Changes in the Splanchnic Circulation after Haemorrhage

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The experimental work described below was done in the Department of Medicine, College of Physicians and Surgeons, Columbia University, in collaboration with Dr. S. E. Bradley, Dr. P. A. Marks and Mr. C. Chidsey.

The splanchnic circulation may be defined as that part of the circulation which, in the normal animal, opens into the inferior vena cava by way of the hepatic veins. The changes which may occur in this system after haemorrhage may be subdivided as follows:

Changes in total splanchnic blood flow. The maintenance of an adequate splanchnic blood flow is essential for the nutrition of the viscera.

Changes in splanchnic blood volume. It has been suggested that the splanchnic area may serve as a reservoir which can expel blood into the rest of the circulation after haemorrhage. On the other hand, it has been suggested that when the phase of irreversible shock supervenes, the reverse process may occur and there may be pooling of blood within the splanchnic bed.

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(3) Intrinsic changes within the splanchnic bed. Blood may be redistributed within the splanchnic area without any appreciable change in total flow or volume.

In the experiments to be described, splanchnic blood flow and splanchnic blood volume were measured, but the methods were not suitable for the detection of intrinsic changes within the splanchnic area.

Splanchnic blood flow was measured by the BSP clearance method and splanchnic blood volume by a new tracer dilution technique. Two types of haemorrhage were studied.

The first group of dogs were subjected to an acute haemorrhage amounting to about 30 % of the total blood volume and then allowed to recover spontaneously. Both splanchnic blood flow and volume fell abruptly after haemorrhage and then returned towards normal values during the second hour after bleeding.

The second group of animals were subjected to a similar haemorrhage, but the pressure was kept down in the 40-50 mm. Hg range for two or three hours by graded haemorrhage. Most of these dogs failed to recover after transfusion and were in the irreversible stage of haemorrhagic shock when the final determinations were made. Both splanchnic blood flow and volume fell, and remained low throughout the hypotensive phase. Even in the phase of irreversible shock there was no suggestion of pooling within the splanchnic area.

In both series of experiments the fall in splanchnic blood volume was proportionately much greater than the fall in total blood volume so that it is probably an active rather than a passive mechanism. It is not primarily due to splenic contraction since the same phenomenon was observed in splenectomised dogs and it is probably due to a constriction of the portal and hepatic veins. It is thought that these veins act as the capacity regulators of the splanchnic circulation just as the arterioles, by virtue of their high resistance to flow, are the main flow regulators.

A reduced splanchnic blood flow, such as that seen after haemorrhage, could cause hepatic insufficiency if sufficiently severe and sufficiently prolonged. It was possible to make serial determinations of liver function by measuring the BSP clearance. After acute haemorrhage, BSP clearance was not significantly reduced, but in the dogs subjected to prolonged hypotension, the reduced hepatic blood flow was associated with a progressive deterioration in liver function.