EXPERIMENTAL PRODUCTION OF PORTAL HYPERTENSION IN DOGS BY A WHOLE LIVER COMPRESSION

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Summary

In spite of many attempts to produce an experimental model for studying the pathogenesis and the pathophysiology of portal hypertension and esophageal varices, satisfactory results have not been reported. Since most attempts involved multiple operations or complicated surgical maneuvers to achieve portal hypertension, experimental animals could not survive easily.

This new procedure requires only a simple operation, so experimental animal survival is high. The portal venous pressure can be raised immediately by increasing intrahepatic vascular resistance. This is done by wrapping and compressing the whole liver with polypropylene mesh, which also prevents the development of hepatopetal collaterals. The experimental production of portal hypertension in fifteen dogs resulted in only one death. The remaining fourteen dogs were in good condition for nine weeks after the operation and were maintaining elevated ranges of portal pressure with an average of 326 mmHg. Varying degrees of esophageal venous dilatation were evident. Based on the results, this newly developed method seems to be useful for studying the pathophysiology of the portal hypertension and esophageal varices.

Key Words: experimental portal hypertension, whole liver compression, esophageal submucosal vein.

Introduction

Many various attempts to produce the experimental portal hypertension in animals have been reported\textsuperscript{2-13}. Unfortunately, successful production of a significant degree of chronic portal hypertension and esophageal varices has been difficult. In 1979 we developed a new method\textsuperscript{1) }to produce experimental portal hypertension in dogs, whole liver compression which required only a simple operation. It has not been found in the previous reports.

Portal venous pressure was able to be raised immediately by this procedure and maintained at a high pressure for a long time.

The purpose of this paper is to report the methodology and experimental results of this new method.

Material and Method

Experiments were performed on 29 mongrel dogs of both sexes weighing between 11 and 19 kilograms. The animals were fasted for 18 hours before the operation. They were anesthetized with pentobarbital sodium 25 mg/kg; in-
tubated oroethracheally, and allowed to breath spontaneously. A continuous infusion of Ringer's solution was administered by a venous line. The abdomen was opened by an upper median incision. A catheter was placed into a branch of the superior mesenteric vein for measurement of the portal venous pressure, and an electromagnetic flow meter was set around the portal vein for measurement of the portal venous blood flow (Fig. 1).

Ligaments around the liver were divided carefully and the compressing material (polypropylene mesh or gauze) was inserted into the behind liver. The whole liver was wrapped and compressed with a tense of polypropylene mesh or gauze. The compressing material was ligated and fixed with 5-0 silk sutures when the liver was shrank well and the portal venous pressure was elevated to the satisfactory level (Figs. 2-A, and 2-B). Special attention was paid to avoid constriction of the extrahepatic veins and portal veins by the compression.

Experimental animals were divided into two groups, one for short and another for relatively long-term observations. The fourteen dogs in Group I were used for fundamental studies to observe the change in the portal venous pressure after the liver compression. A comparative study was also performed on the effect of the type of wrapping material, differentiating between polypropylene mesh or gauze, to confirm which was more useful. The portal venous blood flow was measured in 7 dogs before and after the liver compression to study the change of the hepatic blood flow. A post mortem radiopaque injection study was performed on the portal vein, hepatic vein, and hepatic ar-

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Fig. 1. Schematic presentation of measurement of the femoral arterial pressure, portal venous pressure, and portal venous blood flow.

Fig. 2A. Photograph of the whole liver.

Fig. 2B. Photograph of the whole liver compression with polypropylene mesh.