A CONTRIBUTION TO THE TECHNIQUE OF MAKING
THE ECK FISTULA.

BY FREDERICK C. HERRICK, CLEVELAND.

(From the Physiological Laboratory of the Medical Department of Western Reserve University.)

The work of a number of investigators upon the nitrogen metabolism of dogs has relied quite extensively on the establishment of a fistula known as Eck fistula between the vena portae and the vena cava inferior. The ingenious method recently described by J. E. Sweet is a very material improvement over previous ones in use.

We have thought it of value at this time to place on record our experience in making the Eck fistula, especially since, after several trials with the older methods and with modifications of them, we also came to devise a special technique which would seem to have certain advantages.

In view of the recent publication by Sweet, in which a complete bibliography is given, it does not seem advisable to discuss the older methods here. It is sufficient to state that the performance of them, as well as of a snare operation which we devised earlier, is beset with many uncertainties and complications.

As chief among these, haemorrhage may be mentioned, and this results from the difficulty of making the opening at the proper place and of right size, without unnecessary injury to the vessel walls. Another great drawback comes from the handling of scissors equipped with wires within a limited space and in a deep-seated area of operation, and the extreme tediousness of the operation itself.

If the haemorrhage can be controlled, the operation itself is rendered comparatively simple. The following experiments were directed to the overcoming of this difficulty.

\[1 \text{ The Journal of Experimental Medicine, 1905. vii 163.}\]
In order to determine the effects of clamping the vena portae and vena cava inferior, the following operations were performed.

No. 15, male, mongrel, 8 kilos weight. The portal vein was clamped by compression with soft-rubber tubing for two periods of ten minutes each, with one five-minute intermission. At the end of the experiment the pulse was 90, respiration 94, temperature 99.8° F. The abdomen was closed, the dog recovering as from an ordinary abdominal section.

No. 16, female, mongrel, 5 kilos weight. The same procedure was followed as in No. 15, except that both the portal vein and the inferior vena cava were clamped, the latter above the entrance of the renal vein, the former above the entrance of the splenic vein.

The results were the same as in No. 15. The pulse rate increased to 100, the respiration to 90, at one period. Perfect recovery followed closing the abdomen.

It was evident then that clamping the vena portae and vena cava inferior in this manner was followed by no serious consequences. We therefore proceeded to make the Eck fistula as follows:

An incision is made three inches downward from the juncture of the right costal border and the outer edge of the rectus muscle. The vessels are exposed by drawing the intestines toward the left side. A silk ligature is passed around the vena portae in the space between the bifurcation and the point of entrance into it of the vena pancreatico-duodenalis. This space is usually short, averaging from five to seven millimetres. It is sometimes difficult to locate the vena pancreatico-duodenalis.

The parietal peritoneum overlying the vena cava inferior is cut through and the vessel separated from its bed for one centimetre at two points: one being just above the point of entrance of the renal vein, the other three to five centimetres upwards toward the liver. Between these points one lumbar vein enters, which is tied. In some cases it is necessary to separate the cava from its bed between these two points in order to draw it near enough to the portal vein.

The vena portae is separated in like manner from the mesenteric envelopment, from the junction of the splenic vein below to that of the pancreatico-duodenalis above.
For controlling the blood current, two pieces of soft-rubber tubing, from five to eight millimetres in diameter and thirty-two centimetres long are used. Two pieces of glass rod of equal length can be easily slipped into each so that their point of contact is at the mid-point of the tube. One of the glass rods is slipped into one end of a tube, across the end of which a clamp is placed, while the other end of the tube is carried beneath the vena cava and vena portae just above the renal and splenic veins. The vessels are brought to lie opposite the middle of the tube. The second glass rod is then slipped in until it touches the first and a clamp is placed over the end of the tube to hold it. By approximating the outer ends of these rods the blood current is controlled and the vessels are held in close
apposition for the suturing. Another tube is placed in like manner just below the entrance of the vena pancreatico-duodenalis. The seat of operation in the veins is between these two clamps.

In order to make the first line of sutures elliptical, a temporary suture is placed midway between the clamps and at a point one-

fourth way around and between the veins, so that when traction on it is made this point will be drawn up. The suture passes through the wall of the portal vein and through the adventitia and media of the inferior cava. By pulling gently upon it and closing the clamps which are held by an assistant, a line of running sutures is inserted from one and a half to three centimetres long. This operation requires five to ten minutes. The
temporary suture is withdrawn and the clamps loosened. Five minutes is allowed for the congestion to be relieved, during which time two other temporary sutures, one at the mid-point on top of each vein, are placed.

The clamps are then closed. The temporary suture in each vessel is separately drawn so as to put the wall on a stretch between this point and the first line of sutures. A fine pair of scissors is then used to make a slit in each vessel from one to two and a half centimetres long. The two outer edges of these slits are sewed together by a running suture, after which the temporary sutures and clamps are removed.
Six dogs were operated on in this way, with the following results:

1. One dog showed a collateral circulation, and in this animal the portal vein had been tied by mistake distally to the point of entrance of the vena pancreatico-duodenalis. The collateral circulation consisted in an anastomosis between the pancreatico-duodenalis and the splenic vein. This dog suffered a series of interesting convulsions to be described elsewhere.

2. One dog died of a septic pneumonia following a secondary operation on the veins, in which an incision was made through stitch abscesses in the abdominal wall.
3. One dog died twelve hours after operation in coma. This dog recovered well from the anæsthetic, walked about, was catheterized, but gradually sank into coma. Autopsy showed a patulous fistula without thrombosis and with the portal vein ligatured.

4. Two dogs had convulsions following a meat diet. One died during these convulsions, the other became to all appearances normal and was killed for autopsy.

The first of these two showed a fistula one and a half centimetres, the second one centimetre, across. In neither had a collateral circulation developed.

5. The sixth dog is still living at this writing and is in good condition.

In order to prove the non-existence of collateral circulation, these dogs were injected through a canula placed in the inferior vena cava below the fistula, pointing toward the heart. A cut was made in each lobe of the liver and the inferior cava clamped above the liver.

The injected fluid, as was expected, came back and flowed out through the hepatic veins on the cut surfaces. The cava was then clamped between the fistula and the liver, and the injection continued. The fluid was now passing through the fistula into the portal circulation which was completely injected, but none appeared on the cut surfaces of the liver. Hence it was proven conclusively that no communication between the extra-hepatic and intra-hepatic portal circulation existed.

We were unable to demonstrate the collateral circulation described by v. Kaltreu in the ligamentum hepato-duodenale, and can see no reason for its formation provided the fistula be of sufficient size.

By the above described technique the haemorrhage attendant upon other methods is lessened, the operation is simplified, and the duration is shortened to from three-quarters of an hour to one hour.

The results of the operation are as good as, or better than, by the older methods. In my hands all the dogs survived the operation.
It is, of course, essential that the needles and suture material be of the finest compatible with the necessary strength, and that the operators adhere strictly to the usual precautions for an aseptic technique.

As has been noted, several of the dogs with fistulas exhibited symptoms very like those described by Pawlow, Nencki, and others. A chemical examination of the urine of these dogs was made by Drs. Macleod and Haskins. The results of these observations, and a discussion of the possible relationship of the convulsions to carbamate poisoning, as suggested by Nencki, will be published in the near future.

I am greatly indebted to Dr. J. J. R. Macleod for assistance and suggestions which he kindly extended to me. I wish also to express my thanks to Messrs. Haskins, Lewis, and Schultz, and to Messrs. Wilcox, Miller, and Cummer for various acts of assistance.