GRADUAL EXPERIMENTAL CLOSURE OF THE LUMEN OF THE PORTAL VEIN

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In experimental investigations on the liver it is sometimes necessary to ligate the portal vein.

The one-stage ligation of the portal vein is known to lead to the rapid death of the animals: dogs, cats, rabbits and rats die from 30 minutes to 15 hours after ligation [1, 5, 6, 8, 9, 12]. In carrying out chronic investigations it is essential that an animal in which the portal vein has been ligated should live for a long time. The methods of ligation of the portal vein that have so far been suggested and which permit survival of the animal may be divided into two groups.

The first group includes operations in which the branches of the portal vein — superior mesenteric, gastro-epiploic and pancreaticodueodenal veins — are ligated in stages [3, 6, 11]. Multiple operations under ether anesthesia are not without effect on the animal, especially when the liver is excluded. The operation wounds heal badly and the repeated operations leave adhesions which render manipulations of the portal vein difficult.

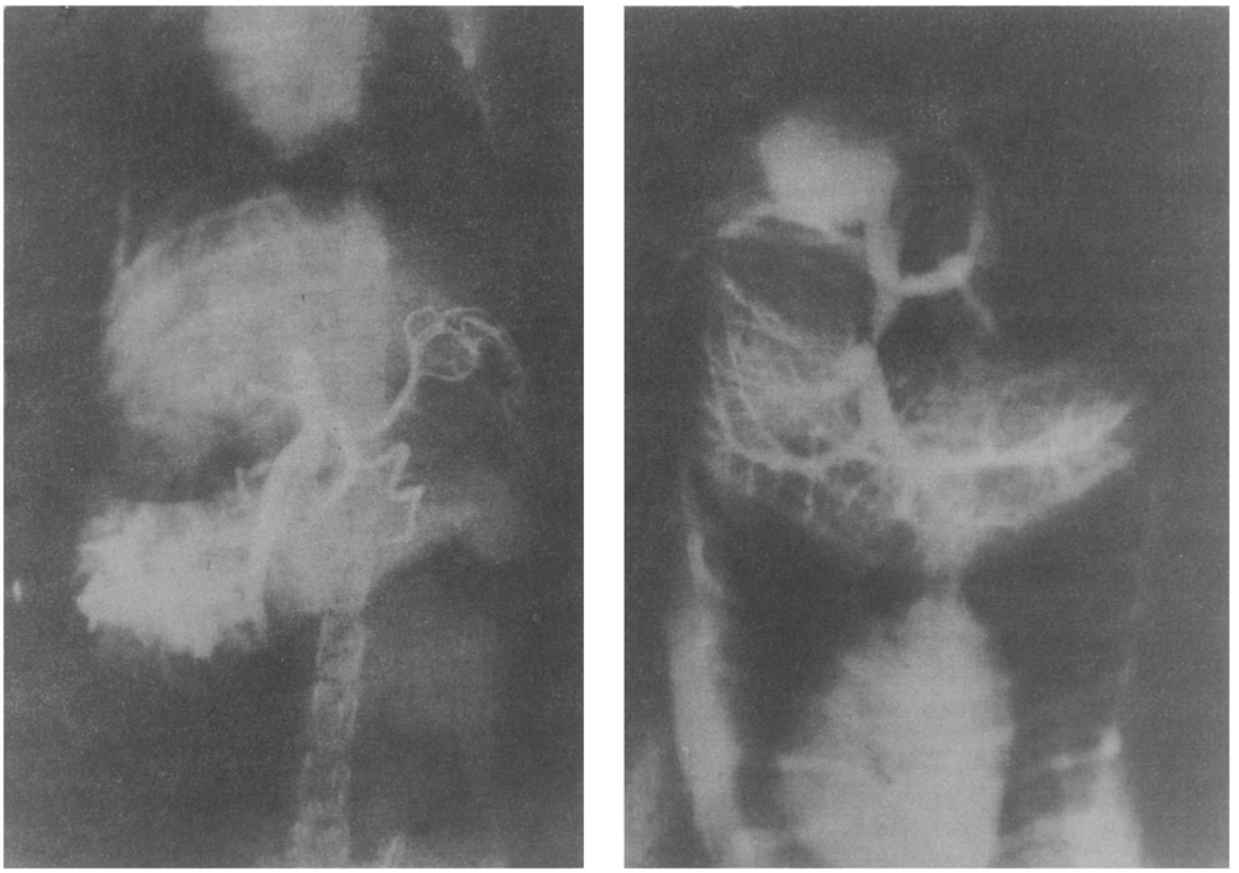
The second group consists of operations to close the lumen of the portal vein gradually [1, 2, 3, 8]. Many authors solve this problem differently. The original method was suggested by N. N. Burdenko [1]. He ligated the pancreaticoduodenal vein and constricted the gastrosplenic vein. Around the trunk of the portal vein he passed a loop of thread, which was fixed behind the deep spinal muscles. It was assumed that when the animal got up, the contracting muscles would draw the thread tight and constrict the lumen of the vein. From 1 to $1\frac{1}{2}$ months later, and sometimes a little before, the portal vein was completely ligated. This author did not carry out a check of complete obstruction of the portal vein.

Recently experimental workers have mainly used the method of constriction of the lumen of the portal vein in stages. Some authors [4, 6, 8] assert that the first constriction of the portal vein should only be to an insignificant degree, but others [2, 7] point out that in some cases the first constrictions may be by more than half the lumen of the vein.

The majority of workers use a silk ligature. A silk ligature, however, even after prolonged stenosis of the portal vein, as a rule fails to close the lumen completely, and repeated ligation has to be done. There are no convincing reports in the literature giving the times of complete closure of the lumen of the portal vein by the different operative methods.

In our own experimental work on the study of the effectiveness of portocaval anastomosis between the left kidney and the omentum, it was necessary to produce artificial portal hypertension in dogs.

For this purpose, in 6 dogs we first used N. N. Burdenko's method [1], but we found no indication that this method had been used by anybody else besides N. N. Burdenko himself. In all 6 dogs, 5-6 months afterwards, splenoportography showed that the lumen of the portal vein was not completely closed, and the development of preexisting and of newly formed portocaval anastomoses was quite inadequate.



Closure of the lumen of the portal vein in an experiment on a dog.

There are indications in the literature of the use of an aneroid cuff and of a cotton tape, sprinkled with decithyl phosphate powder for gradual closure of the lumen of the vessel [10]. Since these materials were not available, we used cotton thread soaked in iodine solution.

After only 10-13 days the lumen of the portal vein was completely closed, as was demonstrated by splenoportography and at postmortem. The experimental method was as follows. From 18-20 white cotton sewing threads No. 30-40 a string was made, 70-80 cm long, the threads not being plaited. Every 20 cm, along the string, were tied two knots, separated by a short interval. The string was loosely wound on a glass tube or glass slide not more than twice, boiled in water for 30-40 minutes and then immersed in a 10% solution of iodine, in which it was kept for 8-10 days.

At operation, a ligature was cut from the string between two knots, and this was passed under the portal vein with a Deschamps' needle in the region of its bifurcation, nearer to the liver and passed to an fro under it several times. Under these circumstances the vein was twisted by the string and the adventitia was partially removed by it. The ligature was tied over a Roser – Sinitsyn bougie with the end sawn off. The lumen of the portal vein, which in dogs weighing 20-39 kg is usually 1.5-1.7 cm, was constricted in this way to 0.2-025 cm.

It must be pointed out that, in order to avoid adhesions, careful protection of the operation field and the surrounding organs with gauze from the ligature, soaked in iodine, is essential. After each operation a control splenoportography was performed to test the degree of constriction of the lumen of the portal vein.

The primary constriction of the portal vein which we performed was much greater in degree than that described by other authors.

In order to ascertain the time required for complete closure of the lumen of the portal vein by our method, we carried out splenoportography at different times in 76 dogs. In all the dogs, 13 days after application of the cotton ligature soaked in iodine, the portal vein was no longer patent. In order to determine more accurately the times of closure of the portal vein, we also sacrificed 10 dogs at various times. Hence it was found that in 2 dogs sacrificed 10 days after operation, the patency of the portal vein was still partially preserved, and in 2 dogs sacrificed on the 11th day, the lumen of the portal vein was no more than 1 mm. Of 2 dogs sacrificed on the 12th day, in one the portal vein was completely closed, and in the other there was a lumen of less than 1 mm. In 4 dogs sacrificed on the 13th day, the lumen of the portal vein was completely closed.

Our method of gradual closure of the lumen of the portal vein this enabled repeated operations to be avoided and guaranteed closure of the lumen of the vessel within a certain time.

SUMMARY

A method of gradual closure of the portal vein lumen is suggested for creating experimental portal hypertension. Portal vein is constricted to the diameter of 0.2-0.25 cm by means of a bundle of cotton threads (No. 30-40) impregnated with 10% iodine solution. When a bundle of threads is passed under the vein it is pulled back and forth several times, so as to traumatize the adventitia. With the aid of splenoportography it was established that in 76 live dogs and at autopsy in 10 dogs closure of the portal vein lumen occurred on the 13th day after iodized thread ligation of the vein.

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