indirect form of reconstruction for aortoiliac occlusive disease: (1) severe cardiac disease (recent myocardial infarction, intractable heart failure, or significant angina pectoris); (2) chronic renal failure (creatinine clearance rate < 40 ml/hr or the need for hemodialysis); (3) severe pulmonary insufficiency (dyspnea at rest, oxygen dependency, or a forced expiratory volume < 1 L/sec); (4) morbid obesity (weight > 45kg, or at least 100% > ideal body weight); and (5) any uncontrolled malignant or other systemic disease that limits life expectancy to less than 2 years (3, 7, 13, 18).

The results such as a small number of early and late postoperative complications, absence of hospital mortality in patients at high operative risk, a high percentage of saved extremities with critical forms of ischemia, and graft patency (which is very similar to the graft patency with conventional operation on aortic segment) are similar to those reported in larger series by eminent vascular surgeons (2, 13, 14).

Successful operative management, good tolerance in patients at highest operative risk, technique attractiveness, high patency and limb salvage rates, as well as low morbidity and mortality rates, are the reasons due to which the methods of extra-anatomic bypasses have deserved their place in modern vascular surgery.

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# REVASKULARIZACIJA VISOKORIZIČNIH AORTOILIJAČNIH OKLUZIJA

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Kratak sadržaj: *Oboljenja koja limitiraju izvođenje opsežnih transperitonealnih hirurških zahvata, kao što su hronična bubrežna insuficijencija, teška srčana oboljenja, pulmonalna insuficijencija, enormna gojaznost ili pak, odmakle maligne ili sistemske bolesti, indikuju ekstraanatomsku rekonstrukciju u slučajevima aortoilijačne okluzivne bolesti. Tokom prethodnih pet godina (1999-2003), metodama ekstraanatomskog bajpasa, operisano je 37 takvih pacijenata. Femorofemoralni bajpas je izveden kod 30 pacijenata, aksilounifemoralni kod 3 dok su aksilobifemoralnom rekonstrukcijom operisana 4 pacijenta. Zadovoljavajuća protočnost ekstraanatomskih bajpaseva, odsustvo hospitalnog mortaliteta, dobro prihvatanje intervencije kao i njena tehnička atraktivnost predstavljaju osnovne razloge zahvaljujući kojima metode ekstraanatomske rekonstrukcije nalaze mesto u našem svakodnevnom radu, potvrđujući sopstvenu vrednost.*

Ključne reči: *Ekstra-anatomski bajpas, aortoilijačna okluzivna bolest, revascularizacija*