

Minilaparotomy as Surgical Approach for Aortoiliac Occlusive Disease - Single Center Initial Experience

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Rezumat

Tratamentul chirurgical al bolii ocluzive aortoiliace utilizând minilaparotomia

Obiectiv: Scopul acestui studiu este de a sublinia beneficiile și indicațiile minilaparotomiei în abordul chirurgical al aortei abdominale.

Material și Metodă: În perioada ianuarie 2011 - iulie 2012 un număr de 23 de pacienți (19 bărbați și 4 femei) cu o mediană a vârstei de 60 de ani (între 49-75), diagnosticați cu boală aortoiliacă ocluzivă (n=22) sau anevrism al aortei abdominale (n=1) au fost incluși într-un studiu retrospectiv nerandomizat. La 11 pacienți s-au efectuat revascularizări aortofemorale prin minilaparotomie (grup ML) iar la 12 pacienți s-a folosit abordul clasic, prin laparotomie standard (grup LS). Au fost urmărit parametrii demografici, clinici, evoluția postoperatorie și complicațiile la cele două grupuri în studiu. Urmărirea postoperatorie s-a efectuat prin examen clinic și ecografie Doppler la 1, 3, 6, 12 luni postoperator.

Rezultate: Nu s-au înregistrat diferențe semnificative ale parametrilor clinici și demografici între cele două grupuri. În grupul ML s-au înregistrat două conversii ale minilaparotomiei la incizia clasică (18,18%). Timpul operator mediu a fost mai redus la grupul ML (124 ± 22 min), iar timpul de clampaj aortic a fost similar între cele două grupuri. Diferențe majore au fost observate postoperator; pierderile sanguine au fost mai

importante la grupul cu LS (550 ml) față de grupul cu ML (350 ml) (semnificație statistică p=0,01, testul Student). Pacienții cu LS au necesitat mai multe lichide pentru reechilibrare (10000 ± 2000) față de grupul ML (6000 ± 1000), p=0,0001, sonda nazogastrică a fost suprimată mai repede la pacienții operați prin ML (1,1 ± 0,5 zile) față de grupul martor (2,5 ± 0,6 zile), valoare p=0,001. Timpul de ședere în salonul de terapie intensivă și timpul de spitalizare a fost semnificativ mai redus la pacienții operați prin ML. Nu am înregistrat mortalitate precoce la cele două grupuri de pacienți studiate; un pacient din grupul operat prin ML a fost reoperat la 43 de zile postoperator pentru o tromboză de greșon. Doi pacienți au fost pierduți din urmărire iar timpul mediu de urmărire a fost de 9 ± 1,5 luni.

Concluzii: Minilaparotomia poate constitui o variantă sigură și fezabilă de abord al aortei abdominale în bolile ocluzive aortoiliace

Cuvinte cheie: minilaparotomie, boală ocluzivă aortoiliacă, bypass aortobifemural, morbiditate

Abstract

Purpose: The purpose of this study was to emphasize the benefits and indications of performing minilaparotomy as surgical approach for occlusive aortoiliac disease.

Material and Method: From January 2011 to July 2012, a total of 23 patients (19 men and 4 women), with a median age of 60 years (range 49-75) diagnosed with aortoiliac occlusive disease (n=22) or abdominal aneurysm (n=1), were included in a retrospective non-randomized clinical study. Among these patients 11 underwent aortic bypass procedure by minilaparotomy approach (ML group) and 12 patients by standard laparotomy (SL group). Demographic and clinical data, operative

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data, postoperative recovery data and complications were analysed according to these two groups of patients. Follow-up consisted of clinical examination and duplex scanning at 1, 3, 6 and 12 months postoperatively.

Results: There were no significant differences between the mini-laparotomy and standard laparotomy control groups concerning clinical and demographical data. Two surgical conversions to standard laparotomy were necessary (18.18%) in the ML group due to technical difficulties. The mean operative time was shorter in the ML group (124 ± 22 minutes) and the mean aortic clamping time was similar between the two groups. Major differences between the two lots were observed post-operatively; mean blood loss was more important in the SL group (550 ml) than in the ML group (350 ml) (statistical significance $p=0.001$, Student test). Patients who have undergone standard laparotomy required more fluids (10000 ± 2000 ml) in comparison to the other group (6000 ± 1000 ml) – p value= 0.0001 , while the duration of nasogastric suction and period before resuming a liquid diet was both shorter in the ML group (1.1 ± 0.5 days) than those from the SL group (2.5 ± 0.6 days) – p value= 0.001 . The period spent in the ICU was significantly shorter for the ML lot of patients and the median hospitalization time was 5.6 days for patients in ML group, whereas in the SL group the median hospitalization time was 8.9 days (Student test - p value 0.01). We had no 30-day mortality in any of the groups included in the study. One patient from the ML group was readmitted in postoperative day 43 and re-operated on for a prosthetic limb graft thrombosis. Two patients were lost to follow-up and the mean follow-up was 9 ± 1.5 months.

Conclusions: Minilaparotomy as surgical approach for aortic diseases is a feasible, safe procedure on selected patients.

Key words: minilaparotomy, aortoiliac occlusive disease, aortobifemoral bypass, morbidity

Introduction

The infrarenal aorta and iliac arteries are frequently affected by atherosclerosis. Aortofemoral or aortobifemoral bypass grafting still remain the standard, well-established surgical treatment for aortoiliac occlusive disease, the procedure nowadays having low morbidity and mortality and excellent long-term patency rates (1,2).

Surgeons are constantly looking for technical improvements to perform surgery; in the field of general surgery minimal-invasive procedures have now gained widespread acceptance due to their well-known advantages: less postoperative pain, shorter hospital stay, esthetic reasons etc. Vascular surgery has slowly entered the field of minimal-access surgery; one possible explanation is that balloon angioplasty and aortic endoprosthesis have for a long time been the mainstay of minimally invasive techniques in the treatment of aortoiliac

occlusive and aneurysm disease (3-5). Totally or assisted laparoscopic aortobifemoral bypass and even robotic approach to the abdominal aorta are now recognized as feasible vascular procedures inspite of their well known drawbacks: both require highly specific laparoscopic skills, a steep learning curve, long operative and clamping times, expensive instruments (4-6).

Minilaparotomy is an interesting alternative to traditional, standard laparotomy in patients with aortoiliac occlusive disease or abdominal infrarenal aortic aneurysm due to its clearly defined advantages: easy to be learned and easily reproducible, does not require expensive laparoscopic or robotic instruments, good cost-benefit balance (1-3).

Our study is trying to highlight the benefits and indications of performing minilaparotomy as surgical approach for aortoiliac occlusive disease.

Patients and Method

This is an observational retrospective non-randomized clinical study which is trying to emphasize a preliminary single team experience with a less invasive technique for the exposure of the infrarenal abdominal aorta and its impact on intraoperative and postoperative variables. It was based on the analysis of observational charts, intensive care unit and theatre records.

Between January 2011 and July 2012 a total of 31 patients (25 men and 6 women), admitted in our clinic (Second Surgical Department, Emergency Mures County Hospital) with severe aortoiliac and infrainguinal occlusive disease, underwent different types of aortofemoral and infrainguinal reconstruction with graft implantation, all the procedures being performed by the same surgical team. We included in this study patients under 75 years of age, without previous abdominal surgical interventions, diagnosed with severe aortoiliac lesions TASC type C and D (TASC II classification of aortoiliac lesions-Norgren et al, 2007) (7), requiring different types of aortoiliac vascular reconstructions. We excluded patients with associated femoral and popliteal lesions requiring more extensive, combined aortoiliac and infrainguinal vascular procedures (5 cases), since we did not consider them comparable with the control group. Obesity ($BMI > 30 \text{ kg/m}^2$), prior abdominal surgery (hostile abdomen), patients over 75 years of age were regarded as unsuitable for ML approach or contraindicated for aortic surgery and they have been excluded from the study as well (3 cases). Therefore, a total of 23 patients were finally analysed. Among these patients, 11 underwent aortofemoral reconstruction by mini-laparotomy approach (ML group) and 12 by conventional, standard laparotomy (SL group); only normal weight patients ($BMI < 25 \text{ kg/m}^2$) were considered for mini-laparotomy approach.

Preoperatively, all patients were evaluated by means of Doppler sonography and arteriography, data obtained in both groups being comparable with regard to the extensiveness of the lesions. In the ML group we performed 7 aortobifemoral and 4 aortounifemoral bypass grafts, whereas in the SL group there were 11 aortobifemoral bypass grafts and one abdominal aortic aneurysm resection with aorto-aortic bypass graft reconstruction.

Surgical technique

Surgical interventions through minilaparotomy were performed under general anesthesia with endotracheal intubation and optimal muscular relaxation. Patients were placed in a slightly anti-Trendelenburg, right-tilt position. The incision was a median para-umbilical laparotomy of 6-8, maximum 10 cm in length, the intestinal loops being maintained inside the abdomen with the help of a few large abdominal compresses judiciously arranged on the incision's flanks (Fig. 1, 3, 4). We took advantage of an autostatic abdominal wall self-retractor along with an autostatic vascular retractor in order to maintain the abdominal and retroperitoneal operating field, respectively (Fig. 2).

After opening the retroperitoneum, we exposed the abdominal aorta on a variable length, sometimes also the iliac arteries, dissecting and preparing them for anastomosis. In every situation we preferred cross-clamping of the aorta instead of lateral clamping. The femoral arteries were dissected and prepared for anastomosis; note that these

vessels were sometimes discovered through mini-incisions in the Scarpa region (Fig. 1). Patients were administered 1 mg/kgc of intravenous heparin after performing the proximal and distal clamping of the aorta. Proximal end-to-side anastomosis of the 16/8 mm bifurcated Dacron graft was performed with continuous Prolene 4.0 suture. It is relevant to note the necessity of performing the anastomosis from a distance, using long surgical instruments in order to avoid the obstruction of the operating field (Fig. 2), as well as the more difficult manner of retroperitoneal tunnelling to the femoral regions in the absence of some special curved dressing forceps. The retroperitoneum was closed without drainage. In the case of patients on who the classic, standard laparotomy method was used, a generous median incision (approximately 25-30 cm) was made and intestinal loops were exteriorized from the abdominal cavity and isolated in wet surgical compresses, whereas for the exposure of the operating field, two abdominal retractors were utilized. Apart from that, the operations were similar, without major differences compared to the group of patients operated through mini laparotomy.



Figure 1. Para-umbilical mini laparotomy of approximately 8-10 cm and the exposure incisions at the bilateral femoral level

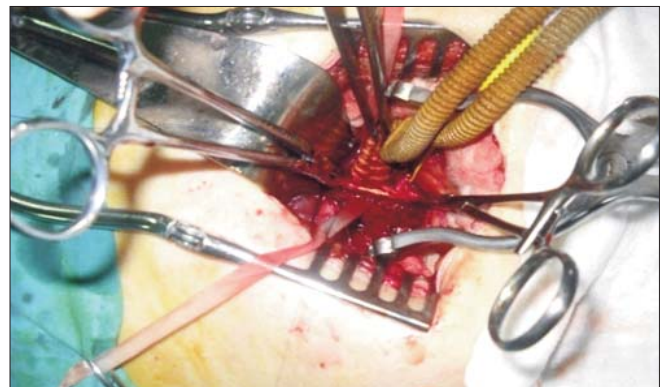


Figure 2. Aorto-bifemoral prosthesis 16/8 mm and the proximal anastomosis with Prolene 4.0 suture



Figures 3, 4. Final aspect of incisions

After surgery all patients were placed in the post-operative intensive care unit (ICU), with all the cardiovascular, pulmonary, renal, etc. variables being monitored.

Statistical analysis

The data were processed in Excel, whereas for the statistical analysis we used Medcalc. We have therefore used descriptive statistics, as well as inferential-analytic methods. From a descriptive point of view, we have mainly observed the indicators of data central tendency, which are characterised by the mean, median (50th percentile) as well as indicators which show the variability of data (standard deviation). Firstly, study data was exposed to concordance tests (Kolmogorov-Smirnov test) to analyse its normality. We have then proceeded to applying parametrical statistical tests, more specifically the student test for two independent sets of data. We have applied a $p=0.05$ border significance value for all tests and the statistical significance was considered for all values of p lower than the border significance value.

Results

There were no significant differences between the two groups of patients as regarding age, sex, weight, comorbidities; furthermore, there were no major differences between groups as concerning the clinical stage of the disease or imagistic data. (Table 1).

ML group comprises 9 men (81.81%) and 2 women (18.18%), with a median of age 64.1 years (range 51-72) and SL group includes 10 men (83.33%) and 2 women (16.66%), median age 59 years (range 49-75). Seven patients (63.63%) had claudication and four patients (36.36%) had tissue loss in the ML group. On the other hand we had seven patients (58.33%) with claudication and five patients (41.66%) with tissue loss in the SL group, respectively.

At the beginning of our experience with minilaparotomy approach we had two patients for whom the minilaparotomy incision was converted to the standard one due to the

extensive aortic lesions or technical difficulties (conversion rate = 18.18%). Mean blood loss was more important in the SL group (550 ml) than in the ML group (350 ml) (statistical significance $p=0.001$, Student test); three patients from the SL group required the administration of a blood unit during or immediately after the surgery.

Regarding the mean operative time, this was significantly reduced statistically in the ML group (124 ± 22 min) in comparison to the SL group (165 ± 23 min), especially after exceeding the learning curve (p value = 0.002); there were no significant differences regarding the mean aortic cross-clamp time between the two groups of patients (32.5 ± 6.1 minutes – ML versus 26.8 ± 7.8 minutes – SL group) (p value = 0.06).

Significant differences between the two groups were revealed postoperatively. Patients who have undergone standard laparotomy required more fluids (10000 ± 2000 ml) in comparison to the other group (6000 ± 1000 ml) – p value = 0.0001. Furthermore, the duration of nasogastric suction and period before resuming a liquid diet were both shorter in the ML group (1.1 ± 0.5 days) than those from the SL group (2.5 ± 0.6 days) – p value = 0.001. The period spent in the ICU was significantly shorter for ML patients, 9 of them (81.81%) leaving the ICU 24 hours after the intervention; 4 SL patients (33.33%) left the ICU only on the third day following the operation – p value = 0.03. We re-operated on a patient from the ML lot due to a postoperative bleeding at the femoral anastomosis level, and in the SL group we had one patient who required a thrombectomy with Fogarty probe for a limb graft thrombosis. The median hospitalization time was 5.6 days for patients in the ML lot, whereas in the SL group the median hospitalization time was 8.9 days (Student test p value 0.01). We had no 30-day mortality in any of the sets of patients included in the study.

Follow-up consisted of clinical examination and duplex scanning at 1, 3, 6 and 12 months postoperatively. We had one patient from the ML group who was readmitted on post-operative day 43 and re-operated on for a prosthetic limb graft thrombosis. Two patients were lost to follow-up and the mean follow-up was 9 ± 1.5 months. The short/medium term follow-up does not permit conclusions regarding the grafts' patency, incisional hernia incidence or other late complications (graft infection) for the two groups of patients.

Table 1. Demographic and clinical characteristics

	Minilaparotomy	Standard laparotomy
Median age	64.1	59
Sex - M	9 (81.18%)	10 (83.33%)
- F	2 (18.18%)	2 (16.66%)
Weight (kg)	57-82	55-92
Smokers	8	10
Hypertension	7	8
Hypercholesterolemia	8	7
Surgical procedure	- aortobifemoral (7)	- aortobifemoral (11)
	- aortofemoral (4)	- aortic aneurysm resection (1)

Discussion

Our study revealed the benefits of performing minilaparotomy as surgical approach to the abdominal aorta in selected patients with severe aortoiliac diseases.

Reconstructive surgery for treatment of aortoiliac occlusive disease or abdominal infrarenal aortic aneurysm has generated long-term patency along with low morbidity and mortality rates (1,2).

Minilaparotomy technique has recently gained acceptance in the vascular surgeons' world, being defined as an abdominal transperitoneal approach of 3 to 10 cm, without video-assistance, using conventional surgical instruments for aortic reconstruction (1-5). There are few prospective trials

comparing minilaparotomy technique with conventional, standard laparotomy for aortoiliac occlusive disease but all revealed the advantages of minilaparotomy: less operative trauma, earlier return to enteral nutrition, decreased length of stay in ICU and hospital, thus reducing treatment cost (5).

Standard median laparotomy, consisting of an incision of the abdominal wall approximately 30 cm long, causes significant trauma with important postoperative pain, large fluid shifts, prolonged postoperative ileus along with large, obtrusive scars. Furthermore, it facilitates wound infection and subsequent incisional hernias thus increasing hospital stay and treatment cost (2,3).

Minimal-invasive procedures in the treatment of aortoiliac disease would supply more comfort and less trauma with the same or greater safety for the patient; furthermore, they reduce operative morbidity, which apparently is mainly related to the surgical parietal trauma and not to the arterial reconstruction itself (5,6,8-10).

Balloon angioplasty and aortic endoprosthesis have been, for a long period of time, the mainstay of minimally invasive techniques in the treatment of aortoiliac occlusive and aneurysm disease (5). The drawbacks of endovascular treatment have become evident in the last decade: bad long-term results for some indications thus requiring new treatments at a distance, technical limitations in extensive aortic lesions, persistently high costs etc (11-14).

Although totally or assisted laparoscopic and robotic aortoiliac approach became a feasible technique in hands of experienced laparoscopic surgeons, it remains a very demanding procedure, requiring highly specific laparoscopic skills and a steep learning curve (15-17). Furthermore, there are few available randomized trials comparing conventional surgery and laparoscopic approach to demonstrate the latter's superiority. All of these along with economic reasons are the main disadvantages of these techniques (18,19).

From a technical point of view it is worth mentioning that minilaparotomy technique requires, for a good exposure of the surgical field, few special surgical instruments - abdominal self-retractors, long clamps and needle holders, long curved dressing forceps for retroperitoneal tunnelling. It is an easy and reproducible procedure but also implies a short, undeniable learning curve (20-25). At the beginning of our experience with this approach we had two patients in the ML group for whom minilaparotomy was converted to standard laparotomy due to technical difficulties in exposing the retroperitoneum, misplacement of the minilaparotomy, inadequate selection of the cases, and last but not least, exceeding the learning curve.

From a patient's point of view, when it is compared with standard approach, minilaparotomy has several undeniable advantages. In our study the operative time was observed to be slightly lower in the ML group than the SL group, with no differences in the aortic clamping time or time required for the proximal end to side anastomosis; shortening of operative time is observed as the surgeon's experience grows. In the ML group all patients experienced fewer abdominal pains, less time to return to liquid or general diet, shorter ICU and hospital stay. Nevertheless, blood loss and fluid requirements were less

important in the ML group. There were no significant differences in postoperative morbidity between the two groups of patients and we did not encounter 30-day postoperative mortality.

This study represents the analysis of our initial experience with minilaparotomy approach of the abdominal aorta and has several limitations, such as the reduced number of patients and short/medium term follow-up period. However, we believe that minilaparotomy is a safe, feasible and effective surgical approach for aortoiliac occlusive diseases in selected cases.

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