

THORACO-ABDOMINAL APPROACH FOR PORTACAVAL ANASTOMOSIS*

WITH A CASE REPORT OF PORTACAVAL SHUNT EMPLOYING THIS METHOD

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THE WORK OF BLAKEMORE and Lord,¹ Whipple,² and Blakemore,³ has established portacaval shunt as an effective means of treating portal hypertension in properly chosen cases. The indication for, the results of, and the problems attending this operation have recently been reviewed by Blakemore.⁴

The usual approach for portal vein shunt operations (portacaval or splenorenal), is through a wide transverse or an extensive left paramedian abdominal incision. By means of pressure readings of the various parts of the portal system, one can determine whether a portacaval or splenorenal anastomosis is indicated. In general, if either one can be used, as is the case in the intrahepatic block of cirrhosis of the liver, the portacaval shunt is the more desirable, since it offers a larger shunt.⁵ The difficulty with the portacaval procedure, however, lies in the fact that the exposure is hardly adequate, necessitating working in a small area under the costal cage, in a deep wound. For this reason many surgeons have been employing the less efficacious but easier splenorenal shunt in instances of intrahepatic block.

It occurred to the writer that a transthoracic, thoraco-abdominal approach to the hilum of the liver would not only give more direct access to the region and present the structures of the hilum and inferior vena cava more superficially but would permit freer mobilization of the liver by permitting its dislocation into the right thorax through the incised diaphragm. Moreover, by placing the patient in a true lateral position, with the right side up, the relationship of the common duct and hepatic artery to the portal vein could be altered from the surgeon's point of view; the portal vein would now be lying to one side instead of behind the above-named structures, thereby excluding the necessity of dissecting the common duct and hepatic artery in order to reach the portal vein. Finally, because of the better exposure and the freer mobilization of the tissues in this region, it would be possible to dissect out the portal vein beyond its point of bifurcation; the branches of the portal vein could therefore be tied and a greater length of the portal vein be preserved for its anastomosis to the inferior vena cava. Obviously, the added advantage of the greater mobilization of the portal vein lies in the fact that there is less danger of tension at the suture line. Then, too, by ligating the branches of the portal vein, the stump is reduced to a minimum, thereby reducing the possibility of an ascending thrombosis initiating in a blind venous pouch.

* Submitted for publication February, 1948.

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With these advantages in view, starting on January 17, 1948, six dogs were subjected to the thoraco-abdominal approach for portacaval anastomosis. In four dogs an incision was made along the course of the ninth rib, from the right lateral margin of the erector spinae muscles to the lateral border of the right rectus muscle. In two dogs the thoraco-abdominal approach was made through the eighth interspace. Either method can be used, depending on the individual surgeon's preference for rib resection or intercostal incision. It

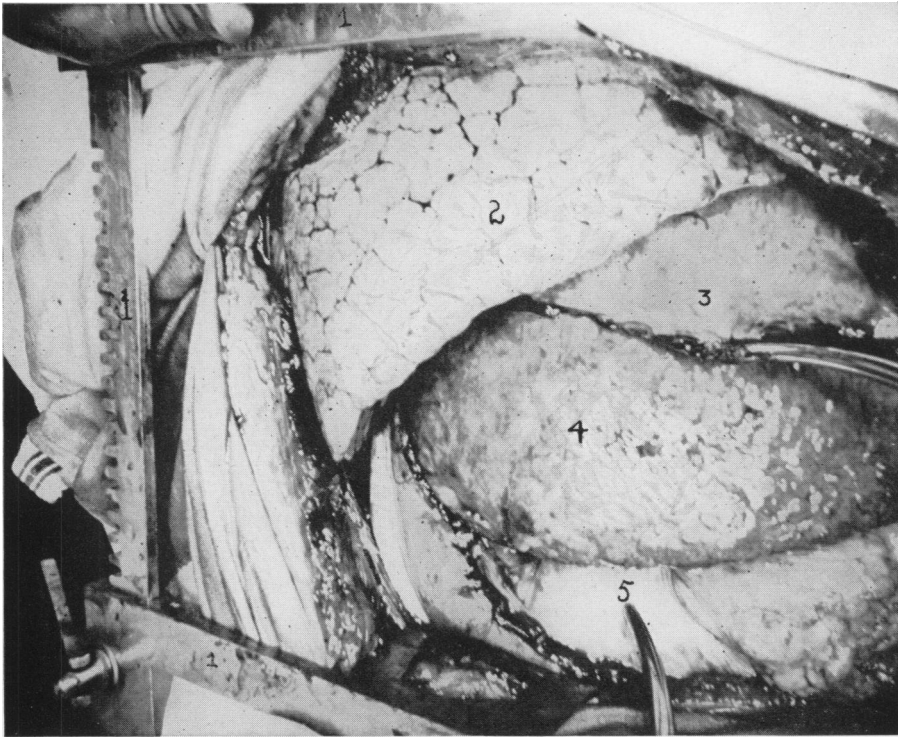


FIG. 1.—The exposure made possible by thoraco-abdominal approach: 1. Finochietto rib spreader between eighth and tenth ribs; 2. Lower lobe of the right lung; 3. Upper leaf of incised diaphragm; 4. Liver. Note marked cirrhosis; 5. Clamp points to lower leaf of severed diaphragm. The wound extends well to the right of area shown in this picture.

may be advisable in some instances to resect the eighth rib, depending on the size of the liver. In each dog the costal cage was opened under positive pressure anesthesia and the diaphragm incised along the line of the wound in the direction of its fibers. The incision was extended through the abdominal muscles to the lateral border of the right rectus muscle, and the peritoneum in this region was opened so as to unite the right hemi-thorax with the abdominal cavity. The intestines were packed away, and the hilum of the liver, the right kidney, the right adrenal gland and the inferior vena cava were easily exposed. The peritoneum over the inferior vena cava was incised and the inferior vena cava was mobilized from the renal vein to the point where it

passed under the liver. The portal vein was then approached; it was clearly discernible to the lateral side of the common duct and hepatic artery. The portal vein was mobilized along its entire length, up to the point where it enters the substance of the liver after branching. It was ligated beyond the point of bifurcation and transfixed by suture-ligature just at the point of bifurcation. The lower portion of the portal vein was compressed by means of a Blalock clamp. A clamp with a deep curve was then placed over the



FIG. 2.—Following retraction, the structures to be dealt with are exposed: 1. Inferior vena cava. Note strands of adventitia not yet dissected away; 2. Liver; 3. Portal vein; 4. Common duct pointed out by clamp.

right superior aspect of the inferior vena cava above the renal vein so that the passage of blood would not be obstructed during the anastomosis. A piece of vein between the clamp was excised so as to prevent closure of the aperture postoperatively. A direct end-to-side anastomosis between the portal vein and the inferior vena cava was successfully carried out in all six dogs by use of an everting suture, as described by Blalock,⁶ thereby effecting an intima to intima approximation of the vessels. No. 00000 braided black silk on an atraumatic needle was used.

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On January 28, 1948, this technic was employed on a 45-year-old male patient suffering from cirrhosis of the liver; he had experienced four episodes of nearly exsanguinating hemorrhage from rupture of esophageal varices, and at the time of operation exhibited a moderate degree of ascites. The operation



FIG. 3.—Completed posterior layer of anastomosis: 1. Stiles rubber-shod kidney clamp on inferior vena cava; 2. Blalock clamp; 3. Portal vein; 4. A forceps holding away anterior layer of portal vein. Note the intima-to-intima anastomosis of these vessels.

was performed under intratracheal cyclopropane anesthesia, with the patient lying on his left side in the true lateral position, supported by a sand bag under the left loin. The ninth rib was resected subperiosteally from its angle to the costochondral junction. The costochondral junction at this point was

cut through, connecting the right thorax with the abdomen. The diaphragm and the muscles were incised along the line of incision. Bleeders from the edges of the diaphragm were clamped and ligated. The intestines were packed away and, because of the posterior lateral exposure afforded by this approach, the need for resection of adhesions from a previous anterior abdominal operation was completely obviated. An excellent view of the hilum of the liver, the right kidney, and inferior vena cava was obtained. The peritoneum lateral to the inferior vena cava was incised. At this time the right adrenal gland was brought clearly into the field. The inferior vena cava was mobilized and vaselized umbilical tape was passed around it for better control of the vessel. Beginning laterally, so as to avoid injury to the common duct, the portal vein was then mobilized from its origin to beyond the point of its bifurcation. It was possible easily to mobilize the common duct along its entire length, suggesting the value of this approach for difficult hilar reparative surgery of the common duct. The hepatic artery did not come into view during the entire procedure. By means of a Lahey clamp, the right and left branches of the portal vein were dissected out, and double No. 24 cotton ligatures were passed around each. Vaselized umbilical tape was placed around the lower region of the portal vein, and a small tributary to the portal vein near the hilum of the liver was ligated and cut. The portal vein was then placed between the jaws of a Blalock clamp. At this time an attempt was made to take pressure readings of the portal vein but unfortunately the manometer system did not work satisfactorily. The Blalock clamp was then closed and the sutures which had been placed around the branches of the portal vein were tied. A transfixion suture-ligature of No. 24 cotton was then placed in the portal vein at the point of bifurcation. The portal vein was cut transversely between the ligatures and the Blalock clamp which had been placed well away from the transfixion ligature. By using the handle of the clamp for traction, mobilization of the portal vein circumferentially was easily performed down to the origin of the vessel. A Stille's rubber-shod kidney clamp was then placed on the inferior vena cava above the renals, as described in the discussion of the animal work.*

An incision was made longitudinally into the inferior vena cava for about 3 cm., corresponding to the width of the severed portal vein. A portion of the inferior vena cava was excised along the line of incision (approximately 2 mm. in the center and 1 mm. at the ends),* so as to preclude the possibility of postoperative spontaneous closure. The site selected for anastomosis insured against any possibility of angulation. A direct-end-to-side intima-to-intima anastomosis between the portal vein and inferior vena cava was then established by means of a running everting mattress suture. The suture was tied on the outside at one end and continued across the posterior layer to the opposite margin where a knot was again tied on the outside. These knots prevent pursestringing of the suture line. The anterior layer was likewise

* A special vena cava clamp and a curved long-handled scissor for excising a portion of the vein have since been devised. (They are manufactured by George P. Pilling and Son Company, Phila., Pa.)

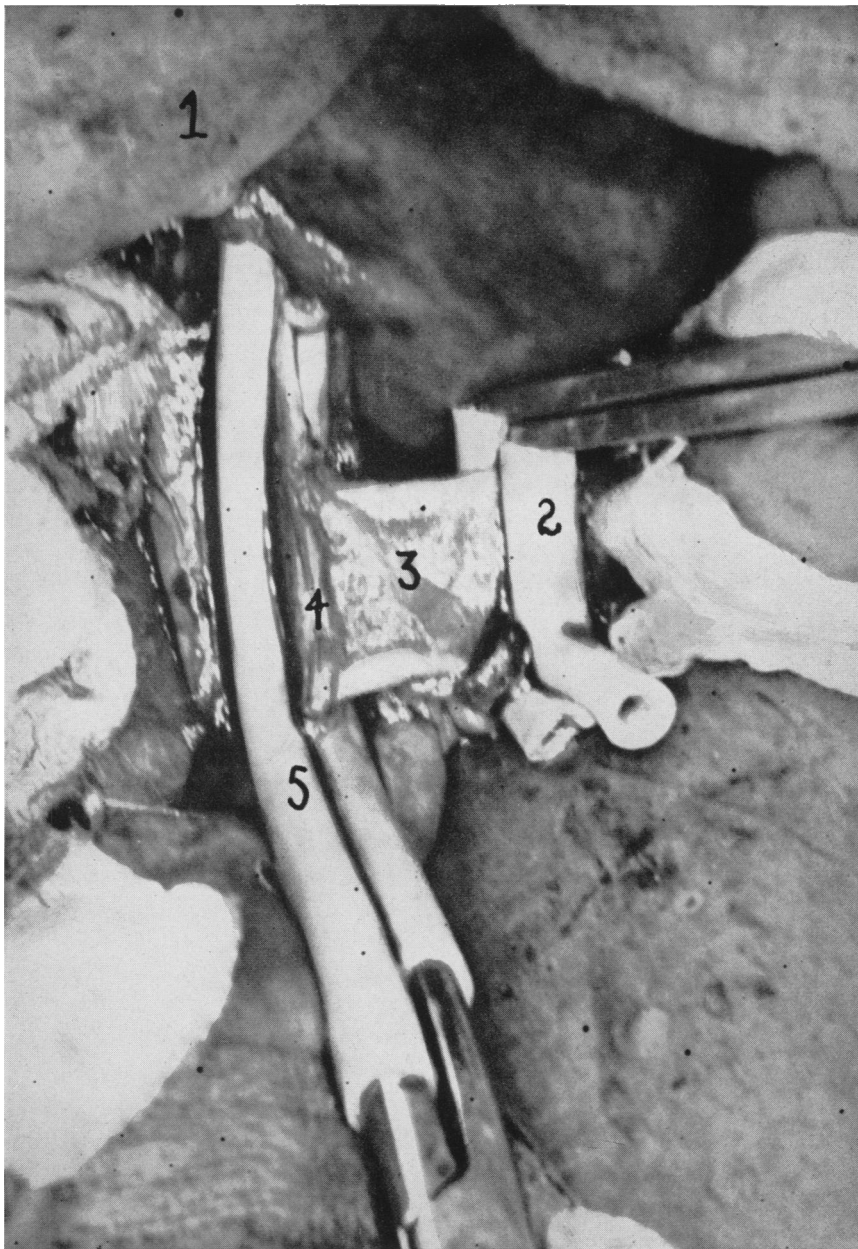


FIG. 4.—Completed anterior layer of anastomosis: 1. Liver; 2. Blalock clamp; 3. Portal vein; 4. Suture line; 5. Kidney clamp on inferior vena cava.

closed with an everting running mattress suture. A single tension suture was placed at each side of the anastomosis and one of the free ends of these sutures was tied to a free end of the anastomatic sutures. During the performance of the anastomosis, the accessible intima of both the inferior vena cava and portal veins were repeatedly irrigated with a heparin-saline mixture (one-half cc. heparin to a medicine glass full of saline), as suggested by Blakemore.⁷ With the good exposure afforded by this approach, the curve of the needle on the No. 00000 braided black silk proved to be most satisfactory.



FIG. 5.—Anastomosis shown after removal of clamps: 1. Liver; 2. Portal vein; 3. Suture line; 4. Inferior vena cava; 5. Clamp points to right renal vein entering inferior vena cava; 6. Right adrenal gland lies in this area.

After the completion of the anastomosis the Blalock clamp was released. There was slight leakage through the small apertures in the vessels made by the passage of the needle. In a few moments, however, the suture line became perfectly dry. The kidney clamp was then removed, and blood was seen to course through the portal vein up into the inferior vena cava very rapidly. The shunt was more than adequate, measuring approximately $2\frac{1}{2}$ cm. in

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diameter, and the strength of the one-layer suture line was put to visible test by the fact that with the patient lying on his left side maximum pull was exerted on the anastomosis by the weight of the intestines. A mixture of plasma and thrombin was injected into the region of the anastomosis. The rent in the posterior peritoneum was sutured. Fifty thousand units of penicillin was placed in the peritoneal cavity and another 50,000 units in the chest. The peritoneal cavity was closed. The diaphragm was repaired with interrupted imbricating mattress sutures, and the chest and abdomen were closed in layers. An intercostal drainage tube below the line of incision was placed in the chest and connected with a water-sealed drainage system. Cotton suture technic was employed throughout. Actual operative time was approximately four hours. The author feels quite sure, however, that in the future the portacaval shunt can be performed in well under three hours by means of this approach.

The severe portal hypertension that existed in this patient and the great speed with which the blood rushed through the anastomosis, coupled with the precaution of having excised a portion of the inferior vena cava before commencing the anastomosis gave assurance that the shunt would not close off. and argued against the need for postoperative parenteral administration of heparin.

Three pints of blood were used during the operation. Postoperatively, the patient was placed in the Trendelenburg position so as to prevent gravity drag on the portal vein; this was maintained for 48 hours, at which time it was felt that sufficient adhesion formation had fixed the portacaval anastomosis and the adjacent tissues in a favorable, tensionless position, and obviated the possibility of postoperative angulation due to variations in posture. The patient received parenteral fluids for three days and was permitted out of bed on the fourth postoperative day. A detailed account of the medical aspects of this case and the results obtained by this procedure will be reported in a future communication.

DISCUSSION

A direct anatomic approach to the hilar structures of the liver seemed a logical and necessary step if surgeons hope to advance and popularize surgical procedures on these structures. The writer felt, for instance, that portacaval anastomosis, physiologically valuable in the treatment of portal hypertension, was not taking its proper place because of a technically difficult and unbelievably time-consuming approach requiring from 7 to 12 hours by the abdominal route. The average physician hesitates to entrust a bad risk patient to the average surgeon for so traumatic a procedure. With the above described approach, however, portacaval anastomosis becomes a relatively simple operation, carrying no more technical difficulty than already mastered abdominal and thoracic operations.

An objection to the thoraco-abdominal approach may be raised by those who feel that it is imperative to obtain pressure readings of the portal system at the time of operation, and that a surgeon should be free to make a choice

between portacaval and splenorenal anastomosis. In most instances, a diagnosis usually can be made preoperatively or at a previous operation. However, the objections would be well taken were it not for the fact that in the thoraco-abdominal approach the abdominal portion of the incision could be made first, and pressure readings taken. If a splenorenal anastomosis is decided upon, the incision could be enlarged to the left side so as to permit adequate exposure for this procedure. If, on the other hand, a free choice exists, then by all means the larger portacaval shunt is desirable and could be performed more easily than the splenorenal shunt, by extending the incision over the costal cage. By means of the thoracoabdominal approach the portacaval anastomosis is certainly easier to perform than a splenorenal shunt, where often exsanguinating hemorrhage is encountered in dealing with an enlarged spleen complicated by perisplenitis and extensive collateral circulation. Moreover, the thoracoabdominal approach reduces to an absolute minimum the handling of bowel, and thereby avoids troublesome ileus.

Because of the excellent exposure of the entire length of the common duct, the approach described is strongly urged for reparative common duct surgery where reconstruction work must be carried out close to the hilum of the liver. It will also prove most useful for easy and complete exposure of the right adrenal and should result in a wider scope of activity in dealing with conditions involving this gland.

SUMMARY

A new approach for a portacaval anastomosis, common duct surgery, and right adrenal gland surgery has been described. The advantages of this transthoracic, thoraco-abdominal exposure are as follows:

1. The structures in the hepato-gastric omentum are approached from the lateral aspect, thereby presenting the portal vein to the side of the common duct and the hepatic artery.
2. The liver can be dislocated into the right hemi-thorax, since the diaphragm no longer restricts mobilization of the liver as it does in the abdominal approach.
3. Access to the hilum of the liver is simplified, enabling ligation of the right and left branches of the portal vein instead of the portal vein itself. High ligation not only affords a longer segment of portal vein for anastomosis but reduces the chances for thrombosis formation in a blind venous pouch.
4. Exposure is wide because of the free spread of the ribs and the free communication of the chest and abdominal cavities.
5. The liver hilum structures and the inferior vena cava are presented more superficially than when the patient is placed on his back.
6. With the patient lying on his left side the suture line supports its maximum tension, and dependability may be visualized at the time of operation.
7. Handling of the intestines is avoided, thereby reducing to a minimum postoperative ileus.
8. The troublesome venous collateral circulation is easily coped with by this direct exposure; more importantly, it is practically avoided.

9. By employing the thoraco-abdominal route, portacaval shunts will be favored over the less desirable splenorenal junctures, and will make for a less hazardous postoperative course since the use of heparin is scarcely called for with the larger portacaval anastomosis.

10. Pressure reading of the portal system can be taken at the time of operation simply by performing the abdominal portion of the thoraco-abdominal wound first.

11. Little chance for postoperative incisional hernia exists, since the abdominal portion of the wound constitutes a small part of the entire incision.

12. Excellent exposure is offered by this route both for reconstructive surgery of the common duct where the injury is close to the hilum of the liver and for right adrenal gland surgery.

CONCLUSIONS

The thoracoabdominal approach as described by the author and as successfully performed by him on a 45-year-old male patient with cirrhosis of the liver appears to be the procedure of choice in dealing with portacaval anastomosis, reconstruction of the common duct close to the hilum of the liver, and surgery of the right adrenal gland.

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The author would like to express his appreciation to Dr. Charles P. Bailey, Associate Professor of Thoracic Surgery, Hahnemann Medical College and Hospital, for his generous cooperation both in the animal and clinical aspects of this case; to Dr. William B. Likoff, who cared for the patient medically; to Dr. Hector Redondo and Miss Jean Fialka, R.N., for their assistance with the animal work; and to Dr. Arthur Blakemore of the Presbyterian Hospital, New York City, for his invaluable suggestions regarding the management of portacaval shunts.

The photographs presented in this article were taken by Dr. Charles P. Bailey and Miss Mildred Updite, R.N.