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THE REVERSE PORTACAVAL SHUNT

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IN A recent study of hepatic metabolism in dogs,⁸ an experimental preparation was established in which the entire deep femoral venous return passed through the liver. This was accomplished by the formation of a side-to-side portacaval fistula, ligation of the inferior vena cava proximal to the anastomosis, and removal of the caval and iliac collaterals. Because of the potential value of this procedure in other studies of liver function, the method will be described.

METHOD

Five mongrel dogs, approximately 10 Kg. in weight, were selected. Under sodium pentobarbital anesthesia the abdomen was entered through a long upper midline incision. The stomach and intestines were displaced down and to the left. Adequate exposure of the operative site was obtained by upward retraction of the liver after the thin mesenteric veil of the caudate lobe was sectioned. (Fig. 1.) The portal vein and the vena cava were prepared for anastomosis and a preliminary untied ligature was placed around the proximal cava. The small bile duct tributary that crosses the portal vein was avoided. The anastomotic site was selected well above the renal veins and two guide sutures placed at least 1 cm. apart through the wall of both the portal vein and the inferior vena cava. The sutures were tied to approximate the vessels and a modified Potts clamp⁶ was positioned to provide partial occlusion of both veins. An ellipse was excised from the wall of both

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vessels and the anastomosis was carried out with continuous 5-0 arterial silk (Fig. 1). The partial occlusion clamp was removed and the vena cava was then tied and transected well above the entrance of the adrenal veins. When the anastomosis was adequate, there was no distention of the distal vena cava.

Two to three weeks after surgery, dye studies were done by injecting 90 per cent Hypaque sodium into the femoral vein. Only a portion of the injected material reached the hepatic bed. The remainder bypassed the liver via extensive collaterals which originated from inferior vena cava branches (Fig. 2). A second procedure was then done on three of the five dogs and all venous tributaries from the site of caval ligation through the hypogastric veins were divided with the exception of the renals. Dye studies two to three weeks after reoperation revealed that all material injected into the femoral vein passed directly through the anastomosis into the liver (Fig. 3). Inferior caval pressures in two dogs, obtained three weeks after the second procedure, were 140 and 160 mm. saline, respectively.

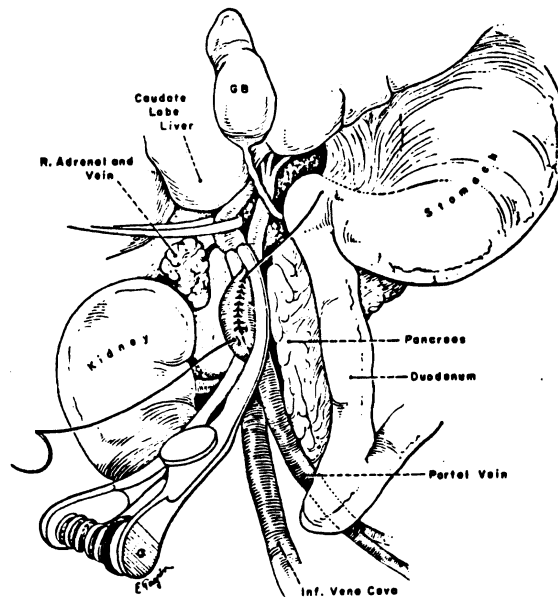


Fig. 1.—Artist's view of side-to-side portacaval anastomosis in formation of reverse Eck fistula.

DISCUSSION

These procedures were not detrimental to the health of any of the five dogs. Oliguria, edema of the hindquarters, or ascites did not develop. Except for an increase in prominence of the superficial veins of the abdominal wall, the dogs were indistinguishable from normal animals. Previous investigators have described the absence of harmful sequelae after reverse Eck fistula.^{1, 3, 4, 5, 7} It is evident, however, from the present venographic studies that the usual reverse Eck fistula provides incomplete diversion of caval blood

flow into the portal system due to the rapid development of systemic venous collaterals. Division of these collaterals was not attended by an increased morbidity in the present series.

Since diversion of large quantities of systemic blood through the portal system is not injurious to liver function,^{2, 9} impaired hepatic metabolism in the present circumstances would be surprising. The absence of any morbidity or mortality is of interest, however, inasmuch as the (adrenal) venous drainage

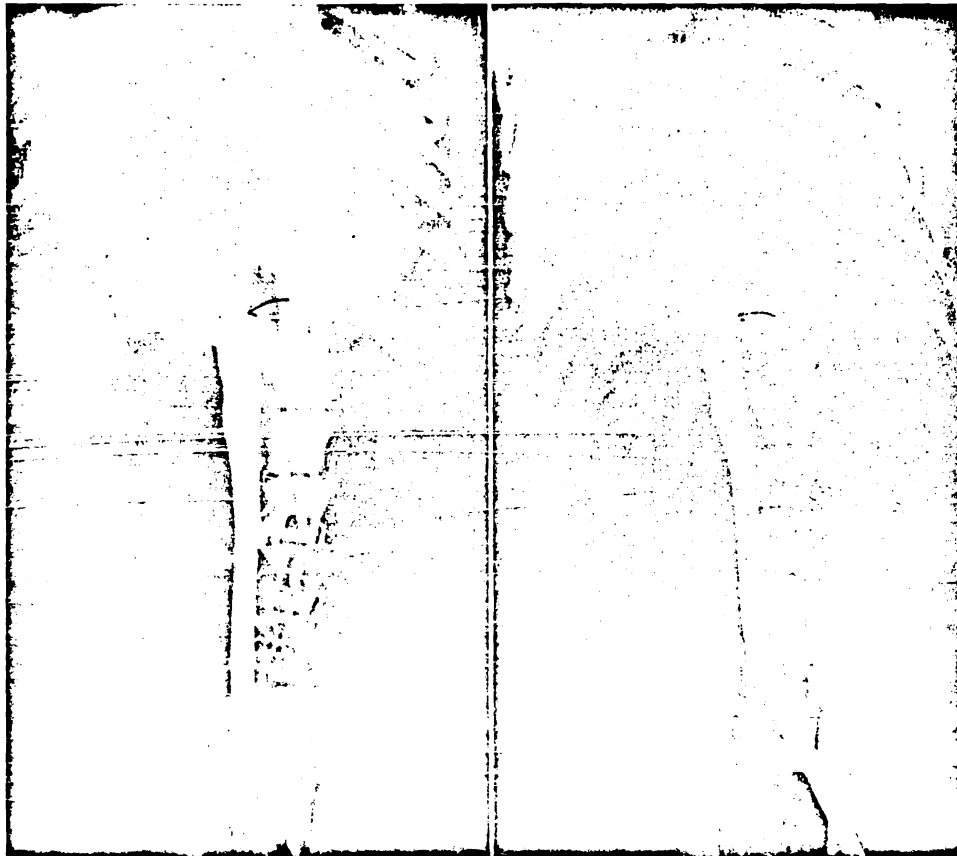


Fig. 2.

Fig. 3.

Fig. 2.—Distribution of 90 per cent Hypaque during injection into the femoral vein in a dog with reverse Eck fistula. Note the development of large systemic venous collaterals with resultant incomplete diversion of caval flow into the portal vein. The anastomosis is marked with an arrow.

Fig. 3.—Hypaque injection into the femoral vein (same dog as Fig. 2) three weeks after caval-iliac strip. Note that the entire dose of dye passes through the anastomosis (arrow) into the liver.

was shunted through the portal bed. In commenting on the difficulty of obtaining survivors in portacaval transposition, Summers, Malette, and Eisman¹⁰ have implicated the passage of endogenous adrenal hormones through the hepatic parenchyma as the principal cause of death. The present findings do not support this concept.

The described technique of altering the venous drainage of the inferior half of the body has application in the experimental study of certain phases of hepatic metabolism. Ordinarily, when repeated intraportal injections of any substance are desired, it is necessary to perform multiple celiotomies or splenic punctures. With the present preparation, injections can be made into the leg veins of the unanesthetized animal and all the material will pass through the reverse Eck fistula into the liver bed. For such studies to be valid it is necessary to interrupt the entire caval collateral (Figs. 2 and 3). If desired, the effect of systemic venous administration can then be compared in the same dog by injection of the substance into a forelimb vein. The role of the liver in the physiology of hormones or other drugs can thus be conveniently studied. This method also affords a means by which hepatotoxic drugs can be repeatedly instilled directly into the portal circulation in an effort to produce experimental cirrhosis.

It is interesting to speculate about the occasional clinical situation to which the principal of caval-portal rerouting may be applicable. The most obvious possibilities would be neoplastic invasion of the inferior vena cava between the renal veins and the diaphragm, or traumatic injury in this area severe enough to necessitate sacrifice of a segment of the vessel. It would be tempting, under these circumstances, to anastomose the distal end of the cava to the side of the portal vein rather than accept the high risk of failure of interposing a replacement vein graft.

SUMMARY

A technique has been described in which all the venous drainage of the deep femoral system is diverted through the hepatic bed by means of a reverse Eck fistula and systematic division of collaterals from the inferior vena cava and iliac veins. The use of this technique in the study of liver metabolism is proposed. Employment of simple reverse Eck fistula is suggested in clinical situations in which there is subdiaphragmatic destruction of the inferior vena cava.

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