A Novel Technique to Arrange Retrograde Visceral Bypass Grafts used in Hybrid Therapy for Thoracoabdominal Aortic Aneurysms

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Submitted 11 June 2008; accepted 25 August 2008

KEYWORDS
Thoracoabdominal aortic aneurysm; Endovascular surgery; Hybrid therapy

Abstract
Hybrid therapy administered for thoracoabdominal aortic aneurysm involves stent grafts and surgical reconstruction. This therapy entails retrograde visceral artery bypass before stent-graft implantation, establishing an inflow from either the distal abdominal aorta or the iliac arteries. Kinking is of great concern since it may cause acute occlusion, especially in grafts to the celiac axis and superior mesenteric artery because these vessels are directed caudally toward the right. Here, we describe a novel technique to achieve good exposure of the visceral vessels and appropriate graft position.

Introduction
Since the emergence of hybrid therapy involving stent grafts and surgical visceral reconstruction, visceral bypass grafting has attracted attention as an alternative treatment for thoracoabdominal aortic aneurysms (TAAAs). This therapy entails retrograde visceral artery bypass before stent-graft implantation, establishing an inflow from the distal abdominal aorta or iliac arteries and finally, excluding the TAAA. The conventional technique and exposure require minimal exposure of target vessels at the anastomosis site to achieve end-to-side anastomosis with the graft positioned on the shortest path. Therefore, it is often difficult to create a smooth curvature along the length of the prosthesis to the target vessel, particularly the celiac axis (CA) and superior mesenteric artery (SMA) because these vessels are directed caudally toward the right. In such cases, graft kinking is of great concern since it may cause acute occlusion. To ensure smooth...
configuration of grafts to their target vessels, the grafts should ideally approach the target vessels from the left and as cranially as possible.

Here, we describe a novel technique to achieve good exposure of visceral vessels and appropriate graft position.

**Technique**

For retrograde visceral bypass grafting, the abdomen is opened via a midline incision extending from the xiphoid process to the pubis. To expose the bilateral renal arteries (RA), abdominal aorta, and iliac arteries, the retro-peritoneum is incised above the abdominal aorta from the left renal vein to the iliac arteries. The CA and SMA are exposed with medial rotation of the pancreas and spleen to the right (Fig. 1). The cranial portion of the descending colon is mobilized, if necessary, to gain good access to the CA and SMA roots. The two dissected areas can be easily connected posterior to the duodenum, pancreas, and descending colon for graft passage. Most importantly, to ensure smooth curved configuration of the grafts, the length of the grafts to the CA and SMA in the dissected areas should be slightly longer than required. The inflow end of a quadrifurcated inverted graft is anastomosed to the distal abdominal aorta or iliac arteries, and its distal ends are anastomosed end-to-end to the roots of the visceral arteries to achieve anastomosis at the widest diameter of the native vessels. The origins of the host vessels are ligated to prevent endoleaks.

Since August 2005, 5 patients with Crawford type II TAAA, 2 of whom had already undergone aortic surgery, have been treated with retrograde visceral bypass grafting with medial rotation of the pancreas and spleen as the first procedure of hybrid therapy (3 men, 2 women; age, 67.4 ± 12.9 years). Nineteen visceral grafts (CA, 5; SMA, 5; right RA, 5; and left RA, 4) were implanted (Fig. 2). All patients were extubated in the operating room, and their postoperative courses were uneventful. Contrast-enhanced computed tomography performed during the follow-up period (586 ± 279 days) revealed that all these grafts were patent.

**Discussion**

Our technique for achieving smooth curved configuration of the prostheses to native vessels poses novel technical challenges. First, only end-to-end anastomoses were performed. In most reported cases of visceral reconstruction, Dacron grafts are anastomosed end-to-side to visceral arteries because such an anastomosis is technically easy and demands less surgical exposure. However, compared to end-to-end anastomosis, end-to-side anastomosis induces greater suture line stress. Moreover, exacerbation of distal anastomotic intimal hyperplasia by compliance mismatch between stiff Dacron grafts and native arteries is less in end-to-end than in end-to-side anastomosis. Second, medial rotation of the pancreas and spleen in addition to the conventional midline retroperitoneum incision facilitates excellent surgical exposure of both the CA and the SMA and offers freedom to position the quadrifurcated grafts while maintaining smooth curved configuration. A previous study describes the lazy C graft technique for CA reconstruction with a loose graft in order to achieve a smooth graft configuration; however, this technique has been applied only to the CA and it does not involve medial visceral rotation. Our technique allows smoother graft configuration to both the CA and the SMA. Third, our method enables the placement of the prosthesis without direct contact with the duodenum. Alternatively, the omentum can be placed between these structures to reduce the risk of aortoenteric fistula formation.

In conclusion, in retrograde visceral bypass, medial rotation of the pancreas and spleen and an end-to-end anastomosis between the prostheses and target vessels are important for achieving smooth curved configuration of the prostheses. However, the number of patients treated with this technique is limited, and a long-term follow-up is mandatory to confirm its effectiveness.
Figure 2  Intraoperative image (a) and postoperative CT scan (b) of a representative case. Note that the length of the grafts to the CA (asterisk) and SMA (arrow) is slightly redundant, and smooth curved configurations of the grafts were meticulously created. #: graft to left RA.

References


