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THE SPECIFIC INFLUENCE OF NONHEPATIC SPLANCHNIC VENOUS BLOOD FLOW ON THE LIVER

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THE FOLLOWING experiments were performed in order to determine if some substance in the portal venous blood had a specific hepatotrophic effect. Partial portacaval transposition was performed in 8 dogs attaching the distal end of the transected vena cava to either the right or left main portal branch, leaving the other half of the liver

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supplied with splanchnic venous blood. In 11 additional dogs, the quantity of venous inflow to the 2 liver halves was measured by a direct collection technique. Finally, the venous oxygen content of the splanchnic versus the suprarenal inferior vena caval blood was measured in 13 more unanesthetized dogs with standard portacaval transposition, sampling by a multiple catheterization method.

RESULTS

The 8 dogs with split transposition remained healthy until killing after 70 to 94 days. There were elevations in SGOT, SGPT, and alkaline phosphatase but never jaundice. In 7 animals the cavaportal anastomosis was patent. The part of the liver supplied with caval blood was shrunken in every case. The other portion was normal or enlarged. Hepatic glycogen content per gram weight was measured from biopsies of both sides just before killing. The glycogen content of the hepatic fraction receiving vena caval flow was always reduced, with only 42 to 83% of the concentration present in the lobes receiving splanchnic flow. Phosphorylase, glucose-6-phosphatase, acid phosphatase, mutase, and protein concentrations were not significantly different. Microscopically, that half of the liver receiving splanchnic venous blood appeared to have larger lobules and hepatocytes than in previous control biopsies; mitotic figures were absent but there were an unusual number of binucleate and trinucleate cells. The side perfused with systemic venous blood invariably showed shrunken lobules; centrizonal atrophy; irregularity of cell size, shape, and staining with frequent reticulin condensation; and centrizonal collapse. Sinusoidal irregularity and engorgement of periportal cells with paraaminosalicylic positive material were prominent.

The 11 dogs with split transposition which had blood flow measurements were studied from a few hours to 7 days after operation, employing a teflon side graft for bleedoff. The vena caval blood flow to the liver averaged 17.8 $\pm$ 8.8 (SD) ml./kg./min. The mean splanchnic venous blood flow was 15.8 $\pm$ 6.3 (SD) ml./kg./min. Analysis of the differences of blood flow revealed no statistically significant difference ($0.4 > p > 0.2$).

The 13 dogs with complete portacaval transposition were studied 12 to 115 days after operation by means of catheters which were directed under fluoroscopic control into the suprarenal inferior vena cava and into the superior mesenteric vein. Oxygen content was determined with the Van Slyke method on at least 3 different specimens from each site. The nonhepatic splanchnic blood was more desaturated (mean 10.42 $\pm$ 1.9 (SD) Vol. %) than that in the inferior vena cava (17.55 $\pm$ 2.2 (SD) Vol. %), the oxygen content being lower in the superior mesenteric vein in 11 of the 13 dogs ($p < 0.005$).

CONCLUSIONS

Under the conditions of these experiments, there appears to be an hepatotrophic influence of splanchnic venous blood. The data indicate that the competing liver fraction which received normal portal blood flow operated at a physiologic advantage, presumably due to specific substances presented to it in high concentration by blood returning from the intestinal tract. The other portion of hepatic parenchyma was not protected from injury simply by substituting equivalent volumes of systemic venous flow. The observed differences in the liver fractions were not explicable by a greater oxygen availability in the splanchnic venous blood, since the oxygen content of vena caval blood is at least as high as that in the superior mesenteric vein.