

Effects of Massive Intestinal Resection and Splenectomy on Portal Pressure and Thoracic Duct Lymph. An Experimental Study

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Summary

The effect of massive intestinal resection (MIR) alone and when combined with splenectomy, on portal pressure and thoracic duct lymph (TDL) flow, and protein content, was experimentally studied in a series of 12 dogs with created presinusoidal portal obstruction. MIR was associated with a significant drop in the portal pressure and TDL flow, and significant increase in TDL protein content. When splenectomy was added, more reduction of the portal pressure and TDL flow was obtained. The significance of these findings is discussed in relation to the hemo- and lymphodynamic changes in presinusoidal portal obstruction.

Introduction

Witte et al. (29) have proposed the replacement of the term "passive congestion" by the more accurate designation of "active congestion" to characterize the circulatory derangement in human portal hypertension. The same authors have suggested that in patients with predominantly increased splanchnic arterial flow and minimally increased portal resistance, splenectomy or restriction of the mesenteric inflow above a critical minimum or resection of small bowel may relieve ascites and varix haemorrhage. The purpose of this investigation was to make a quantitative estimate of the portal pressure, the rate of lymph production and its protein content under conditions of partial obstruction of the portal vein and observing the influence of MIR alone and plus splenectomy on such estimates. It is an acute experiment and valid only as an acute observation.

Material and Methods

The study was carried out on 12 healthy, adult, male and female mongrel dogs weighing from 17 to 25 kg. The anaesthetic used was thiopentone sodium in 10 ml saline (0.025 g/kg body weight) for induction and barbitone sodium solution in saline (0.25 g/kg body weight) given by intravenous drip for maintenance. The thoracic duct was exposed and cannulated at the left jugular-subclavian junction and the abdominal cavity was opened for passage of a polyethylene catheter into the portal system by way of a superior mesenteric vein tributary, for portal venous pressure measurements. Control values of TDL flow rate and portal venous pressure were determined, and TDL and systemic venous blood samples were taken. Then portal vein partial occlusion was performed, using a vascular clamp for creation of portal hypertension. Massive resection of the small intestine was done. It was severed proximally 12-in from the ligament of Treitz and distally 6-in from the ileocecal valve.

The last step in the study was the addition of splenectomy to massive intestinal resection. In each phase of this experiment, 40 minutes were to elapse before the determination of new measurements, and TDL was collected and measured during 3 periods of 10 minutes each. The total protein content of lymph samples and plasma was determined (biuret method). Saline and dextran were administered to replace lymph losses and to support arterial pressure when needed, without venous overloading.

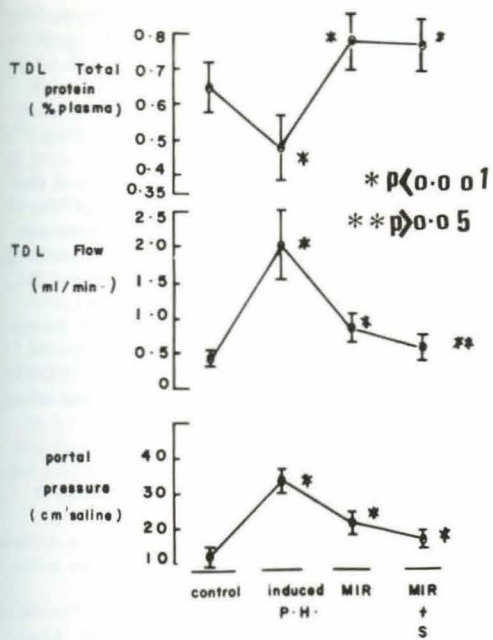


Fig. 1 Mean \pm SD of the portal pressure and thoracic duct lymph (TDL) flow/min, protein content "percent plasma", before (control) and after induction of portal hypertension "P.H.". The same figure shows the values after massive intestinal resection "MIR" and MIR + splenectomy "S" in such dogs with prehepatic portal partial obstruction

Results (Fig. 1 and Table 1)

Induction of portal hypertension evoked elevation of the portal pressure from 12.5 ± 2.6 to 33.6 ± 3.2 . TDL flow increased from 0.46 ± 0.53 to 2.03 ± 0.49 and TDL total protein (percent plasma) was decreased from 0.65 ± 0.07 to 0.48 ± 0.09 . These changes were all significant ($P < 0.001$).

MIR was followed by significant decrease of the mean values of portal pressure (21.75 ± 2.87 , $P < 0.001$), and of TDL flow (0.83 ± 0.23 , $P < 0.001$). The total protein (% plasma) in TDL was significantly elevated (0.78 ± 0.08 , $P < 0.001$).

Following MIR and splenectomy a reduction was found in each of the portal pressure (49.7%), and TDL flow (71.9%) as compared with the values after induction of portal hypertension.

Table 1 Changes in TDL total protein (% plasma) after MIR and MIR + splenectomy in dogs with partial occlusion of the portal vein (mean \pm SD)

	TDL total protein (percent plasma)
Control	0.65 ± 0.07
Induced portal hypertension	0.48 ± 0.09 *
MIR	0.78 ± 0.08 **
MIR + splenectomy	0.77 ± 0.07 ***

*Significantly lower than control value ($P < 0.001$).
 **Significantly higher than control value ($P < 0.001$).
 ***Insignificantly different from value after MIR ($P > 0.05$).

The TDL total protein (percent plasma) was significantly higher than baseline value ($P < 0.001$), but insignificantly different from that after MIR ($P > 0.05$).

Discussion

Portal pressure elevation in man results from a spectrum of disturbances in splanchnic blood flow combined with increased portal vascular resistance (29). The hyperdynamic portal circulation is due to enlarged splanchnic arteries (3, 30) particularly to the spleen (31) and from arterio-venous fistulae in the digestive tract and spleen (2, 8, 16). The resulting hypervolaemia leads to excessive lymph production (5, 6, 15, 18), that exceeds the thoracic duct drainage capacity (5, 11) and may initiate or perpetuate ascites (12, 27, 28, 30).

In our experiment, the portal vein was partly occluded for creation of presinusoidal portal hypertension, simulating to a certain extent the hemodynamic alteration in patients with pure schistosomal hepatic fibrosis. Such type of portal obstruction is associated with increased low protein TDL (18, 25, 26); its main sources are the intestine (7, 13, 14, 22, 25) and spleen (1). MIR in such dogs with induced portal hypertension was associated with a significant reduction of portal pressure and TDL flow secondary to the marked reduction of mesenteric circulation, which constitutes two-thirds to three-fourths of portal blood flow

(10). When splenectomy was added a more reduction was obtained as the congestive spleen contributes to the elevated portal pressure and to the excess lymph production (1).

The significant increase in TDL protein after MIR and MIR + splenectomy could be the result of the relative increase in the proportion of the high protein hepatic lymph in the thoracic duct.

Decompression of the excess TDL was achieved by thoracic duct drainage (4, 6, 9, 15, 17), and the creation of cervical lymphatico-venous shunts (19–21, 23), with encouraging results. Witte et al. (29) have suggested techniques that reduce lymph production in cases suffering from portal hypertension. In the present experiment MIR + splenectomy, succeeded in reducing markedly the portal pressure and TDL flow. However, MIR is a catastrophic insult resulting in extensive reduction of the absorptive surface of the small intestine, with intractable diarrhoea, malabsorption, weight loss and inanition (24). So the concept of controlling the mesenteric arterial inflow above a critical minimum (29), by other alternative trials would have a role in the reduction of elevated portal pressure and TDL flow, with the subsequent possible relieve of ascites and varix haemorrhage.

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