Laparoscopic Aortic Surgery

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Endo-aneurysmorraphy with intraluminal graft placement, described by Creech, is the gold standard for abdominal aortic aneurysm repair [1]. The new alternatives, like the endovascular stent graft exclusion technique for abdominal aortic aneurysm and percutaneous transluminal angioplasty stenting of the distal aorta and iliac arteries for occlusive disease, are far from perfect and offer incomplete solutions. The risk of graft rupture, migration, thrombosis, aneurysm expansion, persistent endo-leak, proximal and distal attachment failure, as well as the long-term outcome of the endovascular stent graft remain uncertain. Moreover, the cost of endovascular abdominal aortic aneurysm treatment is extremely high. According to the TransAtlantic Inter-Society Consensus for severe aorto-iliac disease aorto-bifemoral bypass remains the therapy of choice [2].

The rate of operative mortality from open aortic reconstruction is less than 5% and the long-term results are excellent. However, morbidity rates, operative trauma and substantial systemic complications are traditionally cited as the major drawback of direct aortic reconstruction and can be influenced by the surgical approach.

In recent years, minimally invasive techniques have been developed in order to reduce the perioperative morbidity of aorto-iliac surgery. Recently, aortic surgery entered the field of laparoscopic surgery. In 1993, Dion conducted a laparoscopically assisted aorto-bifemoral bypass and in 1996 the first laparoscopic abdominal aortic aneurysm resection was performed [3-5]. The concept of laparoscopy is to use the gold standard aortic reconstruction with the advantages of the videoscopic abdominal approach. The main advantages of the laparoscopic technique are reduced pain, shorter hospitalization and earlier return to regular daily activities. However, laparoscopic aortic surgery is technically demanding and its learning curve is quite long. The number of surgical disciplines that have incorporated minimally invasive surgery into the arsenal of routine operation keeps growing and it is now the standard procedure for many gastrointestinal, gynecological and urological operations. We believe that laparoscopic aortic surgery will join them in the not too distant future.

Indications and approaches

The indications for laparoscopic aorto-iliac surgery today include repair of abdominal aortic aneurysm, aorto-iliac reconstructive surgery (aorto-bifemoral and ilio-femoral, extra-anatomic obturator and thoraco-femoral bypasses), and combination of laparoscopic and endovascular techniques to improve the outcome of aortic endografts (hybrid procedures and treatment of endo-leaks, endotension and migrations of the grafts) [5-17].

Contraindications to LAS today are the same as for open surgery [6], namely severe non-treatable coronary lesions, severe cardiac insufficiency, tight aortic stenosis, severe renal insufficiency and cirrhosis, and severe and diffuse occlusive lesions of the visceral arteries (isolated occlusive lesions of superior mesenteric artery can be treated with laparoscopic bypasses). Extensive aortic calcifications are also considered relative contraindications to laparoscopic aortic surgery, and inflammatory and ruptured abdominal aneurysm is a contraindication to total laparoscopic repair.

Despite the long learning curve it seems that laparoscopic aortic surgery significantly reduces the morbidity of abdominal aortic repair

There are several technical approaches to performing LAS, the most prominent being the laparoscopic assisted approach, the hand-assisted laparoscopic approach, and the total laparoscopic approach. All of these can be performed via transabdominal (midline, retrocolic), retrorenal or retroperitoneal incisions [6-12].

Discussion

Despite the development and widespread use of endoprotheses and endostents, open repair is still considered the most reliable and durable technique to treat abdominal aortic aneurysm and severe aorto-iliac occlusive disease (TASC 3 and 4). Postoperative mortality is less than 5%, and unlike endoluminal treatment it allows definitive prevention of rupture with better long-term patency of the graft. The main drawback of open repair is its operative trauma. The main advantage of laparoscopy compared

LAS = laparoscopic aortic surgery
TASC = TransAtlantic Inter-Society Consensus

with endovascular procedures is that it is a standard procedure (endo-aneurysmorrhaphy or aorto-bifemoral bypass) that will provide the same excellent results as conventional aortic surgery [7,10].

On the other hand, laparoscopic aortic operations have a steep learning curve, which prevents its widespread use, especially with regard to total laparoscopic procedures. The two specific difficulties of aortic laparoscopic surgery – exposure of aorta and performance of aorta prosthetic anastomoses – have discouraged vascular surgeons from adopting the technique [6-8]. The technique is easier to perform when a mini-laparotomy is used to perform the aortic anastomosis. Yet we know from general surgery that any kind of mini-laparotomy increases the surgical trauma compared with total laparoscopy. Any benefit of a total laparoscopic approach is lost when blood loss, the complication rate, and the mortality rate are higher than those of a conventional procedure [10,16].

In obese patients and those with chronic obstructive pulmonary disease the laparoscopic technique is probably superior to the open approach

The most severe complications occurred during the first cases of the learning curve. Unfortunately, proficiency in laparoscopic cholecystectomy does not automatically translate to other minimal access methods, and performing laparoscopic cholecystectomies does not qualify a surgeon to perform LAS. Additional training, specifically in laparoscopic aortic techniques, is mandatory before one can contemplate LAS. The single most important predictor of adverse events in minimal access procedures is the operator's experience with the specific procedure. Patient selection is crucial when a total laparoscopic procedure is performed, something one has to learn over time and with increasing experience. In published series, mortality was related to increased operating times and prolonged ischemia. The incidence of complications in the total laparoscopy group was highest in patients with severe calcifications, which prevented secure aortic clamping or suturing [6-8,10,16].

The duration of total laparoscopic procedures and clamping times decrease as a function of the operator's training and experience but is always longer than for conventional surgery [6-8]. Once the learning curve of the procedure is mastered, the endoscopic cross-clamping and total operative times become significantly shorter [7,8].

At the beginning of the learning curve and in the more complicated cases, a laparoscopy-assisted procedure is probably a safer choice. Such an approach will avoid excessive blood loss that leads to major complications. A significant difference in mortality and complication rate was observed between a total laparoscopic operation and a laparoscopy-assisted procedure [10-12,16].

Despite the widespread use of endovascular aneurysm repair, the published Dutch DREAM trial and the EVAR 1 and 2 trial present very good arguments for another less invasive treatment option for patients with a more difficult aortic anatomy who are not good candidates for an endovascular approach. This includes patients who require suprarenal clamping [16].

High risk and elderly patients do not benefit from the laparoscopic approach because of the need for aortic clamping and prolonged operating times. In these cases, EVAR has a clear benefit over conventional or laparoscopic surgery [16].

Once one masters the learning curve, total laparoscopic aneurysm surgery can be performed with a low mortality rate and a complication rate similar to or less than that of open surgery. Some surgeons routinely offer total laparoscopic abdominal aortic aneurysm repair to all patients younger than 75 who are fit for surgery. Today the laparoscopic techniques and the instruments to perform even complex aortic cases are available, and the surgical team should aspire to move from LAS to TLAS for several reasons. The most striking of these is the observation that in a laparoscopy-assisted operation, problems with exposure arose the very moment a mini-laparotomy was performed, which usually does not permit the kind of visualization the surgeon had when an endoscope was still used. The other obvious reasons are the markedly reduced pain after total laparoscopy, early mobilization, and reduced incidence of late sequelae, such as incisional hernias.

The combination of laparoscopic and endovascular techniques enables us for the first time to operate on complicated thoraco-abdominal aortic pathologies with a minimally invasive approach

As in any other innovative technique, patient selection is of paramount importance. Poor patient selection is a major cause of adverse events. It is strongly recommended that laparoscopic techniques not be offered to all patients, especially at the beginning of a learning curve [7,8,10,16].

Another major factor in determining the outcome is the amount of blood loss. Extensive blood loss can now be avoided by using an improved operative technique. Before and after clamping, all lumbar arteries must be meticulously sought and controlled with a hem clip. Having done this, an almost

EVAR = endovascular aneurysm repair
TLAS = total LAS

bloodless operative field can be found after thrombus evacuation. In the near future, this will be facilitated with a special stapling device [16]. Thus the length of the procedure, one of the major factors in predicting outcome, can be markedly reduced.

In iliac aneurysms, or in the presence of severe calcifications of the distal aorta, making a small incision in the lower abdomen can help the surgeon in performing the distal anastomosis under direct vision with occlusive balloons used for bleeding control [7,8,10,16].

One should remember that in elderly patients the length of hospitalization and the length of stay in the intensive care unit did not differ significantly when compared to open surgery; therefore, octogenarians most likely will not derive any benefit from the laparoscopic procedure. In these patients, stent graft repair offers clear advantages with regard to post-intervention quality of life. Similarly, laparoscopy did not favorably influence postoperative outcome in patients at high surgical risk, except for patients with morbid obesity or severe chronic obstructive pulmonary disease [6,16]. TLAS is a technique in evolution. Technical innovation and specific instrumentation like stapling devices and special grafts will probably change the way the procedure will be performed [10,16].

Compared with open surgery, the mid-term results of laparoscopic aortic procedures are promising. Yet the time has come to prove in controlled studies that good results are not reproducible only in a few specialized centers. Laparoscopy could change the field of vascular surgery very rapidly, as did the endovascular technique, and unfold many refinements in technique and instrumentation. Combined laparoscopic and endovascular techniques are likely to increase and new devices will be developed to contribute to these new surgical techniques. In the future, many conventional procedures performed today using open surgical techniques will be done partly or totally laparoscopically [10-12,14,16,17]. The average vascular surgeon should be able to perform minimally invasive procedures with outcomes comparable to the standard "open" reconstructions, and laparoscopic techniques should be integrated in training programs.

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When insults had class, or, examples of acerbic wit:

A member of Parliament to Disraeli: "Sir, you will either die on the gallows or of some unspeakable disease." "That depends, Sir," said Disraeli, "whether I embrace your policies or your mistress." Walter Kerr, American writer and Broadway theater critic, described an actor as having "delusions of adequacy." Clarence Darrow, famous American lawyer and civil libertarian, was noted for saying: "I have never killed a man, but I have read many obituaries with great pleasure."