Selected Techniques

Sequential Configuration for Aorto-Celiac-Mesenteric Bypass

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Surgical reconstruction of mesenteric arteries is the most effective treatment for chronic mesenteric ischemia. Among a variety of possible reconstructions, bypass grafting from the supraceliac aorta to the celiac and mesenteric arteries is a well-established operation with satisfactory short and long-term results. Commonly, such an antegrade bypass is constructed by performing an anastomosis between the body of a bifurcated graft to the supraceliac aorta and connecting its limbs to the celiac artery and superior mesenteric artery.

Although other configurations have been reported (including the use of a single saphenous vein graft to serve as an onlay patch of the origin of the celiac artery and "piggy back" vein grafts with a single aortic anastomosis), the use of sequential aorto-celiac-mesenteric bypass has not received attention in the literature. Recently we have chosen to construct our sequential bypasses in this fashion and we feel that in some patients this configuration may be advantageous.

TECHNIQUE

For aorto-celiac-mesenteric bypass without additional procedures, the transperitoneal approach is preferred. In these patients with chronic mesenteric ischemia, who are typically thin, an upper midline or a bilateral subcostal laparotomy provides comfortable access to the supraceliac aorta. A retroperitoneal approach, ideal for endarterectomy, is less desirable for visceral bypass procedures since the more distal portions of the superior mesenteric artery are not easily accessible.

The small bowel and the mobilized fourth portion of the duodenum are retracted to the right. The superior mesenteric artery is exposed as it emerges below the pancreas and branches which originate in the segment intended for anastomosis are isolated. The upper abdominal aorta is exposed by retracting the left lobe of the liver to the right after division of the left triangular ligament.

The gastrohepatic ligament and the posterior parietal peritoneum are incised and the esophagus is identified and retracted to the left. The right crus of the diaphragm, anterior to the aorta, is cut with scissors or electrocautery from the median arcuate ligament to a distance of about 8 cm cephalad. The aorta is exposed and the inferior phrenic arteries are divided. The celiac artery is exposed by cutting the celiac ganglion and the associated and often dense fibrous tissue and the proximal part of the celiac branches is isolated. This exposes a 10 cm segment of aorta and facilitates safe encirclement of the aorta, avoiding the intercostal branches. Using finger dissection from above and below, a tunnel is created between the celiac region and the exposed portion of the superior mesenteric artery, in a plane anterior to the aorta and behind the pancreas.

After intravenous injection of heparin, the aortic anastomosis is performed. Clamping of the supraceliac aorta for an anterior end-to-side anastomosis may be performed with partially occluding clamps, particularly in larger aortas. The theoretical advantage is that aortic flow is not completely halted, moderating increases in cardiac afterload and reducing hemodynamic insult at declamping. However, our feeling is that, even in large aortas and
certainly in smaller ones, it is more expeditious and safer to occlude the aorta completely for the short duration of the proximal anastomosis. A longitudinal arteriotomy is made in the aorta and a narrow rim of arterial wall is excised. For the sequential graft, 8 mm PTFE or Dacron may be used. It is often useful to transect a limb of a bifurcated graft leaving a generous "flange" of the body of the graft. This allows deep suture placement during end-to-side anastomosis without narrowing the outflow limb. The aortic clamp is slowly removed while maintaining a close watch on the hemodynamic state and the graft is clamped adjacent to the anastomosis.

The celiac artery is disconnected from the aorta as proximally as possible and its proximal stump is sewn closed. Control of the celiac artery branches may facilitate the anastomosis, especially if the celiac artery is short. An incision is made in the anterior aspect of the proximal portion of the graft. An end-to-side anastomosis of the celiac artery to this opening is performed and the clamp is moved down below this anastomosis. The graft is passed in the retropancreatic tunnel and brought out near the exposed portion of the superior mesenteric artery which is clamped proximally and distally. Side branches may be temporarily occluded with rubber loops or small Cushing clips. A longitudinal arteriotomy is made in the lateral or posterior aspect of the superior mesenteric artery, the graft is cut to size and anastomosed to it in an end-to-side fashion.

This results in a graft that originates in the supraceliac aorta, travels caudal adjacent to the aorta, gives rise anteriorly to the celiac artery (Fig. 1), enters the retropancreatic tunnel directly below this anastomosis, and terminates by joining the superior mesenteric artery (Fig. 2).

**DISCUSSION**

Construction of a sequential aorto-celeial-mesenteric bypass requires the same exposure and the same amount of time as a similar bifurcated bypass. However, it offers several advantages over a bifurcated graft, particularly in patients with small arteries.

A bifurcated graft is rather bulky at the aortic anastomosis where its body and both limbs project forward. Consequently, the celiac artery which receives the anterior limb is displaced forward. After construction of a sequential bypass, the smaller graft can originate from the aorta at a sharper angle, creating a more streamlined configuration and the revascularized celiac artery remains closer to its original anatomic position.

With most prefabricated bifurcated grafts, the bodies of the graft are invariably larger than required to accommodate the flow and graft limbs are often wider than the recipient arteries. A sequential bypass of 8 mm can clearly carry adequate flow to both celiac and superior mesenteric arteries and, since the celiac artery is anastomosed to the graft end-to-side, there is no problem of size mismatch.

We have utilized this approach in four patients in the last 2 years. Postoperatively the patients recovered well. When obtained, follow-up arteriograms were satisfactory. We have no data to show any difference in long-term results in this type of reconstruction, but we would expect it to be no different than a similar reconstruction with a bifurcated graft.

The variable pattern of visceral arterial occlusions found in chronic mesenteric ischemia and the frequent association with aortoiliac and renovascular occlusive disease require individual tailoring of the surgical procedure. Within the various revascularization procedures available, sequential aorto-celeial-mesenteric bypass represents an additional