VITALLIUM TUBES IN BILIARY SURGERY*

HERMAN E. PEARSE, M.D.
ROCHESTER, N. Y.
FROM THE DEPARTMENT OF SURGERY, UNIVERSITY OF ROCHESTER, SCHOOL OF MEDICINE AND DENTISTRY, ROCHESTER, N. Y.

STRICTURE of the common bile duct may result from congenital atresia, ulceration from stones, or infection from septic cholangitis, but most often follows clamping, ligation, or excision of the duct during an operation for cholecystectomy. The presence of structural anomalies, the occurrence of unexpected hemorrhage deep in the wound, or the distortion of normal anatomic landmarks by infection are circumstances that may confuse even the most expert surgeon, and are likely to bewilder the operator who has not been schooled in common duct surgery.

Small strictures may be successfully treated by dilatation, division, excision, and end-to-end anastomosis, or by plastic repair to enlarge the lumen. These procedures are applicable only if normal tissue can be approximated without tension for otherwise reformation of the stricture occurs. An alternative method is by implantation of the hepatic or common duct into the stomach, duodenum, or jejunum which has the two possible faults of stricture formation at the site of the anastomosis and of ascending biliary infection from lack of the sphincter of Oddi.

Long strictures from extensive loss of the common duct create a very difficult problem which may appear insoluble when multiple operations fail to correct the defect. Three years ago such a condition was encountered in a young woman, the mother of five children, who on two occasions was asymptomatic with a rubber T-tube in the duct but who reformed a stricture shortly after its removal. This led to a trial of permanent intubation of the common duct with a Vitallium tube. The patient recovered completely and her transformation from chronic invalidism to useful living was so dramatic that it gave encouragement to try the method in others. The subject was presented[7] at the meeting of the Society of University Surgeons a year ago. Since then more information has accumulated from animal experimentation, dissection on cadavers, and clinical experience, especially with different uses for these tubes and with modification of their design. It appears desirable at this time to report these data and evaluate the use of Vitallium tubes in biliary surgery.

COMMON DUCT STRICTURES

The first Vitallium tube was made 4 cm. long, 6 Mm. wide in outside diameter with a central flange 6 Mm. high for an anchor which protrudes through the wall of the duct and prevents the tube from slipping out of place. No modification of the anchoring device has worked better than this simple flange and the only change that may be desirable is to shorten it to 4 Mm.,

* Read before the American Surgical Association, Cleveland, Ohio, April 6–8, 1942.

for sometimes it protrudes too far above the duct. Figure 1, No. 1, shows in a detailed sketch how a flat piece of metal is welded to the tube to make the anchor. This flange can be grasped with a curved clamp to allow manipulation of the tube in a deep wound (Fig. 1, No. 2), for without this it would be difficult to insert the tube into the ends of the bile duct. Figure 1, No. 3, shows how an unanchored tube may slip below the level of injury and allow reformation of a stricture. Loss of substance of the duct or fixation by scar tissue may make it difficult to bring the ends of the duct together over the tube to suture them in place. For this purpose, tension sutures pulled through the eye of the flange (Fig. 1, No. 4) can be used to hold the duct while doing the anastomosis. These can be removed after the suture line is completed or left in to take tension off the anastomosis if desired.

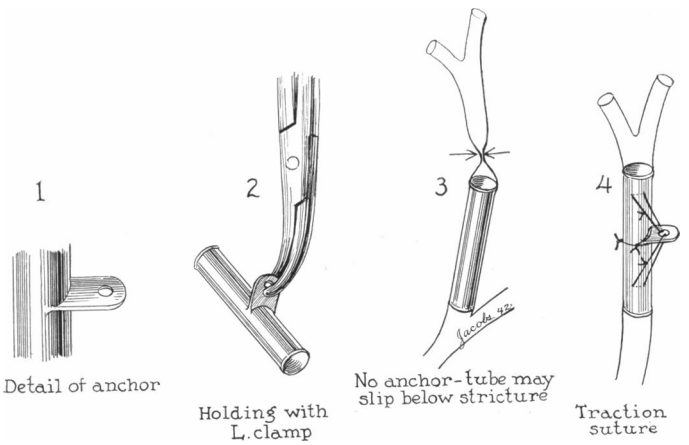

FIG. 1.—The flange on the Vitallium tube used to anchor it in place. (1) A detail sketch to show how a flat piece of metal is welded to the tube for an anchor. (2) Shows how the tube can be manipulated by a clamp grasping the flange. (3) A diagrammatic illustration of how an unanchored tube may slip down below a stricture, allowing it to reform. (4) Demonstrates the purpose of the eye in the flange for holding tension sutures while doing the anastomosis.

The majority of the cases which require permanent intubation of the bile duct have had previous operations for repair so the ends of the duct are bound together by scar tissue. This should not be excised. The normal duct should be opened above and below the stricture and the tube inserted (Fig. 2, Nos. 2 and 3). In this way the Vitallium tube holds open the strictured area and there is no danger of the ends of the duct slipping off the tube. When used for this purpose it was found that the length of the tube could be shortened from 4 cm. to 3.3 cm.

The standard 6 Mm. x 3.3 cm. tube was never designed for use in anastomosing the bile duct to the intestinal tract, in fact it was created to avoid that very thing and so preserve the function of the sphincter of Oddi. However, it has been used by others on several occasions for hepaticoduodenostomy (Fig. 2, No. 4), apparently to prevent stricture of the anastomosis. This is the only possible advantage of such use and even this may be vitiated

by the tendency of all tubes used in this way to pass into the gastro-intestinal tract.

Loss of part of the duct followed by infection and scar may leave the two ends fixed in widely separated positions. Attempts to bridge this gap by a Vitallium tube tied into each end of the duct have failed because of retraction of the duct off the ends of the tube. To overcome this, a straight tube 6 cm. long was made but it was so awkward to use that it was discarded. Perhaps a long tube bent in the center to accommodate the angulation of the ducts would work better, but this condition has been successfully treated in another way. The stump of the common hepatic duct is dissected free in the sulcus

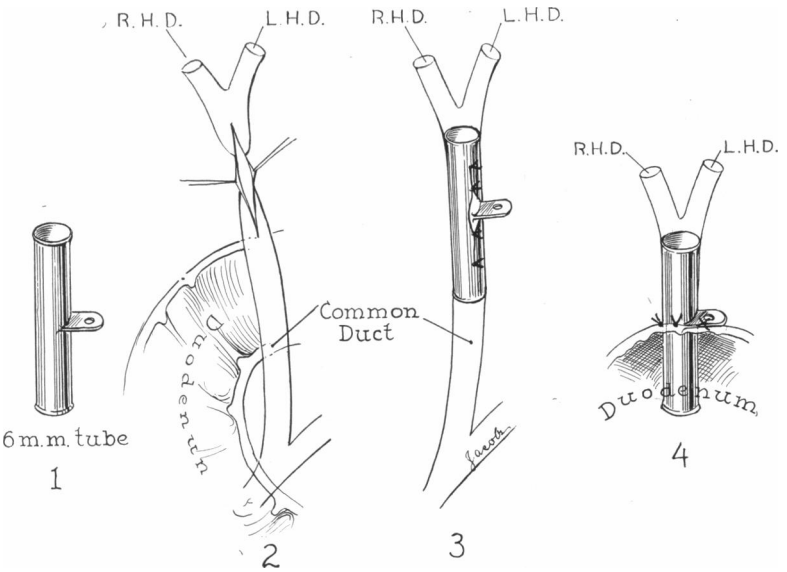

FIG. 2.—(1) The straight tube 3.3 cm. x 6 mm. (2) For holding open a strictured area the duct, the tube is slipped into the duct, which is then closed over it, leaving the anchor flange protruding through the suture line (3). (4) The use of this tube in hepaticoduodenostomy.

transversus of the liver and the common duct is searched for by freeing all tissue off the hepatic artery and portal vein. If it is not found, the duodenum is rolled out and down and the scar tissue beneath it carefully dissected and sectioned. In this way the common duct is usually found underneath the duodenum and so closely attached to it that it appears to be a part of the bowel wall. At this stage the gap may look to be irreparable but after both ends of the duct have been completely mobilized they can be brought together by pushing up on the duodenum and pancreas and pulling on the ends of the duct. End-to-end anastomosis under these circumstances is done under tension, and a stricture will usually form, so this is prevented by doing the anastomosis over a Vitallium tube. Another successful method is to use a rubber T-tube until all infection subsides and after two months reoperate upon the patient, remove the T-tube and insert a Vitallium tube.

COMMON HEPATIC DUCT STRICTURES

The anatomic nomenclature calls the common hepatic duct that part between the bifurcation of the right and left hepatic ducts and the junction of the cystic duct. That below the cystic duct is called the common bile duct. The studies of Nuboer[6] have shown that because of the anomalies of the cystic duct the common hepatic duct may vary from 0 to 5.8 cm. in length and the common bile duct from 3 to 9.5 cm. in length. Surgeons often speak of the common bile duct as that part which is exposed below the liver in the gastrohepatic omentum. This is logical, for treatment of this part is the same irrespective of the relation of the cystic duct. On the other hand, injury, or stricture, within 1 cm. of the bifurcation of the hepatic ducts creates distinct problems of management which are not present at a lower level. For the purpose of this discussion, these will be called common hepatic duct injuries or strictures.

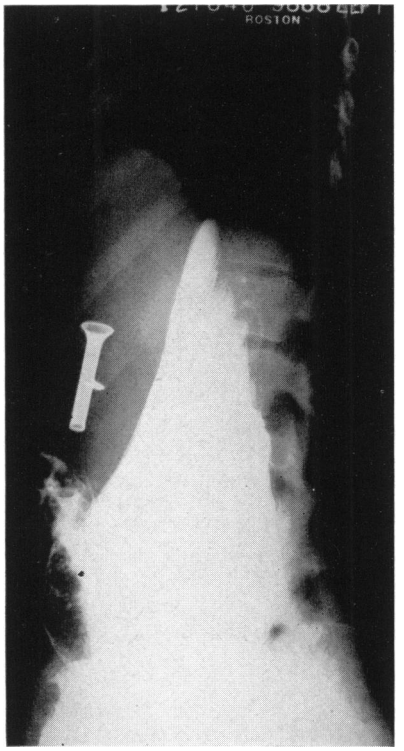

FIG. 3.—The trumpet-shaped tube used by Clute for a high stricture of the common hepatic duct is shown in a postoperative roentgenogram taken with barium filling the stomach.

Dr. Howard M. Clute first succeeded in curing a patient with only about one-eighth inch of common hepatic duct remaining after four unsuccessful operations. A Vitallium tube with a trumpet-shaped end (Fig. 3) was designed and inserted into the stump of the common hepatic duct so that it would act as a funnel for the bile from the right and left hepatic ducts. The lower end was placed in the common duct and an anastomosis done over the tube.

Some of the situations encountered in these high strictures of the common hepatic duct are shown in Figure 4. A complete external or internal fistula leading from the common hepatic duct (Fig. 4, No. 1) is usually associated with a closed functionless common duct which must be sought in scar tissue without any tract as a guide to it. The common hepatic duct has been found to empty into a bile-filled cavity (Fig. 4, No. 2) which communicated with an external fistula and the common duct. Nature may attempt to reconstruct the injured area by a long, narrow, constricted passage (Fig. 4, No. 3) through scar tissue. This channel may be no bigger than a string and yet carry enough bile to prevent severe jaundice.

Much thought has been given to the design of tubes for use in the hepatic duct strictures. The anterioposterior curvature of the ducts, the bifurcation

of the hepatic ducts so near the end of the common hepatic duct and the inaccessibility of these structures in the sulcus transversus of the liver create problems in technic that are difficult to overcome. The trumpet-shaped end of the tube (Fig. 4, No. 4) used by Clute does not enter either of the primary

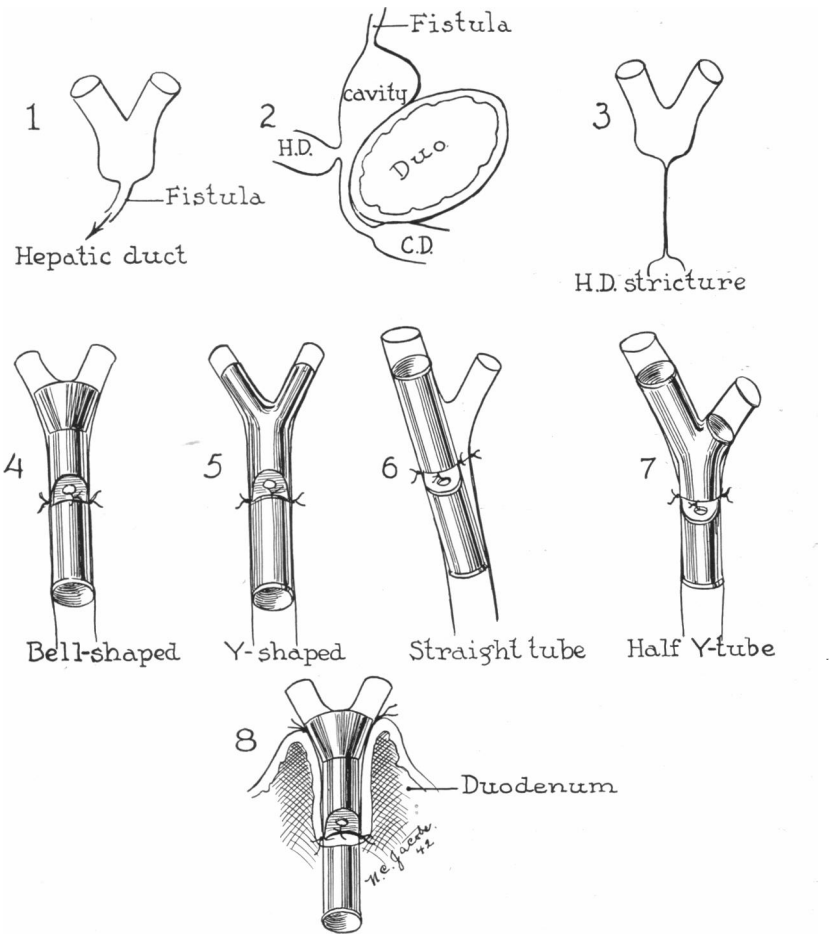

FIG. 4.—The conditions found in strictures of the upper common hepatic duct may include an external fistula (1) associated with a functionless common bile duct, a communication with a bile-filled cavity (2) which drains into a fistula and the common duct or, as in (3) a long thread-like channel joining the ends of the ducts.

In 4, 5, 6, and 7, are illustrated the tubes that have been used in high strictures of the common hepatic duct. Here, the inaccessible bifurcation of the hepatic ducts close to the stricture in a short stump of the common hepatic duct creates mechanical problems of management. Zinninger used the bell- or trumpet-shaped tube for hepaticoduodenostomy (8) when the end of the common duct could not be found.

hepatic ducts so has little to hold it in place. If it is unstable and slips away from the hepatic ducts, it may not drain their bile. To overcome this, a Y-shaped tube (Fig. 4, No. 5) was made with 4 Mm. openings at the two proximal ends. Even so, the distance across the two limbs of the Y is 1.3 cm., in contrast to the 1 cm. width of the funnel on the trumpet-shaped tube. The right and left hepatic ducts meet at an angle which varies between 80° and

90°, so the limbs of the Y cannot be brought much closer than this, yet it is difficult to insert them through the stump of the common hepatic duct when they are this far apart. If the hepatic ducts are not too deeply buried in the liver, one or the other can be visualized and slit up the outer side to give room for inserting the Y-tube. In one patient neither the trumpet-shaped nor Y-tube could be inserted so a straight 6 Mm. tube was put up the right hepatic duct (Fig. 4, No. 6) for want of anything better to do. After operation the

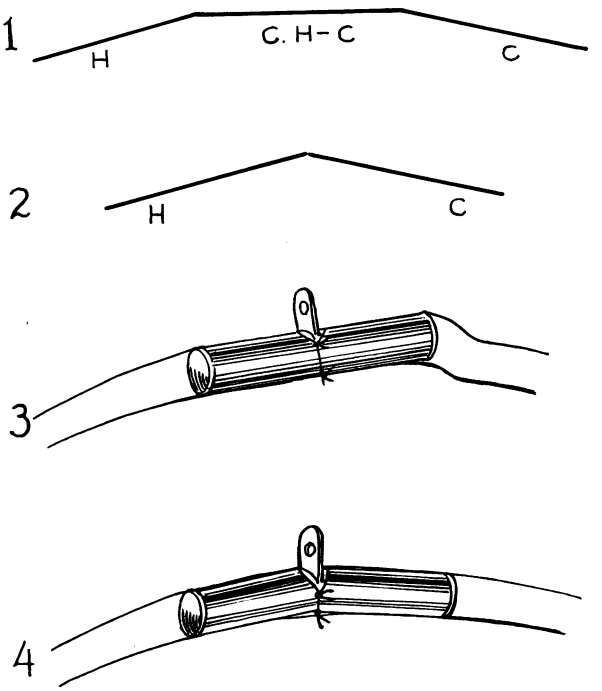

FIG. 5.—(1) The diagrammatic representation of the angulation of the ducts where the hepatic ducts have an anterior inclination, the distal common duct a posterior declination, and the central part of the common hepatic and common bile ducts and horizontal. If this middle part is destroyed (2) then the upper and lower part of the ducts come together at an obtuse angle of about 170°. This causes a straight tube to tip up at one end (3), and may cause pressure necrosis or kinking of the duct. To avoid this a tube has been designed with a bend forming a 170° angle, which will be most useful in the high common-hepatic duct strictures.

left lobe of the liver enlarged, then shrunk and though it may become cirrhotic, yet the patient is well without any signs of hepatic insufficiency. This led to the design of the tube shown in Fig. 4, No. 7, which is essentially a half Y for one limb is cut off. Instead of this, one might have only a hole on the left side so the bile from the left hepatic duct could get into the tube, but unless this opening was accurately placed over the orifice of the duct it would not serve its purpose. Exact placement might be difficult to do by sense of touch so it was thought desirable to have a short stub on the left side to indicate when it was in the correct position. Zinninger[10] describes the anastomosis, shown in Fig. 4, No. 8, in a case where no remnant of the common

bile duct could be found. The trumpet-shaped tube was used for hepatico-duodenostomy and this anastomosis secured by rolling the duodenal wall up onto the hepatic ducts.

A straight tube inserted into the hepatic ducts above and the common duct below tends to tilt up at one or the other end. This is due to the slight anterior inclination of the hepatic ducts and the posterior direction of the common duct which is shown in Figure 5. The diagram in Figure 5, No. 1, shows the central part of the common hepatic and common ducts to be horizontal. If this is destroyed so that the proximal hepatic duct is joined to the distal common duct, an obtuse angle is formed. No information could be found in the literature on this,* but measurements taken at operation and on the cadaver showed this angle to be about 170°, or a deviation of 10° from

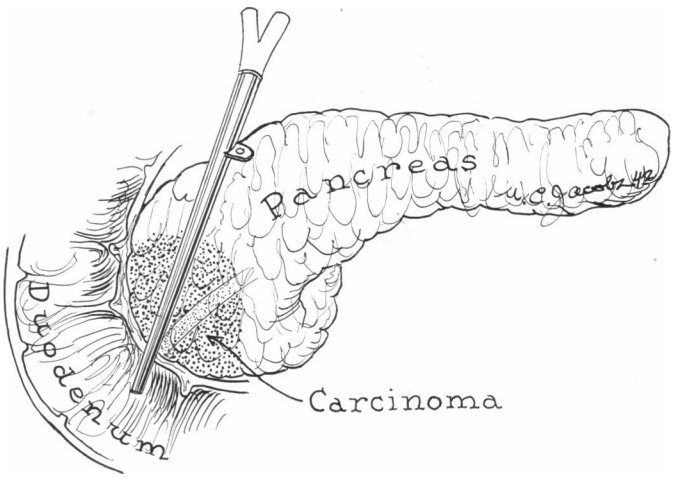

FIG. 6.—An 8 cm.-tube which tapers from 6 to 4 mm. in diameter is illustrated. For use in the palliative treatment of occlusion of the bile duct from carcinoma. This might be used instead of cholecystogastrostomy.

the horizontal. To prevent the tilting of the straight tube shown in Figure 5, No. 3, efforts were made to manufacture a curved tube. Vitallium is a very hard alloy which cannot be bent, molded, or machined but must be cast. Curving the tube prevented polishing it around the bend on the inside, so finally the manufacturer suggested welding two pieces of straight tubing together at an angle of 170°, as shown in Figure 5, No. 4. It is expected that all tubes designed for treating strictures of the proximal common hepatic duct will have this anteroposterior angulation. But this raises the question of where to put the bend, for it should come at the site of the anastomosis yet the stump of the common hepatic duct may be as short as 3 or 4 Mm. or as long as 1.5 cm. in different cases. The bifurcation of the hepatic ducts fixes the position of the tube above and the length of the common hepatic duct determines the location of the anchor flange and bend below. A rigid tube cannot be altered to conform to the different distances between these points in different cases so an average length will have to be used. It would appear

* I find that Dr. D. B. Pheiffer of Philadelphia has described this angulation.

that a length of 1 cm. from the lower part of the bifurcation of the tube to the bend and anchor would meet the needs of most cases.

MALIGNANT STRICTURES

Vitallium tubes have been considered for use in the palliative treatment of malignant occlusion of the bile ducts. The only one that has been made was intended for obstruction from carcinoma of the head of the pancreas. This tube was made 8 cm. long for the average combined length of the common hepatic duct (3.3 cm.) and the common bile duct (6.3 cm.) is 9.6 cm. The tube need not go far up into the common hepatic duct so a length of 8 cm. should permit intubation of the duct into the duodenum. The anchor flange was placed 2 cm. from the upper end where the diameter of the tube is 6 Mm. From this point the tube tapers to 4 Mm. (Fig. 6) to allow insertion through a carcinomatous stricture.

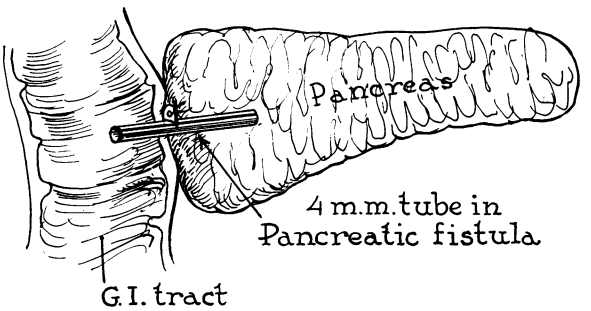

FIG. 7.—A 4 mm.-Vitallium tube is shown inserted into the pancreatic duct for repair of a pancreatic fistula following resection of the head of the pancreas for carcinoma. This method, used successfully by Zinninger, suggests the need of tubes with one short end for implantation into the gastro-intestinal tract.

PANCREATIC FISTULA

A straight Vitallium tube, 4 Mm. in diameter, has been used to close an external pancreatic fistula. The case report sent to me by Zinninger[10] is as follows:

Case Report.—A male, age 62, presented signs, symptoms, and laboratory findings of complete obstructive jaundice from periampullary carcinoma. On October 31, 1939, a first-stage modified Whipple operation was performed. On December 9, 1939, the duodenum and the head of the pancreas were resected for adenocarcinoma of the ampulla of Vater. A pancreatic fistula developed. Every time the fistula closed the patient developed chills and fever, and the fistula had to be reopened. On May 1, 1941, the fistula was traced to the pancreatic stump; one end of the Vitallium tube was inserted into the pancreatic duct (Fig. 7) and the other end implanted into the stomach. The patient's general condition promptly improved. The wound healed by May 19, 1941, and has remained healed ever since.

The use of Vitallium tubes has been thought of in connection with the treatment of some types of hydrocephalus, the repair of ureteral and urethral strictures, and the reconstruction of the vas deferens and fallopian tubes but they have never been reported as used for these purposes.

Discussion.—The question is often asked, what reaction will be caused in the tissues by the presence of Vitallium tubes? Thus far, there is information from only one human case obtained by reoperation, where it was found that little or no reactive inflammation existed. Additional data was sought by means of animal experimentation. Vitallium tubes placed in the common bile duct of dogs remained patent without erosion of the metal or deposition of pigment or salts on them. Most important of all was the absence of reactive change in the mucosa lining of the duct for this would indicate good tolerance of the tissues to the metal. A section of one of these ducts was illustrated in a previous paper.[7] The mucosa was never found to grow inside the tube so one must depend upon the bare metal for the conduction of the bile. Vitallium is an alloy of cobalt, chromium, and molybdenum which has been found to be inert in bone,[8, 9] joints,[4] and the brain[1, 3] so the absence of reaction in the bile ducts is not surprising.

A review of the various methods of treating injuries or strictures of the bile ducts is not presented, for this audience is already familiar with them and the reviews of Kehr[5] and Eliot[2] have discussed them in detail. It is expected that Vitallium tubes will only be used in biliary surgery where extensive damage has occurred and where other methods have failed, for otherwise their indiscriminate use may result in disappointment or even discredit of the method.

SUMMARY

(1) Injury to the bile ducts which was irreparable by other methods has been successfully treated by the permanent implantation of a Vitallium tube.

(2) A straight 3.3 cm. x 6 Mm. tube with a central flange to anchor it in place is most useful to hold open a strictured area of the common bile duct.

(3) Loss of a part of the common duct is best repaired by approximating the ends over a Vitallium tube even if tension must be used. This will hold the ends of the duct together and the tube will prevent occlusion by stricture. It may be dangerous to bridge a gap by tying the tube into the ends of the duct for it may slip out of place.

(4) Injury or stricture of the common hepatic duct within 1 cm. of the bifurcation of the hepatic ducts produces mechanical problems that require special designs to meet them. For this purpose tubes with trumpet-, Y-, and half Y-shaped ends have been made.

(5) Vitallium tubes have been used for the repair of a pancreatic fistula and one has been designed for the palliative intubation of malignant occlusion of the bile ducts. Other uses for these tubes such as in the brain and genito-urinary tract have been considered.

BIBLIOGRAPHY

[1] Beck, C. S.: Repair of Defects in Skull by Ready Made Vitallium Plates. J.A.M.A., **118**, 798, 1942.

[2] Elliot, Ellsworth, Jr.: Benign Cicatricial Strictures of the Bile Ducts. ANNALS OF SURGERY, **104**, 668, 1936.

[3] Geib, W. S.: Vitallium Skull Plates. J.A.M.A., **117**, 8, 1941.
[4] Hopkins, H. H., and Zuck, F. H.: Arthroplasty of Hip with Use of Vitallium Cup. Med. Bull. Vet. Admin., **15**, 1, 1938.
[5] Kehr, H.: Chirurgie der Gallenwege. Neue Deutsche Chir., **8**, 723, 1913.
[6] Nuboer, J. F.: Studien über das Extrahepatische Gallenwegesystem. Frankfurter Zeitf. Path., **41**, 198, 1931.
[7] Pearse, H. E.: Benign Stricture of the Bile Ducts Treated with a Vitallium Tube. Surgery, **10**, 37, 1941.
[8] Venable, C. S.: Stuck, W. G., and Beach, A.: Effects on Bone of the Presence of Metals: Based upon Electrolysis: Experimental Study. ANNALS OF SURGERY, **105**, 917, 1937.
[9] Venable, C. S.: Electrolysis Controlling Factor in Use of Metals in Treating Fractures. J.A.M.A., **111**, 1349, 1938.
[10] Zinninger, M. M.: Personal communication.

DISCUSSION.—DR. HOWARD M. CLUTE (Boston, Mass.): I think Doctor Pearse's work marks a new step, a new era, if you like, in the management of bile duct strictures, which we all know have been one of the most difficult problems which have faced surgeons, and I think it also is significant because it shows us that in the cavity of the body we may put in this metal and have it stay there for a long time without any material change in the viscus in which it lies. It opens possibilities perhaps for the use of Vitallium in many places in the body other than the common bile duct.

For example, in my hospital the urologist has used a Vitallium tube in the perineal urethra, which constantly strictured following amputation of the penis, and he has been able to have a Vitallium tube fitted into that—which has been used successfully and satisfactorily.

The laryngologist has had a mold made to use in the stricture of the larynx, which he was trying to treat with skin grafts, and hopes to overcome the stricture.

My personal experience with Vitallium tubes is limited to a case conducted by my associate, Doctor Albright, about two weeks ago, in which I helped.

There is another case of a friend of mine that I advised, Doctor Hedisheimer, of New Bedford. Doctor Hedisheimer's case has gone on for some five months now. Doctor Albright's is very recent.

Then there is the other case that Doctor Pearse mentioned, the case I cared for myself. I would like to show the lantern slides of that, if I may. This lady had had four previous operations, starting with her original cholecystectomy and injury to the common duct, and three other operations to repair this, two of which I had performed, the fourth operation, the last one that I did being a cholecystohepaticoduodenostomy. In six or eight months this failed to function any further, and we finally reoperated upon her for the fifth time, after learning from Doctor Pearse of these tubes.

This is more or less the picture that we found after we had separated the duodenum from the common duct. We found complete absence of the common duct in this area. The picture does not show it but we catheterized the common duct through the ampulla of Vater, and that helped in finding this at the distal end, which by no means is as clear as the artist has drawn.

The tube we used was a funnel-shaped affair which we had made, because we knew, from three previous excursions into this area, that this stricture was deeply into the liver and we would have a very difficult time to hold anything in it. The funnel-shaped tube was then put in the liver, the other end over here. The surrounding tissue was laid around it as well as we could. Silk sutures were put here in this very dense fiber that remained in the common hepatic duct. I think it was good fortune that in the 16 months past, since this operation the tube has not slipped out. However, it is to be noted, it seems to me, that in this case we had a gap larger than the artist shows, in my recollection three-quarters of an inch, in which there was no common bile duct at all. If the gap had not been here, I agree with Doctor Pearse that it would have been very much to our advantage to approximate the ends, and this no doubt could have been done if one freed the duodenum and freed the hepatic duct.

This is a slide similar to the one Doctor Pearse showed you, but taken some six months after the operation, when the patient had an attack of pain and a slight jaundice,

and I was afraid that something had happened, but it cleared up in a matter of two days. We took this picture just to see whether the tube was where it should be, and it was.

The last slide shows the various tubes I got from Doctor Pearse and some we had, for your observation of the types that have been made. Doctor Pearse has enlarged on these since then. Though it is apparent that this tube can be used to replace absent common duct and that it will last for a long time, and I believe from this case at least that you can have the common duct absent over quite a distance and not pull the two ends of the duct together, as Doctor Pearse recommends and as we recommend, and still have it go on, there is more danger, of course, that the tube may fall out.

I think there is a great advantage, and it is to be emphasized, that you should have the distal end of the common duct toward the distal end of the tube if possible, as Doctor Pearse has said, because in that way you preserve the sphincter of Oddi, and which is of great advantage. In fact, I think it is of such advantage that in Doctor Albright's case I could not find the distal duct and urged him to open the duodenum and find it from within, and having opened the duodenum we found it.

It seems to me that these tubes can be used in biliary strictures of certain kinds. Certainly, I believe they have an advantage over any such procedure as transplantation of external biliary fistula, which carries such a high percentage of failures. I think they are preferable to rubber tubes, even with the slight knowledge we have, and are very valuable when one can use them with the preservation of the sphincter of Oddi, as in these instances.

DR. EUGENE W. ROCKEY (Portland, Ore.): Not knowing of Doctor Pearse's work, some three years ago, I attempted a somewhat similar series of experiments on dogs, using several different substances, and finally settled on metallic magnesium. I found that with those dogs there was no irritation of the gallbladder wall when the tube was implanted into it, and that I got the tubes of the thickness so that they would last from eight to 12 weeks. There was no bile deposited in these tubes.

I then implanted such tubes in two humans. The tube did not have the advantage of the lateral flange which Doctor Pearse had, and in one case the tube slipped down into the duodenum. That was an implantation in the duodenum.

I was about to publish this experience and got a new lot of metallic magnesium tubes from the Dow Chemical Company. I planted those in the dogs' gallbladders and had the misfortune to find that bile salts were deposited on the tubes, which had not been the case originally. I sent the magnesium back to have it analyzed and find whether it was pure magnesium or had some alloy in it which was irritating.

The Vitallium tube apparently has a distinct advantage over the metallic magnesium which I have been using, but I am sure there is a very great need for such a bridge for a stricture of the biliary duct.

DR. WALTER G. MADDOCK (Ann Arbor, Mich.): About a year ago, I first heard of Doctor Pearse's work with the use of this tube, and he supplied two for us to use. I have had the opportunity of trying them on two patients.

The first one, about 11 months ago, came in with a history of multiple previous operations for obstruction to the common duct. This patient had a T-tube in place, and I simply took the T-tube out and slipped the Vitallium tube into the site of it, and it seemed to fit nicely in that direction and did not move up and down. This patient has gone ten months without any difficulty as far as the obstruction is concerned. During the past month, however, she has begun to have attacks of chills and fever and jaundice. It may be that she will get over it, as Doctor Clute's case did, but I am much concerned about the situation, and I feel that something subsequent may be necessary.

A month ago I had a chance to use the tube again on a much similar case, with previous history of operations upon the common duct because of stricture occurring postoperatively. At this time a rubber T-tube was in place. The common duct was cleared downward, but the approach to the hepatic ducts was not as wide-open as I would have liked it. I could not get a uterine sound up that section very well. A small probe, however, did pass. The patient had requested, however, to dispense with the rubber tube, if possible, so I slipped one of these Vitallium tubes into place with-

out disturbing the site of it very much. That patient has not done well. She is having chills and fever, and has had intermittent jaundice on two occasions.

I think this is just an addition to the experience with these Vitallium tubes, and fear that my two cases are going to require some further type of treatment. I do not know what it is going to be.

DR. LEO ELOESSER (San Francisco, Calif.): Just two short points of technic. In a man who had had a very complicated history, including fistula between his transverse colon and his gallbladder, a bleeding duodenal ulcer, and several other complications, an obstructive biliary cirrhosis ensued, with an intermittent obstruction, sometimes on his right and sometimes on his left. In the first attempt to overcome this obstruction, finding a very tight duodenum and having had a bleeding ulcer to deal with, we did a hepaticoduodenostomy and anastomosed the open stump of the duodenum to the hepatic junction. That gave a very wide union between the hepatic junction and duodenum, but the wide union still was not sufficient to overcome the strictures which reformed in the hepatic duct.

I used one of Doctor Pearse's tubes and slipped it into the right duct, but I was confronted with the same situation that he delineated on the second line of his third slide, I think, the last one to the left, in which there was a little button projecing, as it were, as a flange from the side of the tube, because the situation of the duct was such that it would have been quite impossible to introduce a Y-shaped tube. I questioned in that case whether it would be feasible, although I had none at hand, to make a tube with a clip joint, as it were, so that it would be possible to introduce one branch of the Y and then snap the other branch Y into the other hand of the hepatic ducts.

The patient, to whom I refer, died five days after his operation of secondary rupture of his wound and pneumonia. We obtained the specimen, and the tube was in place. There was no effect of the tube on the surrounding tissues and no erosion, and the tissues were perfect in reaction.

DR. HERMAN E. PEARSE (closing): One word about bridging the gap. We have attempted to do this by a longer tube, long enough to prevent the ducts retracting off. The disadvantage was the tilting of the tube, and when a straight tube, 6 cm. long, was made, it was too awkward to be of any use. Now that we have a method of making an angulated tube, it may be possible to devise one long enough to bridge an extensive gap.

I was very much interested in Doctor Rockey's comments, because I am at present contemplating some experiments with Dow metal for an entirely different purpose. Men who have been wounded in aircraft combat, who had fragments of magnesium in their tissues, have been found to develop an extreme fibroplasia about metallic magnesium, so much so that Doctor Walters has been able, experimentally, to shut off the ureter by encircling it with a clip of Dow metal. I was interested in this as another possible means of gradually occluding large arteries by fibroplasia.

It is interesting that magnesium in the biliary system did not produce this fibroplastic reaction.

Of the two patients mentioned by Doctor Maddock, the latter one might well be reoperated upon, perhaps, with the insertion of a tube above the hepatic stricture. We have had one instance of recurrent chills, fever, and jaundice in a patient one year after intubation, in which we suspected occlusion of the tube from cholesterol. We gave her sodium taurocholate and these symptoms disappeared.

Also, one must remember that these patients have had a long history of liver infection and some of their postoperative difficulty may be due to hepatitis.