Open and endovascular combined procedures in lower limb arterial reconstructions

R. GABRIELLI, M.S. ROSATI*, L. IRACE, A. SIANI, S. VITALE, D. CRISTOFANI, G. MARCUCCI

Summary: Open and endovascular combined procedures in lower limb arterial reconstructions.

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Introduction. The association of open and endovascular procedures in patients with obstructive disease of the lower limbs gives the opportunity to treat in a single step multi-segmental lesions which were previously treated in the past by more demanding open procedures.

Patients and methods. From January 2003 to May 2009, 52 patients with peripheral occlusive chronic arterial disease of the lower limbs were submitted to combined open and endovascular procedures. In 37 patients (71.2%) a femoro-popliteal/pedial bypass was carried out after Percutaneous Transluminal Arteriography (PTA) stenting of the iliac/femoral arteries, while in the remaining 15 patients (28.8%) the endovascular procedures were performed following open approach, that consisted in a femoro-popliteal bypass. Iliac stenting intersected the common iliac artery in 19 patients (51.3%), the common and internal iliac artery in 11 patients (29.7%) and the external artery in 7 (19%).

In this same group a fem-pop bypass below knee was carried out in 28 (75.6%), a fem-pop above knee in 6 (16.2%), a fem-pop and jump on the posterior tibial in 2 (5.4%) and a superficial femoral-popliteal in the last one (2.8%). In the other group the fem-pop bypass below knee was followed by a PTA of the tibial vessels in 12 cases (80%) and by a stenting in only 3 cases (20%).

Results. Three patient was lost in follow-up. Three (8.1%) iliac stents became occluded and the sudden onset of an acute ischemia of the limb required in all cases an arterio-femoral bypass. The occlusion of tibial stent in 2 patient (13.3%) was clinical relevant, and the failure of the PTA procedure in 4 patients with the reocclusion of the stented vessels was followed by thrombectomy and amputation. Occlusion of the femoro-popliteal bypass occurred in 9 of 37 patients (24.3%) submitted to iliac stenting and in 4 of 15 (26.6%) patients with PTA of the tibial vessels. The overall patency rate was 69.2%. Limb salvage was necessary in all cases an aorto-femoral bypass. The occlusion of tibial stents became occluded and the sudden onset of an acute ischemia of the limb required in all cases an arterio-femoral bypass. The occlusion of tibial stent in 2 patient (13.3%) was no clinical relevant, and the failure of the PTA procedure in 4 patients with the reocclusion of the stented vessels was followed by thrombectomy and amputation. Occlusion of the femoro-popliteal bypass occurred in 9 of 37 patients (24.3%) submitted to iliac stenting and in 4 of 15 (26.6%) patients with PTA of the tibial vessels. The overall patency rate was 69.2%.

Conclusions. Combination of the open and endovascular procedures to treat lesions of the lower limbs is effective and durable in terms of patency and complication rate. For validation this new approach needs the recruitment of much more patients and prospective protocol studies.

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Introduction

Treating patients with multifocal obstructive lesions of the lower limbs requested in the past demanding open procedures. Furthermore, the final results of the treatment is burdened by longer and repeated hospitalizations and higher risk of infective complications. Obviously, costs were proportionally higher in those patients (pts) who needed surgery. Endovascular treatment offers the opportunity to treat multi-segmental lesions in a single step. This one step approach of the stenotic lesions, above and below the implanted graft, guarantees long-term patency rate compared with similar open procedures.

Few data are currently available on literature about the combination of open and endovascular procedures and no large prospective trials have been designed to compare combined treatment versus open surgery only.

Our report is a further contribution in this field.

Patients and methods

From January 2001 to May 2008, 52 patients (pts), 41 males and 11 females, with lower limb occlusive arterial disease (LLOAD) were enrolled (n = 19 pts in III – IV Fontaine stage n = 33 pts in critical ischemia according to European Working Group) (1). All pts received combined open and endovascular treatment. Arteriography and Ankle-Brachial Index (ABI) score have been performed in all patients, in 18 angio-MRI, in 27 angio-CT and in 14 duplex ultrasound. Patients co-morbidity profile was: 46 pts with hypertension, 27 with diabetes, 9 with renal failure in dialysis.

In 37 patients (71.2%) a femoro-distal bypass was carried out after PTA/stenting of the iliac arteries (group 1), while in 15 (28.8%) pts endovascular procedures in tibial area followed the surgical femoro-popliteal bypass (group 2). Prosthetic material was autologous saphenous vein in 33 patients (63.4%), PTFE EXS in 13 (25%) and a biological graft (Omniflow II) in the remaining 6 (11.6%). In the first group endovascular approach has been reserved to the common iliac artery in 19 patients (15 primary stenting and 4 PTA); to the common and external iliac in 11 patients (9 primary stenting and 2 PTA); to the external iliac artery in 7 pts (6 primary stenting and 1 PTA) (Table 1). Femoro-popliteal bypass below knee was carried out in 28 pts, a femoro-popliteal bypass above knee in 6 pts, a femoro-popliteal with jump on the posterior tibial in 2 and a superficial femoral-pedal in the last one (Table 2). In the second group the fem-pop bypass below knee has been followed by a PTA of the tibial vessel in 12 cases (80%) and by a tibial primary stenting in only 3 cases (20%) (Tables 3 and 4).

Routine Duplex scan at hospital discharge and during the follow-up at 1, 3 and 6 months have been performed. The median follow-up was 34 months. MRI angiography and CT or angiography were performed in complicated cases or in detected failing grafts. The primary end-point of the study was to evaluate feasibility, safety and long term patency of the combined treatment. The secondary end-point was to compare these treatment with open surgery only (data from our experience). Difference between groups has been evaluated through t-Student test and p<0.05 has been considered significative.

Results

Three patient was lost at follow-up and none died. Iliac stent obstruction has been recorded in 3 pts and sudden onset of acute ischemia of the limb required emergency aorto-femoral bypass in all cases. Two pts with tibial stent obstruction did not show relevant clinical symptoms, while the failure of the PTA procedure in other four with the obstruction of the tibial arteries was followed by thigh amputation. Femoro-popliteal bypass obstruction occurred in 24.3% pts of the first group (9/37)and in the 26.6% pts (4/15) of the second group. Overall patency rate was 69.2%, Limb salvage was 77.5%.

One patient from the second group had S.aureus infection and underwent the prosthesis removal, and no
amputation needed. Four pts showed homolateral deep venous thrombosis (DVT), in the first group and 1 in the second one. No major complications were recorded.

**Discussion**

Proximal reconstruction for multi-segmental aortoiliac or distal femoro-popliteal lesions is not adequate to improve the clinical outcome. Nevelsteen et al. (2) and Brewster et al. (3) clearly demonstrated that increasing proximal inflow, by itself, doesn’t improve distal hemodynamic. Since many years ago it has been clear the importance of simultaneous reconstruction of the different lesions to improve long term results; however, this procedure showed higher mortality rate and postoperative morbidity due to the progression of atherosclerosis (4).

Nevertheless, multi-step treatments are burdened by higher graft thrombosis and greater technical complexity in managing several times the same area.

Endovascular approach improved LLOAD treatment because it’s possible to treat multi-level lesions simultaneously with the same mortality and morbidity rate.

Timaran clearly demonstrated that simultaneous treatment of the iliac lesions through the primary stenting and the femoro-popliteal one through bypass, guarantees optimal inflow to the bypass and improves stent patency for distal run-off improvement (5). According to Schneider et al. the role of the bypass in combined procedures is to protect tibial arteries treated by PTA thanks to increased inflow; moreover increasing distal run-off through tibial PTA femoro-popliteal bypass patency could be better (6-7).

Data from literature support the idea that primary stenting has been broadened to aorto-iliac lesions with excellent results; femoro-popliteal-tibial lesions take advantage from PTA approach even if a second treatment or open surgery is anyway possible (8). Notwithstanding the lack of codified protocols, especially for what concerns the best timing, our data suggest to treat with one step procedure proximal lesion first and than the distal one because of the hemodynamic mechanism we explained above. (9-10)

The overall patency rate of 74.3% is similar to the results obtained in the single treatments of the same lesions, while major complication rate is reduced ($p<0.05$). Till now, no codified protocols on the combination are available, so the choice depends on the surgeon’s experience only. In our personal opinion the good results obtained depends also on the patient’s selection and on the arterial disease morphology (11).

Treating simultaneously multilevel lesions of the lower limbs with the combination of the vascular and endovascular surgery is effective and durable in terms of patency and complication rate. In fact no surgical related death were recorded. Major complications concern the prosthesis obstruction but these data do not differ from multi-step approach. This ensures the feasibility and safety of the procedures in terms of results. One-step approach is clearly not related with higher cardiac and pulmonary operative and post-operative events; none of our patients, in fact, showed these symptoms. Secondary complications as infection or DVT

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References


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were not as common as it would be expected and they were managing at all.
This new approach to the arterial disease of the lower limb is an interesting and developing field for research but needs the recruitment of much more patients and the prospective protocol studies for validation.