ENDOVASCULAR AND SURGICAL TECHNIQUES

Midline Extraperitoneal Approach for Elective Abdominal Aortic Aneurysm Repair

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The incidence of abdominal aortic aneurysms (AAA) is rising and elective repair is becoming more commonplace. We describe a new, simple midline extraperitoneal approach for AAA repair. It is particularly suitable for patients who have an inflammatory AAA, abdominal adhesions or a horseshoe kidney. This approach provides excellent exposure to the whole aortoiliac system without the need for separate incisions, whilst retaining the potential advantages of the extraperitoneal approach.

Key Words: Midline; Extraperitoneal; Aortic aneurysm.

Introduction

The incidence of abdominal aortic aneurysms (AAA) is rising. With the advent of screening programs, identification of AAA in the older population (including octogenarians) will increase. Elective repair has been shown to significantly improve longevity and quality of life across all age groups. It is therefore important to employ a method of AAA repair with the lowest operative morbidity and need for hospitalisation. The transperitoneal route has long been the standard approach in most centres for elective and emergency treatment of infrarenal aortic aneurysms. However, several studies have demonstrated significant benefits when a retroperitoneal route is used for elective AAA in terms of fewer postoperative complications and shorter hospital stay. We describe in detail a new, simple, successful extraperitoneal approach to grafting of AAA via a midline incision which overcomes these difficulties. We also believe our approach offers substantial benefits in the “hostile” abdomen, in inflammatory aneurysms, and when a horseshoe kidney is present. Previously described methods all have disadvantages, particularly with regard to access to the iliac arteries, which we believe our method overcomes.

Technique

Preparation

The patient is prepared for surgery as for any major vascular case. Invasive monitoring of arterial blood pressure, central venous pressure and urinary catheterisation are performed on all patients.

Surgical Technique

The patient is placed supine on the operating table and a subxiphoid midline abdominal incision is made to two-thirds of the way between the umbilicus and the pubic symphysis, skirting the umbilicus towards the left of the midline.

The upper part of the incision is then deepened through the subcutaneous fat to the anterior rectus sheath. The linea alba is incised over the upper 7 cm, exposing the epigastric fat pad. This shield-shaped fat
pad is invariably present and separates the posterior abdominal wall from the peritoneum and is thus the gateway to the potential extraperitoneal space. The epigastric fat pad has a capsule-like covering which needs to be cut with scissors to avoid tearing the peritoneum. We feel that this fat pad is a very helpful landmark, as it acts as a buffer between these two layers and allows easy access into the potential space to commence dissection.

The peritoneum is persuaded off the posterior aspect of the anterior abdominal wall with a pledger. Using a mixture of blunt and sharp dissection, one works laterally. Fibrous and fibrovascular strands are encountered connecting the peritoneum to the posterior surface of the anterior abdominal wall. It is important to divide these with scissors, as blunt dissection readily tears the peritoneum. The peritoneum is separated from beneath the rib cage, extending dissection posteriorly and laterally till the tip of the spleen and the extraperitoneal fat overlying the anterior layer of renal fascia comes into view (Fig. 1). Returning to the midline, the linea alba is gradually divided caudally as the midline peritoneum is freed from it.

This process is carried down to the lowermost extent of the incision and then laterally under the full extent of the wound. At this stage, the peritoneum should be mobilised from the right side of the wound for a width of about 2 cm to allow safe closure later. The next important manoeuvre is to find the correct plane anterior to the kidney, its vascular pedicle, the ureter and gonadal vein. To accomplish this, the peritoneum is separated from the anterolateral abdominal wall until first a pad of extraperitoneal fat is found. Beneath this, the tail of the perinephric fat can be found below the free lower border of the lateral conal fascia (Fig. 2a). Using fingers, dissecting upwards and laterally, the free lower border of the tough lateral conal fascia can be palpated and divided with scissors in a cephalad direction. Dividing the lateral conal fascia for 5–7 cm should be guided by palpation, as direct vision can be difficult. This releases the peritoneal sac and allows it to be mobilised across to the right. After this, the peritoneal sac is gradually reflected medially (Fig. 2b) using a combination of blunt and sharp dissection. As the sac is mobilised, the gonadal vein gradually comes into view lying plastered to the peritoneum in a loose tunnel of fibrous tissue. The peritoneum is mobilised away from the vein and the lateral tributaries of the vein ligated. Ensuring that the gonadal vein remains in situ by this method allows the correct plane to be
followed and avoids disturbing or damaging the left ureter.

An Omnitract or similar table-fixed retractor is useful at this stage to retract the peritoneal sac. As the left border of the aneurysm is approached, the peritoneum can easily be opened inadvertently (see Fig. 3). To avoid this, it is useful to divide the fibrous attachments at the peritoneal edge using sharp
dissection (Fig. 2b). When the mid-point of the aorta is reached anteriorly, the inferior mesenteric artery (IMA) pedicle appears. It is normally ligated flush with the aorta using a suture and then divided, as the usual practice of leaving the IMA intact is not practicable with this approach. A long ligature is left on the distal cut end so it can be found and anastomosed to the graft later if necessary. As mobilisation proceeds, the third part of the duodenum is lifted up and away from the aorta in one piece with the peritoneal sac, revealing the left renal vein lying across the neck of the aneurysm.

When the entire abdominal aorta is in view, there is good access to the neck of the aneurysm and to both right and left common iliac arteries. The left iliac bifurcation and the left external iliac are easily accessible by further mobilisation. However, access to the right iliac bifurcation and beyond is best achieved by the additional manoeuvre of mobilising the peritoneum from the right side of the wound in the extraperitoneal plane. Once exposure is complete, aortic reconstruction can be performed. After completion of the anastomoses, the sigmoid colon is examined to ensure its perfusion via a small incision in the peritoneum. If sigmoid perfusion is poor, IMA re-implantation is necessary.

Once haemostasis has been achieved, the aortic sac is wrapped around the graft in the usual way and closure of the wound performed using an all-layer mass closure technique. Neither drainage nor a nasogastric tube are normally employed.

Discussion

The extraperitoneal approach to the abdominal aorta, first described by Sir Astley Cooper in 1810, has seen a resurgence of interest in the past four decades since the first modern attempt by Dubost et al. in 1951. Numerous retrospective studies have claimed the superiority for these approaches over the standard transperitoneal route in terms of reduced intra-abdominal adhesions, decreased intraoperative fluid loss, improved haemodynamic stability, decreased postoperative ileus, decreased blood loss, decreased cardiac and pulmonary complications, and decreased duration of hospitalisation. However, it is difficult to prove that one technique is better than another because of the lack of measurable variables to distinguish them.

Many types of incision have been used for the extraperitoneal approach. Both transverse and oblique loin incisions which proceed retrorenally give good access to the upper aorta but not the iliac vessels. If a bifurcation graft is needed, an additional incision is needed in the right iliac fossa for the distal anastomosis. Various flank incisions placed laterally on the abdominal wall give poor access to the upper aorta and difficult access to the right external and internal iliac arteries. Thus, no incision to date has proved suitable for all abdominal aortic surgery. The midline incision and method of approach described in this paper allow easy access to the whole abdominal aortoiliac system whilst retaining all the potential...
advantages of the extraperitoneal approach. Our experience of over 150 AAA repairs employing this technique is in general agreement with previous studies showing advantages for the extraperitoneal over the transperitoneal approach. Distinct end-points following AAA repair are difficult to measure. However, our mean length of hospitalisation was 12.5 days, major complications occurred in 8% of cases, and the death rate was 3.5%. Our technique gives a "clean" dissection with tidy demonstration of all the anatomical points and perhaps a greater potential to protect the sympathetic nerves lying over the aorta as well as the iliac and renal veins. Access to the juxtarenal aorta is usually easy because full rotation of the peritoneal sac is facilitated by division of the lateral conal fascia. A transperitoneal medial visceral rotation technique has been previously described. However, it suffers from requiring circumferential dissection of the left renal vein to adequately expose the aortic neck. Nevertheless, there are some disadvantages to the extraperitoneal approach. There is the potential risk to the blood supply of the left ureter (avoided by mobilising the gonadal vein, see above) and risk of splenic injury. The latter occurred in two cases during the early development of this approach and has been prevented by avoiding fixed retractors in the left upper quadrant of the wound. The operation takes approximately 20–30 min longer than the transperitoneal route. However, we found no complications additional to those described for other extraperitoneal approaches reported in the literature.

The operative approach described in this paper should not be used in leaking or ruptured AAA, as obtaining control of the aneurysm neck takes too long. However, we would strongly advocate the use of this midline incisional extraperitoneal approach as the technique of choice for elective infrarenal AAA repair, as it is simple to learn once the surgeon becomes familiar with the anatomical landmarks. It affords excellent access to the whole aortoiliac system without the need for separate incisions, and yet retains all the advantages of other extraperitoneal approaches.

Circumstances in which an Extraperitoneal Approach is Particularly Indicated

1. The "hostile" abdomen

When a patient has had multiple previous operations, is known to have abdominal adhesions or has had abdominal radiotherapy, the transperitoneal route to AAA is difficult, time-consuming and hazardous. The risk of opening the bowel and causing graft infection is high. We have successfully employed our approach in a patient who had had two liver transplants and another who had had a sigmoid colectomy and left iliac fossa radiotherapy for carcinoma of the colon. In the first case, the standard left-sided peritoneal mobilisation was employed. In the second, the right side was mobilised in a similar way via the midline incision.

2. Inflammatory aortic aneurysms

In a fully developed inflammatory aneurysm, the transperitoneal approach presents great difficulties in locating the correct plane for dissection. In contrast, using the extraperitoneal route, there is usually normal peritoneum lateral to the aneurysm which can be mobilised medially, and this leads into the correct plane anterior to the aneurysm. The process is facilitated if the "onion-skin" layers of inflammatory tissue are split using scalpel dissection.

3. Horseshoe kidney

This presents a particular surgical challenge when co-existing with AAA. No wholly satisfactory approach has yet been described. The kidney cannot usually be divided vertically through the middle as there is invariably a crossover in the arterial blood supply and venous drainage, and often a common renal pelvis. Although described, mobilising the kidney from the front and working behind it on the aneurysm seems unusually difficult and unsatisfactory. In one case of horseshoe kidney we used our extraperitoneal approach, but in addition approached the aorta retrorenally by mobilising the left side of the horseshoe kidney.

References


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