606

A SIMPLIFIED TECHNIQUE FOR REVASCULARIZATION OF HOMOGRAFTS OF THE LIVER WITH A VARIANT RIGHT HEPATIC ARTERY FROM THE SUPERIOR MESENTERIC ARTERY

Robert D. Gordon, M.D., Byers W. Shaw, Jr., M.D., Shunzaburo Iwatsuki, M.D., Santuro Todo, M.D., *and* Thomas E. Starzl, M.D., PH.D., F.A.C.S.,
Pittsburgh, Pennsylvania

Reprint from
SURGERY, *Gynecology & Obstetrics*
MAY, 1985
VOLUME 160, 474–476

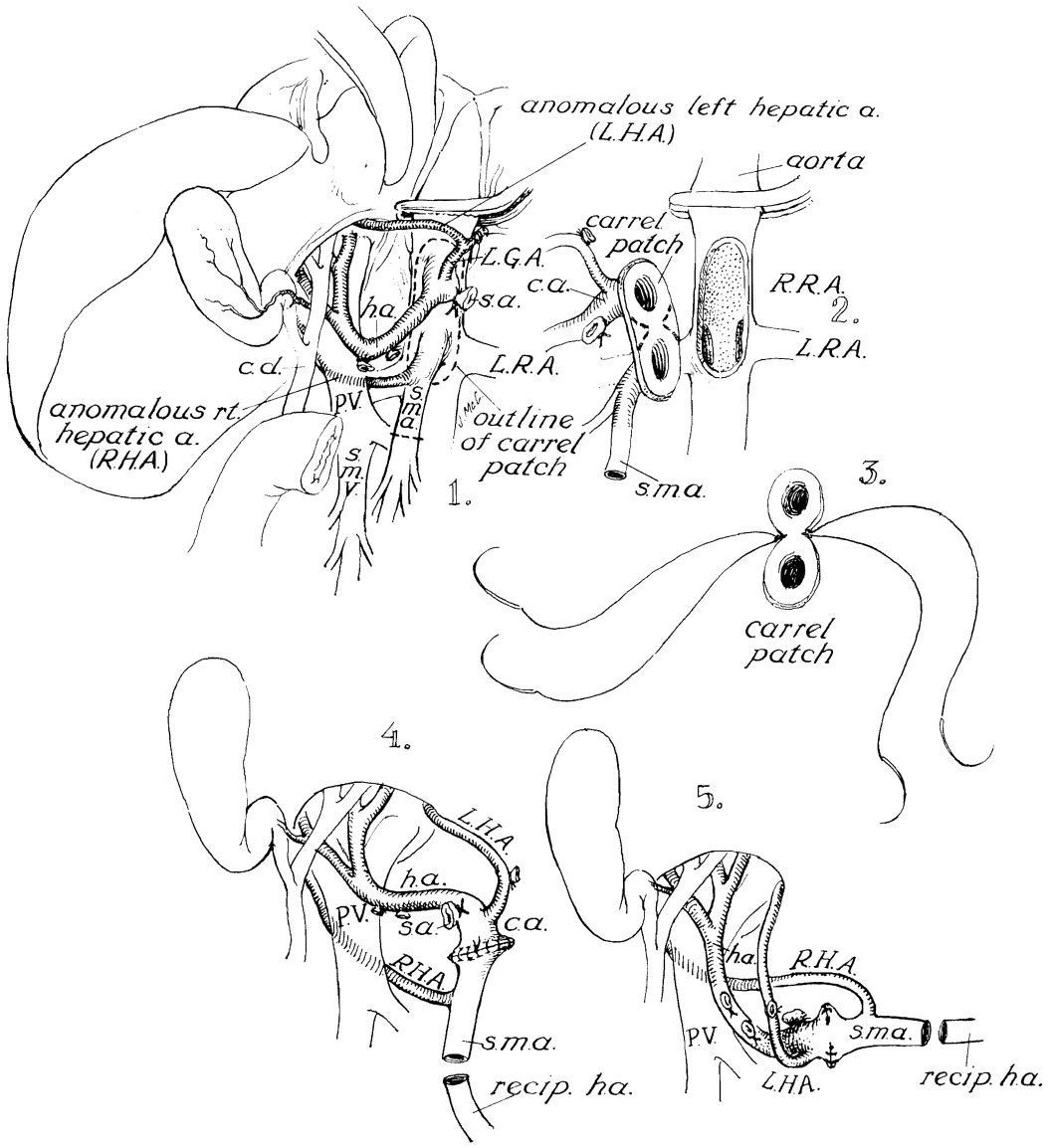

FIG. 1. Split arterial supply to the liver originating from the left gastric, celiac and superior mesenteric arteries. L.H.A., Left hepatic artery; *c.d.*, Common duct; *h.a.*, Hepatic artery; *L.G.A., Left gastric artery; s.m.v.*, Superior mesenteric vein; *s.m.a.*, Superior mesenteric artery; *s.a.*, Splenic artery; *L.R.A.*, Left renal artery; *p.v.*, Portal vein.

FIG. 2. A patch of anterior aorta including the origins of the celiac axis and superior mesenteric artery is removed. The renal artery orifices are protected.*c.a.*, Celiac axis; *R.R.A.*, Right renal artery; *L.R.A.*, Left renal artery; *s.m.a.*,Superior mesenteric artery.

FIG. 3. Folding of the aortic patch permits safe anastomosis of the celiac axis to the superior mesenteric artery.

FIG. 4. The superior mesenteric artery distal to the right hepatic artery is used for anastomosis to the recipient artery. recip. ha., Recipient hepatic artery; *s.m.a.*, Superior mesenteric artery; *R.H.A.*, Right hepatic artery; *s.a.*, Splenic artery; *h.a.*, Hepatic artery; *L.H.A.*, Left hepatic artery; *P.V.*, Portal vein; *c.a.*, Celiac axis.

FIG. 5. The reconstructed arterial supply of the graft may be rotated to match the orientation of the host vessel. *L.H.A.*, Left hepatic artery; *P.V.*, Portal vein; *h.a.*, Hepatic artery; *R.H.A.*, Right hepatic artery; *s.m.a.*, Superior mesenteric artery; *recip. h.a.*, Recipient hepatic artery.

A Simplified Technique for Revascularization of Homografts of the Liver with a Variant Right Hepatic Artery from the Superior Mesenteric Artery.—Robert D. Gordon, Byers W. Shaw, Jr., Shunzaburo Iwatsuki, Santuro Todo and Thomas E. Starzl.

A SIMPLIFIED TECHNIQUE FOR REVASCULARIZATION OF HOMOGRAFTS OF THE LIVER WITH A VARIANT RIGHT HEPATIC ARTERY FROM THE SUPERIOR MESENTERIC ARTERY

Robert D. Gordon, M.D., Byers W. Shaw, Jr., M.D., Shunzaburo Iwatsuki, M.D., Santuro Todo, M.D., *and* Thomas E. Starzl, M.D., PH.D., F.A.C.S.,
Pittsburgh, Pennsylvania

IN MOST instances, the arterial supply of the liver is provided by right and left lobar branches of the hepatic artery, one of the three principal branches of the celiac axis. However, variations from this typical pattern were reported in 45 per cent of instances reviewed by some (1) and in 46.5 per cent of instances reviewed by others (2).

Most variations in hepatic arterial supply appear to derive from incomplete development of the celiac axis resulting in replacement of the missing hepatic supply from other sources (1). The most common anomalies are a left hepatic branch from the left gastric artery and a right hepatic branch from the superior mesenteric artery. Even when well developed right and left hepatic arteries are present, accessory branches from the left gastric and superior mesenteric arteries may be present. Since all hepatic arteries are terminal vessels serving exclusive territories of the liver, even accessory vessels must be preserved during transplantation of the liver.

In the past, we have described techniques of dealing with a variant blood supply of livers prepared for transplantation (3, 4). The principle has been to reconstitute a single vessel for eventual anastomosis in the recipient. The most difficult anomalies have been with a split arterial supply originating from the celiac axis and the superior mesenteric artery. We report herein a method of reconstruction with which these two vessels of origin can be easily reconstructed into a common channel.

From the Department of Surgery, University Health Center of Pittsburgh, University of Pittsburgh, Pittsburgh.

This study was supported by research grants from the Veterans Administration and by Grant No. AM-29961 from the National Institutes of Health, Bethesda, Maryland.

Reprint requests: Dr. Thomas E. Starzl, Department of Surgery, 3601 Fifth Avenue, Room 103, Falk Clinic, Pittsburgh, Pennsylvania 15213.

DONOR HEPATECTOMY

The procedure developed in Pittsburgh for multiple organ procurement has been described recently in detail (5). If a left gastric branch to the left lobe can be seen and palpated in the gastrohepatic legament lying beneath the left lobe of the liver, it can be preserved by dissecting the vessel back to its origin from the main left gastric artery which in turn is preserved to its origin from the celiac axis (Fig. 1).

If a right hepatic artery arises from the superior mesenteric artery, it can be located by its pulsation posterior to the portal vein and common duct. Its origin from the superior mesenteric artery is usually found just beneath the splenic vein near its junction with the portal vein. Division of the splenic vein for insertion of a portal perfusion cannula (5) also facilitates exposure for the superior mesenteric artery and the origin of a right hepatic branch. The superior mesenteric artery is dissected from its beginning at the aorta to at least 1 centimeter beyond the origin of the anomalous right hepatic artery (Figs. 1 and 2). The origin of the celiac axis also is dissected clean at the aorta.

The technique of cold perfusion and preservation has been described (5). A patch of anterior aortic wall containing the origin of both the celiac axis and the superior mesenteric artery is removed. This preserves the entire hepatic arterial supply and is first in reconstruction of a common channel. As the patch is cut, the aortic origins of the renal arteries are noted and avoided. These are in close proximity to the origin of the superior mesenteric artery (Fig. 2).

CONVERSION TO A COMMON CHANNEL

On the back table in the recipient hospital, the donor aortic patch containing the origin of the ce-

liac and superior mesenteric arteries is notched on each side at the midportion leaving a small bridge of aorta intact between the vessels (Fig. 3). A vascular suture (6-0 polypropylene) is secured at each end of the bridge, sewn around to the opposite side, and tied (Fig. 4). The folding together of the modified Carrel patch with a small intact bridge of aorta permits anastomosis of the celiac and superior mesenteric arteries without misalignment or twisting and it eliminates the danger of stenosis resulting from tension on sutures.

ANASTOMOSIS IN RECIPIENT

The end of the superior mesenteric artery distal to the right hepatic branch is anastomosed to the recipient artery (Fig. 4). The reconstructed graft arterial supply may have to be rotated depending upon the orientation of the host artery (Fig.5).

This technique of converting a complex arterial supply into a single vessel has now been used since 26 June 1984 in eight instances. There have been no subsequent thromboses or technical failures of other kinds. Some liver transplantation teams which are aquiring their first experience have had a policy of discarding livers with this anomaly, but with the simple technique described herein, this wastage can be avoided and without risk to the recipient.

SUMMARY

A simplified technique for conversion of a complex hepatic arterial supply into a common channel is described. This technique permits single vessel anastomosis in the recipient of a liver transplant.

REFERENCES

1. Michels, N. A. Newer anatomy of the liver and its variant blood supply and collateral circulation. Am. J. Surg., 1966, 112: 337-347.
2. Suzuki, T., Nakayasu, A., Kawabe, K., and others. Surgical significance of anatomic variations of the hepatic artery. Am. J. Surg., 1971, 122: 505-512.
3. Starzl, T. E. Experience in Hepatic Transplantation. With assistance of C. W. Putnam. Pp. 130-133. Philadelphia: W. B. Saunders Co., 1969.
4. Shaw, B. W., Jr., Iwatsuki, S., and Starzl, T. E. Alternative methods of hepatic graft arterialization. Surg. Gynecol. Obstet., 1984, 159: 490-494.
5. Starzl, T. E., Hakala, T. R., Shaw, B. W., Jr., and others. A flexible procedure for multiple cadaveric organ procurement. Surg. Gynecol. Obstet., 1984, 158: 223-230.