

RESULTS FROM USING VITALLIUM TUBES IN BILIARY SURGERY*

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ANY SURGEON who has treated extensive injury of the common bile duct is well aware of the tendency to recurrent stricture formation with jaundice, cholangitis, and liver damage. These strictures do not respond, as do some smaller ones, to dilatation, plastic repair, or excision with end-to-end anastomosis of the duct. Attempts to implant a biliary fistula failed. Anastomosis of the bile duct to the duodenum was done, but the results were poor, for in Eliot's⁸ review of 68 cases, only 16 (23 per cent) were successful.

Badly damaged or excised bile ducts were repaired by end-to-end anastomosis over a Vitallium† tube, hoping in this way to preserve their continuity and to prevent reformation of the stricture. This was first done on February 26, 1940, the method was reported^{17, 18} and the tubes were made available for the use of other surgeons. I was only interested in their design, so the manufacture, distribution, and sale were carried on by the Austenal Laboratories, makers of Vitallium, who have marketed the tubes through surgical instrument dealers. Thus, there was no way of my knowing who had used them and what the results had been. It was decided to write the members of the American Surgical Association, not only to seek their experience, but also to ask the names of any other surgeons that they might have known who had used the tubes. The response was very gratifying, for, with but few exceptions, replies were received and necessary data given in spite of the press of extra work both in civil and military life due to the war. I am very grateful for this.

The data received combined with that from personal experience allowed the study of 229 cases. Of these, 13 were excluded because they did not give the information pertinent to this study. In ten of these the patient died in the hospital soon after operation, and in three cases it was found that the tube had not been placed in the bile ducts.

REPAIR OF THE COMMON BILE DUCT

There were 106 cases in which a Vitallium tube was used to repair a damaged or excised common bile duct. Some of these were very extensive injuries involving loss from just below the bifurcation of the hepatic ducts to just above the pancreas. The results are shown in Table I.

In such a serious condition often preceded by multiple operations where the best previous score was 23 per cent⁸ this figure of 80.1 per cent good results is encouraging. It will be noted that one cause of failure was from bridging a gap with the tube by tying its ends into the ends of the bile duct. These

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† "The word Vitallium is a registered trade-mark of Austenal Laboratories, Inc."

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cases failed, for sooner or later the tube slipped. Bridging a gap is unnecessary, for even with wide separation it is possible to mobilize the duodenum and pancreas and suture the ends of the duct together over the tube. Final success depends upon accurate end-to-end anastomosis even if done under some tension. The tube holds this open and prevents stricture during healing.

TABLE I

RESULTS FROM USING A VITALLIUM TUBE IN 106 CASES OF REPAIR OF THE COMMON DUCT

Good	83 cases
Good, but tube passed	2 cases
	—
Total—good results	85 cases—80.1%
Doubtful	1 case
Poor—tube plugged	12 cases—11.3%
Poor—bridged a gap	7 cases
Poor—tube slipped	1 case
	—
Total	106 cases

The finding of poor results in 12 cases (11.3 per cent) due to plugging of the tube is more disturbing, for it is not so easily remedied. Many of these patients have infection which increases the tendency to deposition of sediment. I have had this material analyzed on three occasions through the coöperation of Drs. S. H. Bassett and H. E. VanAlstyne.

January 21, 1944	Lipids (cholesterol)	0.1664 Gm. (38%)
	Insoluble*	0.2655 Gm.
March 24, 1945	Lipids (cholesterol)	0.1619 Gm. (36%)
	Insoluble*	0.2881 Gm.
October 23, 1945	Lipids (cholesterol)	0.146 Gm. (56%)
	Insoluble*	0.114 Gm.

* Only from 0.0015 Gm. to 0.0075 Gm. of calcium could be extracted from the insoluble fraction. The remainder appeared to be bile pigment.

This level (36 per cent-56 per cent) of cholesterol is disappointing for it is the only soluble constituent. It has been our custom to give sodium taurocholate at intervals postoperatively in the belief that the solubility of cholesterol was increased. Sodium dehydrocholate also does this, but ox bile (U.S.P. 45 per cent cholic acid) is not so effective.

My personal experience with plugging of the tube has turned out fortunately, for information of value has been obtained. It was found that there had been restoration of normal mucosa, appearance and caliber, so the plugged tubes were removed and the ducts closed.

CASE REPORTS

Case 1.—No. 171848: E. H., a 54-year-old diabetic female. First operation elsewhere, May 22, 1940, for acute cholecystitis. Jaundice, chills, and fever developed in three months. Second operation, May 29, 1941, dilatation of stricture of bile duct and removal of stones. Jaundice returned in three months. Third operation, October 1, 1941, I found a

stricture of the common hepatic duct about 1.5 cm. long that was "so dense that the smallest probe had to be forced through it." Stricture excised and duct sutured over a Vitallium tube with relief for over two years, when jaundice returned. Fourth operation, December 24, 1943. The plugged Vitallium tube was removed. "To the operator's amazement, it was found that the duct would admit a No. 18 catheter easily, and that the lining of the duct was smooth, velvety mucosa which was perfectly normal in appearance." The opening in the duct was closed and uneventful recovery followed. Last follow-up on January 31, 1946 (25 months postoperatively) "The patient's condition is excellent."

Case 2.—No. 186570: A. B., a 33-year-old female had a cholecystectomy elsewhere, November 11, 1941, at which time hemorrhage occurred and the bile duct was opened. It was drained. She had attacks of pain and jaundice after operation. At the second operation, January 22, 1942, the hepatic duct, just below the bifurcation, entered an extrabiliary cavity that connected with the stump of the common duct which was present for one-half-inch above the pancreas. These ducts were freshened and sutured end-to-end over a Vitallium tube. Her condition was satisfactory until August, 1945, when pain and jaundice returned. The third operation was done, October 10, 1945, to remove a plugged Vitallium tube. The site of the anastomosis was covered with mucosa and admitted a 7-mm. dilator so the opening in the duct was sutured and a cigarette drain was placed in the subhepatic space. One episode of upper abdominal pain without jaundice occurred two months postoperatively, the cause of which was not determined. Since then she has remained well.

This is a very encouraging result, for if a severely damaged duct will reconstitute a normal caliber and mucosa, it will not matter if some tubes plug. They will have served their purpose.

The most trying technical problem in the secondary repair of a severed duct is to find the lower end after it has retracted and become buried in scar tissue. Lahey¹¹ has described a method of doing this by mobilizing the duodenum and locating the lower end of the common duct on the undersurface of the pancreas. This maneuver permitted identification of the duct in one of my cases. In all the others it could not be found in this way and was only located by careful, patient dissection in the scar just above the duodenum. But dissection in this region may jeopardize the portal vein, and in two cases I have entered this vessel, fortunately with successful suture in each.

In the hope of getting more exact information on how to locate the distal end of the duct, 18 cadavers were dissected, with the assistance of Dr. C. E. Tobin, of the Department of Anatomy. In all 18 subjects the lower end of the common duct was imbedded in the pancreas so it could not be identified by looking on the undersurface of that organ. Measurements were taken from the pylorus to the opening of the common bile duct into the duodenum. These ranged from 6.5 cm. to 12 cm. with an average of 8.5 cm., so one cannot locate the duodenal end by measurement. The papilla of Vater was present in ten, small in five, and absent in three. The mucosal fold indicating the papilla was normal in 14, small in two, and absent in two. So by opening the duodenum one is not certain of being able to locate the duct, and may incur the danger of a duodenal fistula.

At the present time a combination of these methods is used. All adhesions are freed from the right lobe of the liver, and the relationship of the duodenum to the foramen of Winslow is restored. The hepatic duct is located. If the

lower end of the duct is not seen, it is searched for in the scar of the gastro-hepatic omentum near the upper border of the duodenum. This relationship with the duodenum at about the junction of the first and second portion is a fairly constant one. If these efforts fail, the duodenum is mobilized and the posterior surface of the pancreas inspected. If the duct is not found either the duodenum is opened or the search is abandoned and the upper part of the duct is anastomosed to the jejunum.

HEPATICODUODENOSTOMY

The operation of anastomosis of the hepatic or common bile duct to the duodenum, as it was described by Mayo,¹⁵ was probably the most commonly used procedure in this field. It has the two serious disadvantages of allowing reflux of food into the biliary passages, and a tendency to stricture at the site of union. As a consequence, the majority (77 per cent) of the patients have trouble from cholangitis or biliary obstruction. One personal case (No. 227212) has had 16 hospital admissions and ten operations, many as a result of an hepaticoduodenostomy. She was immediately relieved after this was disconnected and the common bile duct was reconstituted over a Vitallium tube. Neither in this case, nor in any other, has disuse atrophy of the functionless distal end of the common duct been found, as reported by Allen.¹

There are reports of 79 cases in which a Vitallium tube was used in doing an hepaticoduodenostomy. The results are given in Table II.

TABLE II

RESULTS IN 79 CASES OF HEPATICODUODENOSTOMY DONE WITH A VITALLIUM TUBE

Good.....	43 cases
Good, but tube passed.....	3 cases
	—
Total good results.....	46 cases—58.2%
Doubtful.....	1 case
Poor—tube passed.....	27 cases—34.1%
Poor—tube plugged.....	4 cases
Poor—fatal hemorrhage from tube.....	1 case
	—
Total.....	79 cases

If the three satisfactory cases in which the tube passed are added to the 27 poor results in which it passed, it is seen that in 30 cases (38 per cent) the tube is known to have passed into the gastro-intestinal tract. It is probable that, in the end, the majority will pass, for there is little to prevent it. Certainly, the flange in the center is not enough, nor are sutures, for all past experience indicates that any foreign body that protrudes into the bowel will eventually be passed.

These Vitallium tubes were never designed for hepaticoduodenostomy; in fact, they were designed to avoid it, and to retain the function of the sphincter of Oddi by reconstructing the bile duct. But soon after they were available surgeons used them in the duct-duodenal anastomosis, so this use was illustrated¹⁸ in their description. Perhaps this was unwise, for it may have contributed somewhat to having 79 cases of this type to report here. Granted

that the operation is an expedient way out of a difficulty that may give brilliant immediate results, yet it is essentially unphysiologic. The use of the vitallium tube cannot alter this, for it can only prevent stricture of the anastomosis. Reflux and the threat of cholangitis will remain.

HEPATIOJEJUNOSTOMY

As a general principle a bile duct without a sphincter should not be connected with a loop of intestine that conveys food, for sooner or later this will cause trouble. An antiperistaltic loop of jejunum fulfills this requirement. Antiperistalsis has been shown by Mall¹³ to be capable of causing partial blockage of the intestinal current. It has been employed by Mann¹⁴ to prevent leakage from intestinal fistulae. Whipple²² used the Roux-Y-type of antiperistaltic loop of jejunum to anastomose to the biliary tract after resecting the head of the pancreas.

In this series there were 18 cases of hepaticojejunostomy done with a Vitallium tube, the results of which are shown in Table III.

TABLE III

RESULTS IN 18 CASES OF HEPATIOJEJUNOSTOMY DONE WITH A VITALLIUM TUBE	
Roux—Y anastomosis—results good	8 cases
Loop with entero-anastomosis—results good	7 cases
—	
Total	15 cases—83.3%
Loop with entero-anastomosis—results poor	3 cases
—	
Total	18 cases
In seven cases (38.8%) the tube is known to have passed	

This group is too small to have any statistical significance, but the facts available would indicate that the results are superior to those in hepaticoduodenostomy, which is to be expected. These data also give preference to the Roux-Y-type of anastomosis. In this regard Cole⁵ reports a case who after an hepaticojejunostomy by a loop with entero-anastomosis had severe cholangitis. He reasoned that food was being carried past the entero-anastomosis up the proximal loop to the bile duct. So he divided and closed this proximal loop, leaving essentially a Roux-Y anastomosis, with immediate relief of symptoms.

It might be argued that a Vitallium tube is not necessary in doing a bile duct-jejunal anastomosis. This is valid in cases where sufficient hepatic duct remains to do an exact approximation of the structures. However, Cole⁶ feels that his results with the Vitallium tube are definitely superior to those without it. In some cases no mobile bile duct is available for anastomosis, and only a hole in the porta hepatis communicates with the biliary tract. Here the insertion of a tube materially helps in the anastomosis.

OTHER USES

There are three cases where the bile duct was anastomosed to the stomach by means of a tube, with satisfactory results to date. In two instances of

severe chronic pancreatitis a long tube was passed into the duodenum. Both of these were relieved of their symptoms. Five cases of inoperable carcinoma were treated palliatively by using a Vitallium tube, with temporary relief of their biliary obstruction. The pancreatic duct was anastomosed to the intestine by means of a tube in three cases, with satisfactory results.

SUMMARY

A group of 229 cases were collected, of which 216 were suitable to study the results obtained from using Vitallium tubes in biliary surgery.

1. In 106 cases the tube was used to reconstruct the bile duct and preserve its continuity.
 - (a.) 85 cases (80.1 per cent) had good results.
 - (b.) 12 cases failed because of plugging of the tube, so the prevention of this is discussed.
 - (c.) 7 cases had the tube used to bridge a gap between the ends of the divided duct. All were failures.
2. In 79 cases a Vitallium tube was used in hepaticoduodenostomy.
 - (a.) 46 cases (58.2 per cent) had good results.
 - (b.) 30 cases (38 per cent) are known to have passed the tube.
3. In 18 cases an hepaticojejunostomy was done using a Vitallium tube. This group is too small for statistical significance, but the results are suggestive.
 - (a.) 15 cases (83.3 per cent) had a good result.
 - (b.) 7 cases (38.8 per cent) have passed the tube.
 - (c.) The Roux-Y appears better than the loop with entero-anastomosis, since all the failures were in the latter.
4. Vitallium tubes were also used in hepaticogastrostomy, in chronic pancreatitis, in inoperable carcinoma, and in pancreatic fistulae.
5. The Vitallium tube has allowed reconstruction of otherwise irreparably damaged bile ducts. This restores the normal anatomic channel. When the lower end of the common duct cannot be found or for any other reason this repair is not feasible, a Roux-Y anastomosis with hepaticojejunostomy appears to be the best substitute.

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DISCUSSION.—DR. I. S. RADWIN, Philadelphia, Pa.: I think Doctor Pearse is to be congratulated for the excellent compilation and presentation he has made. The field is a very difficult one; as Doctor Lahey said some time ago, we would not have so many of these cases if the surgery of this area were done by surgeons competent to do it. There is no method, vitallium tubes, T-tubes, or catheters, or any other, which is suitable for all defects of the common duct and the hepatic duct. Doctor Pearse has pointed out two important features in this type of work. First, it is important to find both ends of the duct. All too frequently the lower end of the duct is not found and attempts are made to bridge the defect, when a more thorough search would have made permanent restoration more likely. The second matter is equally important; one must have mucosa-to-mucosa approximation. If this can be obtained a successful end-result is more likely. It may be better to do this anastomosis over a T-tube; it may be well to do it over a vitallium tube, or over an ordinary catheter, but the important thing is that we get mucosal junction. When we have used a T-tube, we have at times left it in for eight to thirteen months.

We have carried out in eight patients a method reported before this Association many years ago by John Speese, known as the Speese-Ginsberg procedure, and have had several very satisfactory results in the presence of massive defects.

DR. FRANK H. LAHEY, Boston, Mass.: It seems quite natural for me to be discussing strictures of the common duct on this platform because just four months ago on this very platform I discussed strictures of the common and hepatic ducts before the Southern Surgical Society.