Crossover iliofemoral bypass graft through tension-free abdominal wall-repair mesh

Ann Ital Chir, 2017 88, 5: 433-437
pii: S0003469X17026434
free reading: www.annitalchir.com

Mircea Muresan*, Ovidiu Jimborean*, Gabriela Jimborean**, Radu Neagoe*, Serban Bancu*, Simona Muresan***, Cristian Borz*

**University of Medicine and Pharmacy of Tirgu Mures, Surgery Clinic n. 2, Romania*
***University of Medicine and Pharmacy of Tirgu Mures, Pulmonology Department, Romania*
****University of Medicine and Pharmacy of Tirgu Mures, Physiology Department*

Crossover iliofemoral bypass graft through tension-free abdominal wall-repair mesh

INTRODUCTION: *In vascular surgery the crossover iliofemoral bypass grafting is a well-known surgical technique. In general surgery the repair of an abdominal defect using a Polypropylene mesh is also a standard procedure. A particular technique is defined by the performance of these 2 separate procedures inside a single operation in which the crossover arterial graft is directed from the retroperitoneal space toward the contra-lateral femoral bifurcation through a Polypropylene mesh which closes the musculoaponeurotic layers of the abdominal wall. We present our experience with the use of this particular surgical technique in patients with critical limb ischemia and with indication for extra-anatomic crossover bypass (high-risk patients with contra-indication for the transperitoneal approach, extensive calcified aortic or iliac wall which contraindicated the direct arterial reconstruction or secondary arterial reconstruction after the occlusion of an aorto-femoral graft).*
METHODS: *In principle, the hernioplasty was performed by using the Lichtenstein tension-free hernia repair technique, followed by the crossover iliofemoral bypass. The main feature of this technique is to pass the vascular graft from the retroperitoneal space above the mesh through a calibrated hole in the mesh*
RESULTS: *The 7 patients with inguinal hernia and l limb-threatening ischemia had favorable evolution, without hernia recurrence, limb-threatening ischemia or any graft complication at 3 years.*
DISCUSSION: *Using this particular surgical technique we treated 2 surgical diseases using a single intervention for high-risk patients who had both inguinal hernia and contra-lateral critical limb ischemia. Being encouraged by the initial satisfactory results, we extended this technique even for the patients with indication of crossover iliofemoral bypass but without inguinal hernia.*
CONCLUSIONS: *The particular surgical technique of the crossover bypass in which the vascular graft crosses a tension-free Polypropylene mesh from the retroperitoneal space toward the Retzius space represents an efficient and short procedure which treats simultaneously 2 different surgical diseases (inguinal hernia and contra-lateral critical limb ischemia) in high-risk patients. The results were satisfactory: we had no hernia recurrence and the limb-threatening ischemia was successfully treated. The preferred vascular graft for this particular technique is the reversed autogenous vein because its resistance to infections and the vein long-term patency is better than of a vascular prosthesis. When a prosthetic graft is required, we prefer to use the classic technique in which the crossover graft is placed in an under-aponeurosis site, in order to diminish the prosthesis infection risk.*

KEY WORDS: Abdominal wall, Iliofemoral bypass, Vascular surgery

Introduction

In vascular surgery the crossover iliofemoral bypass grafting is a well-known surgical technique. We prefer this method instead of the classic crossover femorofemoral bypass operation because we can avoid the dissection of one groin and thus we can decrease the rate the vascu-

Pervenuto in Redazione Settembre 2016. Accettato per la pubblicazione Novembre 2016
Correspondence to: Gabriela Jimborean, Adress: 540120, str. Ariesului, No. 6, Tirgu Mures, Romania,(E-mail: dr_muremir@yahoo.com, vidiabi@gmail.com)

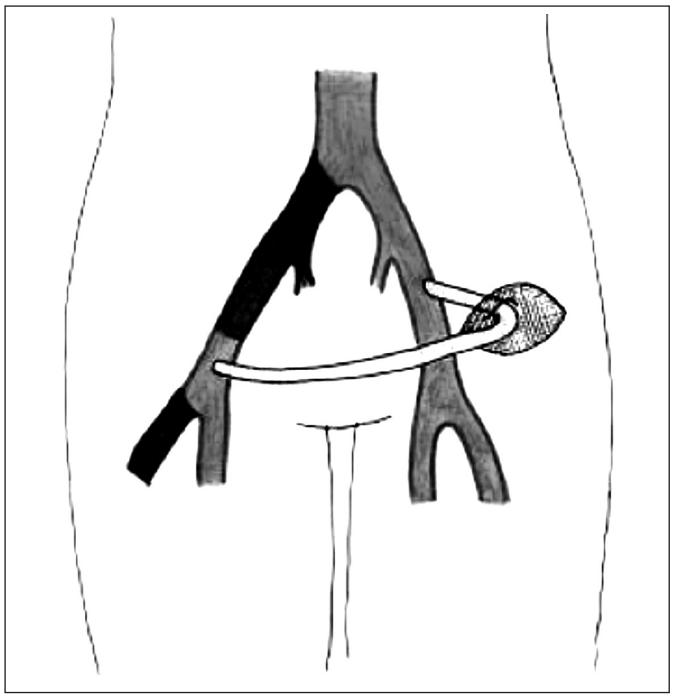

Fig. 1: Schematic feature of the particular iliofemoral crossover bypass.

lar prosthesis infection [1]. In general surgery the repair of an abdominal defect using a Polypropylene mesh is also a well-known procedure [2,3]. A particular technique is defined by the performance of these 2 separate procedures inside a single operation in which the crossover arterial graft is directed from the retroperitoneal space toward the contra-lateral femoral bifurcation through a Polypropylene mesh which closes the musculoaponeurotic layers of the abdominal wall (Fig. 1). We present our experience with the use of this particular surgical technique in patients with critical limb ischemia and with indication for extra-anatomic crossover bypass (high-risk patients with contra-indication for the transperitoneal approach, extensive calcified aortic or iliac wall which contraindicated the direct arterial reconstruction or secondary arterial reconstruction after the occlusion of an aorto-femoral graft).

Methods

We describe this particular technique and we compare it with the other "classic" crossover operations performed between 2003-2012 (graft patency, early and late postoperative complications). We don't have the patients' informed consent for publishing the surgical procedure they underwent, but in the hospital files there are the patients' written informed consent for all the procedures applied during their hospitalization. We do not present any personal data which could identify any patient.

Analysis of the patients with crossover bypass operations

We performed 57 crossover bypass operations: 44 were indicated as primary arterial reconstructions for high-risk patients with limb-threatening ischemia (24 with severe coronary heart disease, 7 with severe chronic obstructive pulmonary disease (COPD); 13 were indicated as secondary arterial reconstructions after late unilateral thrombosis of an aortic bifurcated graft. There were 54 males and 3 women with the age ranging between 46-79 years (mean age=63.78).

Analysis of the crossover bypass operations

There were 35 crossover femorofemoral bypass operations in which we used 14 prosthetic grafts and 21 autogenous veins (reversed great saphenous veins). 28 operations were indicated as primary arterial reconstructions and 7 as secondary arterial reconstructions. The venous grafts were used only for the primary reconstructions as short conduits between the inflow femoral artery and the contra-lateral outflow femoral artery. For the secondary arterial crossover reconstructions we used only prosthetic grafts to which we associated 2 distal femoropopliteal bypass operations and 8 profundoplasties.
There were 22 crossover iliofemoral bypass operations. In these operations we used 11 prosthetic grafts and 11 autogenous veins. 16 operations were indicated as primary arterial reconstructions and 6 as secondary arterial reconstructions. For the secondary arterial iliofemoral crossover reconstructions we used only prosthetic grafts. To these operations we associated 2 distal femoropopliteal bypass operations and 13 profundoplasties.

Crossover iliofemoral bypass operations: types of surgical techniques

We used the "classic" techniques [4] for 4 crossover iliofemoral bypass operations. The other 18 crossover iliofemoral operations were performed using a particular technique (as described in introduction).

Patients and indications for the particular procedure

We performed this particular technique in 18 patients, all males with mean age 63.6 years (range 49-79 years). 12 operations were performed as primary arterial reconstructions and 6 as secondary ones. These extra-anatomic operations were indicated as primary arterial reconstruction in high-risk patients (8 with postmyocardial infarction unstable angina and 4 with severe COPD). A thrombosed aortofemoral prosthesis was the indication for the extra-anatomic secondary arterial reconstructions. At the beginning of the studied period we used this procedure only for the high-risk patients who had a par-

ticular co-morbidity: they presented an inguinal hernia and the opposite limb was severe ischemic. We decided to cure the both diseases by performing a single operation through the same abdominal incision for these high-risk patients.
Gradually we extended more and more this technique even for the patients with critical limb ischemia but without an associated inguinal hernia: in the last studied years we used this operation less for the patients with this co-morbidity and more as a routine technique for performing the crossover iliofemoral bypass operation. In the first 2 years all the 4 patients operated with this particular technique had the above-described co-morbidity; in the last 6 years only 1 patient among other 8 presented the mentioned co-morbidity.

Arterial grafts used in the particular procedure

In these 18 particular surgical procedures, we used 10 autogenous reversed saphenous veins and 8 vascular prostheses.
We used increasingly more often the autogenous veins and increasingly less the prosthetic grafts: in the last 7 years we used only the autogenous veins for the primary reconstructions.

Technical steps of the particular procedure

In principle, the hernioplasty was performed by using the Lichtenstein tension-free hernia repair technique[5], followed by the crossover iliofemoral bypass:
1. Incision of the skin, subcutaneous tissue and external oblique aponeurosis. 2. The spermatic cord is isolated. 3. The hernial sac treatment: for the indirect hernias the sac is dissected, opened for treating its content, then ligated and resected; in direct hernias we close the hernial ring with Polypropylene 2.0 sutures (when necessary). 4. Through the transverse fascia we enter the retroperitoneal space and we dissect the inflow arterial source (external iliac artery or a permeable aortofemoral prosthesis). 5. End-to-side anastomosis of the vascular graft to the arterial source with a continuous Polypropylene 5.0 suture. 6. Clamping the vascular graft just above the anastomosis and removing the arterial clamps. 7. Insertion of the tension-free Polypropylene mesh for closing the posterior wall of the inguinal canal with a continuous suture (Polypropylene 2.0.): the first suture point fixes the mesh to the pubic tubercle and then the continuous suture runs 2 cm on the posterior edge of the inguinal ligament fixing it to the lower border of the mesh; we leave this side of the mesh suture for performing the continuous suture between the conjoined tendon and the upper border of the mesh. Toward the anterior superior iliac spine we cut the mesh in order to encircle the spermatic cord and we calibrate the 2 edges of the mesh around the cord with interrupted Polypropylene sutures. 8. Before completing the continuous suture between the mesh and the inguinal ligament we **pass the vascular graft from the retroperitoneal space above the mesh through a calibrated hole in the mesh** (Figs. 2, 3); the site of this hole is decided in order to avoid the graft kinkings or angulations. 9. Clamping the graft above the mesh and removing the retroperitoneal clamp. 10. Retroperitoneal drain externalized through a separate incision. 11. Completing the mesh suture. 12. Partial suture of the aponeurosis of the external oblique with interrupted Polypropylene sutures in order to avoid the graft impairment. 13. Dissection of the contra-lateral outflow femoral bifurcation. 14. Transfer of the vascular graft through Retzius space toward the opposite Scarpa triangle by tunneling the subcutaneous tissue. 15. End-to-side anastomosis of the vascular graft to the femoral arterial outflow. This anastomosis can also be performed in a side-to-side manner if we want to extend the bypass distally to the popliteal artery.
In patients without inguinal hernia there are differences from the above-described steps: the spermatic cord is not dissected and the continuous suture consolidates the mesh with the entire thickness of the musculoaponeurotic layer of the abdominal wall.

Fig. 2: Hole in the mesh, prepared for the prosthetic graft.

Fig. 3: Vein graft through the mesh.

Postoperative follow-up

Follow-up was completed by clinical examination in all the 18 patients operated with the particular technique and in 27 of the 39 patients (69,2%) operated with the "classic" crossover bypass techniques. The median follow-up period was 2.5 years (range: 1-6 years). We analyze the major postoperative morbidity (early and late prosthesis infections and thrombosis) and the perioperative mortality related to the particular technique and we compare these parameters with those related to other types of crossover bypass operations.

Results

The 7 patients with inguinal hernia and l limb-threatening ischemia had favorable evolution, without hernia recurrence, limb-threatening ischemia or any graft complication at 3 years.

Graft Infection

We didn't register any vein graft infection; 1 patient had a late prosthesis infection (at 40 months) which lead to thigh amputation. Using the classic technique for the iliofemoral crossover bypass operations we registered 1 early (3 months postoperative) and 1 late (20 months Postoperative) Prosthesis Infection Which Also Ended With Major Amputations.

Graft Thrombosis

The limb salvage rate was 100% at 1 year for all the patients with crossover bypass operations. The crossover operations were not followed by early graft thrombosis. The 18 particular iliofemoral crossover operations were followed by 3 late prosthesis thromboses (after 22, 41 and 45 months) which needed thigh amputations.
Among the patients with "classic" iliofemoral crossover bypass operations 9 presented late graft thrombosis (ranging between 15-38 months), also ended with major amputations. Secondary graft patency ranged between 7-17 months in 4 patients.
We did not register perioperative mortality in patients with any crossover bypass operations; meanwhile the late postoperative mortality was not linked to the peripheral arterial disease or to the corrective secondary interventions.

Discussion

Using this particular surgical technique we treated 2 surgical diseases using a single intervention for high-risk patients who had both inguinal hernia and contra-lateral critical limb ischemia. Being encouraged by the initial satisfactory results, we extended this technique even for the patients with indication of crossover iliofemoral bypass but without inguinal hernia.
Advantages of the particular technique: is very easy to perform, is not a significant time-consumer comparing with the classic crossover techniques. The crossing of the vascular graft through an inflexible hole practiced in the Polypropylene mesh avoids the potential inconveniences of the classic technique like incisional hernia or a graft stricture due to the scar healing. The site of the hole can be done anywhere in the tension-free mesh for preventing the kinking of the vascular graft; during the particular technique the rectitude of the graft can be easier verified than when the graft crosses a suture of the musculoaponeurotic layer of the abdominal wall.
The main inconvenience of the subcutaneous paths of a prosthetic graft is the high-risk of the prosthesis infection [6-7]. Considering this, we prefer to use the autogenous veins in this technique and to reserve the prosthetic grafts for the "classic" under-aponeurosis reconstructions, where the prosthetic graft is in direct contact with the muscular tissue. The muscular tissue better protects the prosthetic materials against infections than the subcutaneous tissue[8]. We extended this principle even for other types of bypass operations; for example, we used these under-aponeurosis paths (and not through the subcutaneous tissue) even for latero-thoraco-abdominal segment of the axillofemoral operations: after this decision we did not register any prosthetic graft infection in this segment.
The mesh suture to the abdominal wall and all the other sutures or ligatures are done with Polypropylene wires in order to diminish the prosthetic materials infection risk.
The value of this particular technique still cannot be properly compared with the "classic" techniques because of the still small number of these particular operations.

Conclusions

The particular surgical technique of the crossover bypass in which the vascular graft crosses a tension-free Polypropylene mesh from the retroperitoneal space toward the Retzius space represents an efficient and short procedure which treats simultaneously 2 different surgical diseases (inguinal hernia and contra-lateral critical limb ischemia) in high-risk patients. The results were satisfactory: we had no hernia recurrence and the limb-threatening ischemia was successfully treated.
Considering these observations we extrapolated this technique for the patients without inguinal hernia but with indication for crossover bypass operation.
The preferred vascular graft for this particular technique is the reversed autogenous vein because its resistance to infections and the vein long-term patency is better than

of a vascular prosthesis. When a prosthetic graft is required, we prefer to use the classic technique in which the crossover graft is placed in an under-aponeurosis site, in order to diminish the prosthesis infection risk.
Until now, our results obtained after this particular surgical procedure are comparable to those obtained after the "classic" crossover operations. The advantages or the inconveniences of this method require further experience in order to achieve significant statistical data.

Riassunto

INTRODUZIONE: Spesso, la malattia vascolare può essere associata ad ernia inguinale richiedendo un trattamento chirurgico in entrambi i casi. Tuttavia, l'innesto incrociato può comportare l'ernia inguinale o femorale. Per risolvere questo problema, vi presentiamo una tecnica chirurgica in cui l'innesto vascolare ileofemorale incrociato attraversa una protesi addominale di riparazione.
MATERIALE E METODI: Abbiamo eseguito questa tecnica in 18 pazienti ad alto rischio. Sette pazienti avevano comorbilità - ernia inguinale e occlusione dell'arteria iliaca controlaterale) curati contemporaneamente: innesto vascolare incrociato è diretto dallo spazio retroperitoneale mediante la protesi di ernioplastica verso l'arteria femorale contro-laterale. Abbiamo esteso questa tecnica per 11 pazienti senza ernia associata. Innesti vascolari: 10 vene autogene, 8 innesti protesici. Ulteriori indagini sono state completati per tutti i 18 pazienti da un esame clinico. Il periodo mediano di follow-up è stato di 2,5 ani. Abbiamo paragonato questa tecnica con gli interventi incrociati „classici". che sono state eseguite mediante le tecniche tradizionali. Risultati: non ci sono stati ulteriori recidive di ernia o di ischemia al livello degli arti (nei primi 3 anni), 1 caso di infezione tardiva della protesi e 3 casi di trombosi tardiva della protesi.
CONCLUSIONI: Questa tecnica è stata applicata al trattamento di pazienti ad alto rischio, con 2 malattie, utilizzando un'unico intervento e sembra essere fattibile come procedura incrociata di routine incrociata.

References

1. Defraigne JO, Vazquez C, Limet R: *Crossover iliofemoral bypass grafting for treatment of unilateral iliac atherosclerotic disease*. J Vasc Surg, 1999; 30(4):693-700.

2. Christoffersen MW, Rosenberg J, Jorgensen LN, Bytzer P, Bisgaard T: *Health-related quality of life scores changes significantly within the first three months after hernia mesh repair.*World J Surg, 2014; 38(7):1852-859. doi: 10.1007/s00268-013-2411-0.

3. Carbonell AM, Cobb WS: *Safety of prosthetic mesh hernia repair in contaminated fields.* Surg Clin North Am, 2013; 93(5):1227-239. doi: 10.1016/j.suc.2013.06.012. Epub 2013 Aug 13.

4. Rutherford RB: *Extra-anatomic Bypass,* In: Rutherford R.B. (ed.): *Vascular Surgery,* W.B. Philadelphia: Saunders Co., 2000, 985-88.

5. Sakorafas GH, Halikias I, Nissotakis C, Kotsifopoulos N, Stavrou A, Antonopoulos C, Kassaras GA: *Open tension free repair of inguinal hernias; the Lichtenstein technique.* BMC Surgery, 2001; 1:3. doi:10.1186/1471-2482-1-3.

6. Stilo F, Acri IE, La Spada M, Spinelli F: *Surgical repair of a very large right common iliac aertery aneurysm. Case report and review oft he literature.* Ann Ital Chir Published online (EP) 9 October 2015. DOI: S2239253X15024007.

7. Shermak MA, Yee K, Wong L, Jones CE: *Wong J: Surgical management of groin lymphatic complications after arterial bypass surgery.* Plast Reconstr Surg, 2005, 115(7):1954-62.

8. Muresan M, Muresan S, Bara T, Brinzaniuc K, Sala D, Suciu BA, Radu R: *The intraabdominal pressure. A real indicator of the tension free principle during anterior wall repair procedure after incisional hernias*. Ann Ital Chir, 2015, 86(5):421-26.