Long-Term Results of Roux-En-Y Hepatocholangiojejunostomy

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THE MANAGEMENT of strictures of the extrahepatic biliary system continues to present a difficult challenge to the surgeon. Various operative repairs have been used, but the long-term results have been discouraging because of the tendency for the injured bile duct to heal with stricture formation. Twelve years ago, the late James A. Kirtley, Jr., described a technic for repair of high hepatic bile duct strictures in which the common hepatic duct was "fish-mouthed" and sutured open to Glisson's capsule with a Roux-en-Y segment of jejunum attached around the proximal hepatic duct. In that report a 3-year follow-up of his patients revealed that 87.5% remained well without evidence of recurrent bile duct stricture.[2] In this study Kirtley's 12 patients have been followed as long as 20 years, and ten additional patients have been included.

Operative Procedure

The procedure as described by Kirtley does not involve a mucosa-to-mucosa anastomosis. The proximal segment of the hepatic duct is identified and incised bilaterally for a small distance so as to create both anterior and posterior flaps. This is done preferably just distal to the junction of the right and left hepatic ducts. The hepatic duct is then "fish-mouthed" by suturing the anterior and posterior flaps to the thickened Glisson's capsule. This maneuver helps prevent subsequent stenosis of the proximal hepatic duct. The jejunum is then transected and the distal segment brought up to the porta hepatis in an antecolic or postcolic fashion. The end of the defunctionalized jejunal segment is sutured to the capsule of the liver around the "fish-mouthed" proximal hepatic duct using interrupted non-absorbable sutures. Thus, the jejunal anastomosis is not attached to the hepatic duct itself. The Roux-en-Y is completed by anastomosing the proximal end of the transected jejunum end-to-side of the distal jejunal segment about 40 cm. from the hilar anastomosis (Fig. 1). A drainage tube has not been routinely used in this procedure, but a tube or stent may be placed through the anastomotic site if desired.

Clinical Material

Twenty-two patients, who had hepatocholangiojejunostomy or a closely related procedure as described by Kirtley, are included in this report (Table 1). There were 14 women, 7 men and one child, age 3½ months. The oldest patient was an 80-year-old man. Follow-up studies have been obtained on all patients. The first operation was performed 20 years ago.

Seventeen patients underwent hepatocholangiojejunostomy because of a high stricture of the hepatic bile duct occurring after cholecystectomy. Seven of these patients had concomitant common bile duct explorations while ten had removal of the gallbladder only. Thus, 80% of the patients apparently developed bile duct strictures from an injury sustained at a previous operation. In four patients hepatocholangiojejunostomy was performed for obstruction secondary to sclerosing cholangitis. The infant underwent the procedure for biliary atresia. She is doing well 20 years after operation.

Previous unsuccessful attempts to repair a bile duct stricture had been done in 12 patients. Five patients

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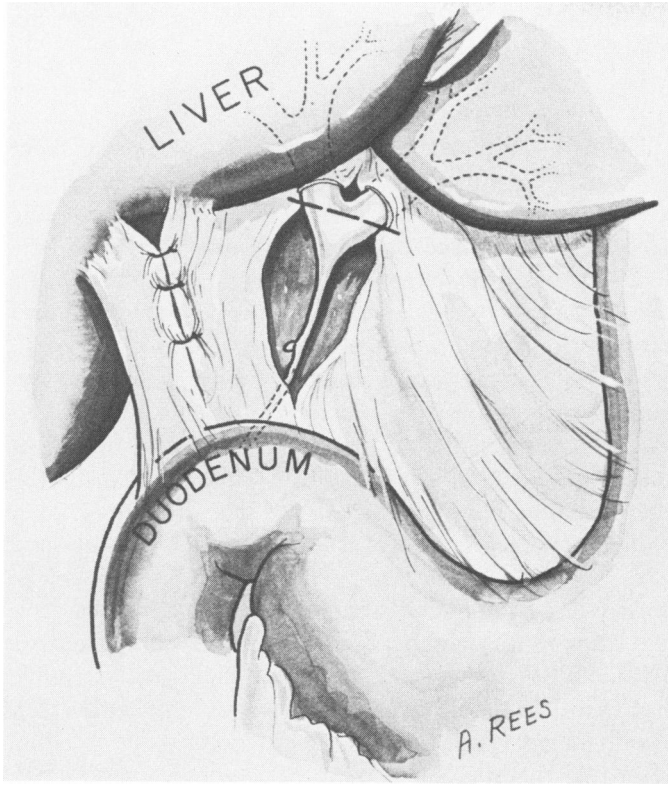

FIG. 1a. Technic of hepatocholangiojejunostomy Roux-en-Y. The proximal hepatic bile duct is incised bilaterally to create anterior and posterior flaps.

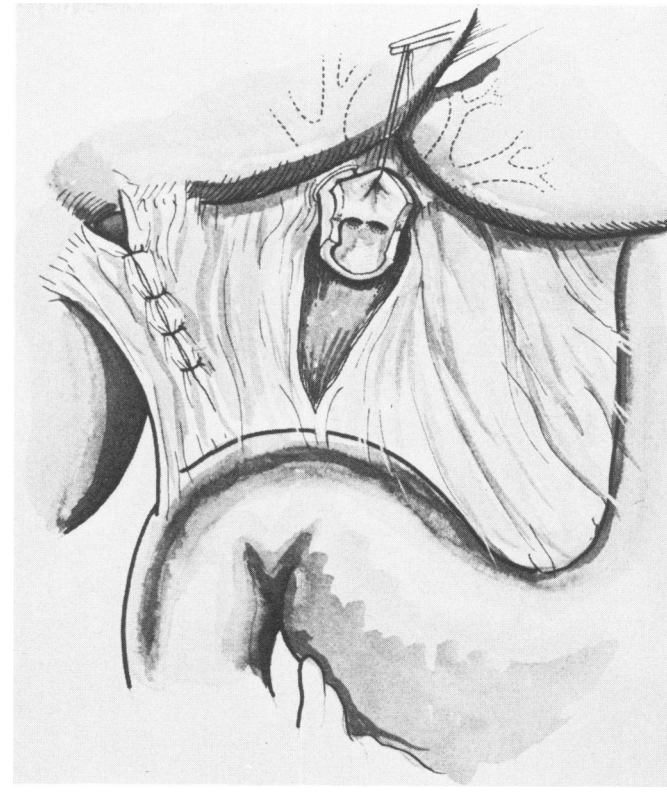

FIG. 1b. The "fish-mouthed" hepatic duct flaps are sutured to the thickened hilar capsule.

had had end-to-end bile duct anastomoses, four had plastic revisions of the common bile duct, and three had choledochojejunostomies. Development of recurrent strictures caused these operations to fail. Two patients had four previous operations each, and two patients each had seven previous attempts at repair of their stricture prior to hepatocholangiojejunostomy.

Results

The results of hepatocholangiojejunostomy are shown in Table 2. Sixteen patients (73%) have maintained a functioning anastomosis without development of recurrent stricture. Seven of these patients have been followed more than 5 years, and four patients survived more than 10 years since operation.

One patient died after operation. She had undergone elective cholecystectomy, developed persistent postoperative biliary drainage and underwent reoperation to repair the bile duct injury at another hospital. Kirtley performed a Roux-Y hepatocholangiojejunostomy in 1956, but her hepatic function continued to deteriorate. She died 2 weeks after this operation with peritonitis, gastrointestinal bleeding and generalized sepsis.

Recurrent strictures requiring reoperation developed in five patients (23%). The average time between initial hepatocholangiojejunostomy and reoperation in patients for recurrent stricture was 4.4 years. One patient required reoperation for recurrent stricture twice. The five patients who underwent reoperation for recurrent stricture have been followed from 1 to 6 years and have generally done well.

Cholangitis occurred in all patients who developed recurrent stricture but not all patients with cholangitis have required reoperation. Two patienets have had brief episodes of cholangitis which responded to antibiotic treatment. A percutaneous transhepatic cholangiogram in one of these patients shows normal intrahepatic bile ducts and no stenosis at the site of the hepatocholangiojejunostomy. Reflux through the Roux-en-Y jejunal limb into the hepatic ducts is not believed to occur if the limb is 40 cm. or more in length. Intestinal reflux as a cause of cholangitis seems unlikely. Cholangitis following hepatocholangiojejunostomy is an ominous sign, strongly suggestive of recurrent stricture. Thus, 14 of the 21 surviving patients (67%) have remained free of any episodes of cholangitis or of recurrent stricture.

Other serious complications developing in these pa-

FIG. 1c. The posterior wall of the Roux jejunal limb is sutured around the hepatic duct.

tients are listed in Table 3. Postoperative upper gastrointestinal bleeding occurred in two patients within a few days after hepatocholangiojejunostomy. Both patients required emergency operation and were found to have stress ulcers. Bleeding was controlled satisfactorily by suture of the bleeding ulcers, truncal vagotomy and pyloroplasty. The patients have done well. The question may be asked if biliary diversion increases the incidence of acute gastrointestinal bleeding. A recent study by Pinkerton, Sawyers, and Foster[5] reported a significant increase in postoperative upper gastrointestinal hemorrhage from stress ulcers after hepatic resection in those patients who had T-tube biliary diversion.

Two other patients developed upper gastrointestinal hemorrhage late after hepatocholangiojejunostomy. Both patients had bleeding from esophageal varices secondary to portal hypertension from biliary cirrhosis. Splenorenal shunt was successfully performed in each patient. Each of these patients had had successful repair of the biliary obstruction without evidence of recurrent stricture prior to development of portal hypertension. Warren[7,8] has emphasized that persistent biliary obstruction may lead to rapid and permanent hepatic damage. Surgical correction of biliary obstruction should not be delayed in order to prevent the development of biliary cirrhosis.

Management of Recurrent Stricture

The five patients who had reoperation for recurrent stricture following hepatocholangiojejunostomy developed stricture at the site of the "fish-mouthed" hepatic bile duct. Scar tissue around the stump of the hepatic duct narrowed the lumen to a pinpoint opening. Stones and/or sludge were always found in the right and left hepatic bile ducts proximal to the stenotic opening.

Various technics were used for management of recurrent stricture. Kirtley had two patients who developed recurrent strictures. He managed these by taking down the Roux-en-Y jejunal limb anastomosed to the liver, dilating the stricture, washing out stones and sludge and doing a repeat "fish-mouth" incision and suture of the hepatic duct. No stent was inserted. The Roux jejunal limb was then resutured to the liver capsule around the hepatic duct. The other three patients developing recurrent stricture were managed as shown in Figure 2. The Roux limb was not dismantled but a short longitudinal incision was made into the jejunum to expose the stenotic hepatic duct which was dilated. Stones and sludge were washed out of the intrahepatic ducts. Various tubes have been utilized as stents. In one patient a Warren Y-tube was inserted (Fig. 2-c).

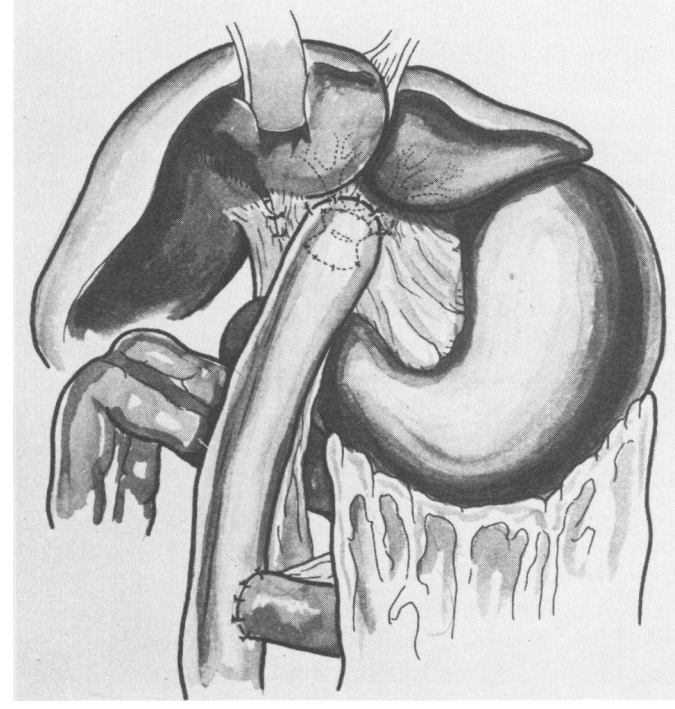

FIG. 1d. The anastomosis to the hepatic capsule is completed and end-to-side jejunostomy performed.

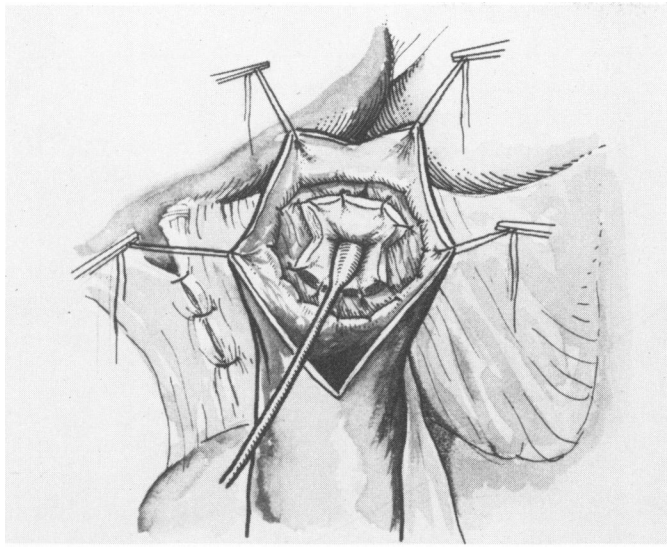

FIG. 2a. Technic for managing recurrent stricture after hepatocholangiojejunostomy without dismantling the anastomosis. Through an incision in the jejunal limb the recurrent stricture is dilated.

A second patient had a transhepatic tube placed as described by Smith[6] (Fig. 2-d). The third patient had a silastic catheter inserted. The patient with the Smith procedure developed a second recurrent stricture at the same site 1 year after the stent was removed. The stent had been in place for 6 months. A similar transhepatic stent was inserted and left for 18 months. The stent has now been removed, and the patient is doing well. The other two patients are asymptomatic. The procedure used in the last three patients avoids revision of the entire anastomosis to relieve obstruction from recurrent stricture.

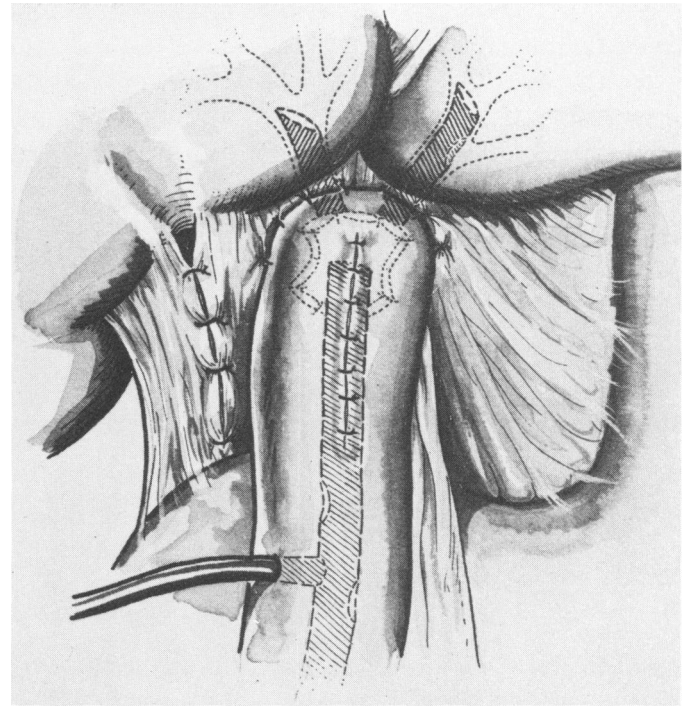

FIG. 2c. A Warren Y-tube was used successfully in one patient.

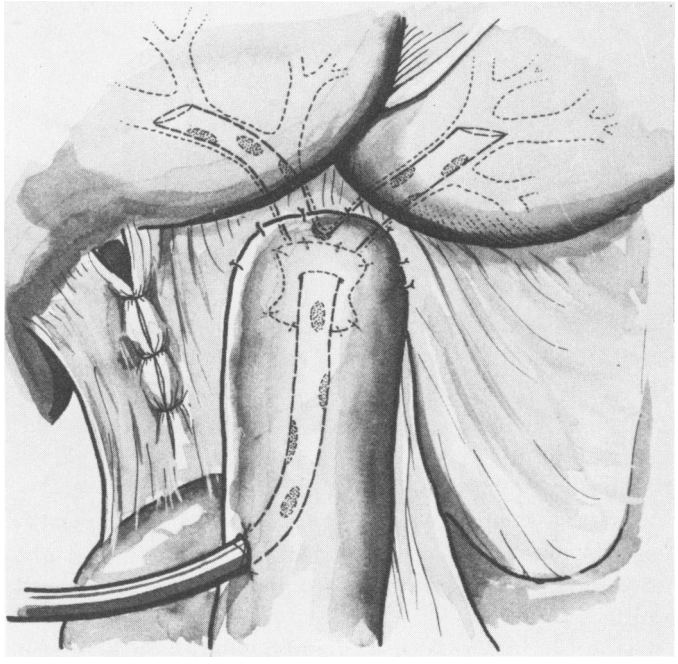

FIG. 2b. After washing out stones and sludge from the intrahepatic ducts a Y-tube is inserted as a stent and brought out through the jejunal limb.

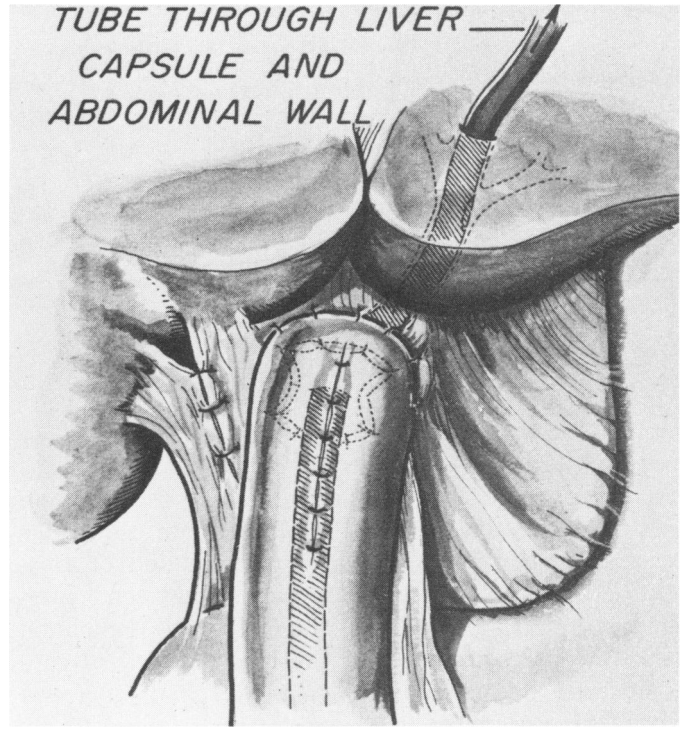

FIG. 2d. A transhepatic tube as described by Smith has also been used.

TABLE 1. *Hepatocholangiojejunostomy in 22 Patients with Hepatic Duct Stricture*

Patient	Sex	Age	Previous Operations	Operative Findings	Operative Procedure	Follow-Up Data	Results
1. M.L.	F	62	A) Cholecystectomy CBD Exploration B) Exploration with T-tube insertion	Stricture of Hepatic Duct	Hepatocholangio-jejunostomy	A) Postoperative UGI hemorrhage B) 15 mo. post-operative cholangitis.	No symptoms after 1 year.
2. W.H.	F	45	A) Cholecystectomy B) Closure of Cystic Duct Remnant C) Roux-en-Y Chole-dochojejunostomy	Stricture Choledocholithiasis and hepatic duct calculi	Hepatocholangio-jejunostomy	A) Spleno-Renal shunt 21 mo. postoperatively B) Recurrent stricture requiring operation 9 yrs. post-operatively	No symptoms for 9 years.
3. N.H.	F	36	Cholecystectomy	Stricture of Hepatic Duct	Hepatocholangio-jejunostomy	Postoperative Peritonitis with Sepsis. Bleeding Dyscrasia	Operative Death.
4. J.C.	F	37	A) Cholecystectomy CBD Exploration. B) Plastic Revision CBD.	Stricture of Hepatic Duct	Hepatocholangio-jejunostomy	Cholangitis and Reoperation 6 yrs. Postoperative.	No symptoms for 6 yrs. B) Repair of recurrent stricture. C) No symptoms for 6 yrs.
5. F.H.	M	80	Cholecystectomy	Stricture Stones of hepatic duct	Hepatocholangio-jejunostomy	No Cholangitis or jaundice	No symptoms for 7 years.
6. E.O.A.	M	55	Cholecystectomy CBD Exploration	Stricture Purulent Material in hepatic duct.	Hepatocholangio-jejunostomy	No Cholangitis Expired-unrelated cause.	No symptoms for 1½ years.
7. C.C.	F	59	A) Cholecystectomy B) Seven Subsequent Procedures for Recurrent Strictures	Stricture of Choledo-chojejunostomy with stones.	Hepatocholangio-jejunostomy	Repair of Stricture 4 years later.	A) No symptoms for 4 yrs. B) Recurrent stricture with repair. C) No symptoms for 3 years.
8. P.B.	F	72	None	Obstruction of Common Hepatic Duct. Pancreatitis.	Hepatocholangio-jejunostomy	No Cholangitis.	No symptoms for 9 months. Died of unrelated cause.
9. E.B.	F	45	A) Cholecystectomy B) Seven Subsequent Procedures for Stricture.	Left Hepatic Duct Found.	Hepatocholangio-jejunostomy with tube.	Spleno-Renal Shunt 7 months postopera-tive-Hepatic Failure	Lived 5 yrs. No stricture Recurrence.
10. S.B.	F	62	A) Cholecystectomy B) Multiple Operations for Stricture	Ileum Anastomosed to CBD. Stones, Stricture	Hepatocholangio-jejunostomy	Expired Cancer of Bladder.	No symptoms for 3 years.

Discussion

It is generally agreed that the best results in repairing bile duct injury are obtained when an immediate or very early end-to-end anastomosis is possible. This procedure requires the distal segment of the common duct to be identified and to be of adequate caliber for satisfactory anastomosis without inflammation or cicatrix. Unfortunately, the conditions for end-to-end anastomosis frequently are not present. In this situation the remaining proximal duct must be restored in continuity with the gastrointestinal tract. The number and variety of procedures that have been described to accomplish this give testimony of its difficulty. Most procedures have a significant incidence of recurrent stricture.

In 1944 Allen[1] described a procedure in which a Roux-en-Y segment of jejunum was brought up to the hepatic hilum and sutured to the capsule of the liver around the open proximal hepatic duct. A mucosa-to-mucosa anastomosis was not performed. A rubber catheter was placed within the proximal duct and brought out through the limb of jejunum, thus serving as a stent.

The procedure described independently by Kirtley[3,4] is in essence a modification of this technic. After the initial "fish-mouth" procedures were done, Kirtley

TABLE 1. (*Continued*)

Patient	Sex	Age	Previous Operations	Operative Findings	Operative Procedure	Follow-Up Data	Results
11. J.C.	F	72	A) Cholecystectomy CBD Exploration. B) Choledochojejunostomy.	Stricture–Stones.	Hepatocholangio-jejunostomy	No Cholangitis	No symptoms 10 yrs. post-operative.
12. D.H.	F	52	Cholecystectomy CBD Exploration Sphincterotomy	Stricture	Hepatocholangio-jejunostomy	No Cholangitis	No symptoms for 10 years followup.
13. J.E.R.	M	58	Cholecystectomy CBD Exploration	Stricture of Hepatic Duct.	Hepatocholangio-jejunostomy	Postoperative UGI Bleeding.	No symptoms for 12 years postoperatively.
14. C.H.	M	58	None	Induration and Obstruction of Extra-Hepatic Ducts. Induration of Pancreas (No Carcinoma) Severe Ulcer Disease	Hepatocholangio-jejunostomy, Vagotomy, Subtotal Gastric Resection.	No Cholangitis	No symptoms 6 years follow-up.
15. M.G.	F	79	A) Stricture CBD. Tube into right Hepatic Duct. B) Tube Replacement.	Tube Obstructed	Hepatocholangio-jejunostomy with tube.	No Cholangitis	No symptoms 1½ years post-operative.
16. M.R.	F	3½ mo.	Hepatocholedocho-duodenostomy.	Biliary Atresia	Hepatocholangio-duodenostomy	Billroth II 20 years postoperative.	No symptoms 20 yrs. post-operative.
17. L.B.	F	47	Cholecystectomy CBD Exploration	Stricture	Hepatocholangio-jejunostomy	Recurrent Stricture Requiring Operation. Warren Tube Placed.	No symptoms 1½ yrs. Post-operative tube placement.
18. R.G.	M	59	A) Cholecystectomy B) Plastic Revision of CBD.	Stricture	Hepatocholangio-jejunostomy	Cholangitis. 2 operations for Recurrent Stricture–9 mo.–3 yr. Rodney Smith Procedure.	No symptoms 9 mo. post-operatively Last Procedure
19. R.G.	F	68	A) Cholecystectomy. B) T-tube Placement	Stricture Cholangioduodenal Fistula.	Hepatocholangio-jejunostomy.	No Cholangitis.	No symptoms 15 months postoperatively.
20. S.C.	F	28	Cholecystectomy	Stricture of Hepatic Duct.	Hepatocholangio-jejunostomy.	Cholangitis	Presently Well.
21. J.C.	M	22	Multiple Procedures for Diaphragm of CBD.	Stricture of CBD and Hepatic Duct.	Hepatocholangio-jejunostomy.	No Cholangitis.	No symptoms 13 years post-operatively.
22.M.G.	M	49	A) Cholecystectomy B) Plastic Revision of CBD.	Right Hepatic Duct not Connected to Intrahepatic Biliary System	Hepatocholangio-jejunostomy to right Hepatic Duct only.	Old Cardiac Disease with later Congestive Heart Failure. No Cholangitis or Operative Complications.	Congestive Heart Failure with Death Later.

felt that no tube or stent would be necessary. The "fish-mouth" procedure served to compensate for lack of a mucosal anastomosis when this was not possible and a circumferential suture line could be avoided. Smith[6] reported that a non-mucosal anastomosis between bowel and liver was ordinarily doomed to failure, but he did not widen the lumen by the "fish-mouth" technic. Other investigators have also stressed the necessity of a stent in any biliary anastomosis. Warren[8] states that stents should be left in place for many months and has kept them in over a year.

Three patients who had Kirtley's "fish-mouth" procedure also had stents inserted at their initial hepatocholangiojejunostomy. Of possible significance is that none of these patients has required reoperation for stricture. In 19 patients without stents, five developed a recurrent stricture. This indicates that a stent may be of value in prevention of hepatic duct stenosis when a hepatocholangiojejunostomy is performed.

Summary

Roux-en-Y hepatocholangiojejunostomy has been performed for high strictures of the hepatic bile duct in 22 patients. Follow-up studies extend to 20 years. Sixteen patients (73%) have had acceptable results. There

TABLE 2. *Results of Hepatocholangiojejunostomy in 22 Patients*

	Pts.	%
Functioning anastomosis	16*	73
Recurrent stricture	5	23
Operative death	1	4

* 7 patients followed over 5 years
4 patients followed over 10 years

TABLE 3. *Complications after Hepatocholangiojejunostomy in 21 Surviving Patients*

	Pts.	%
Recurrent stricture	5	23
Cholangitis without operation	2	10
Upper gastrointestinal bleeding	4	19
Stress ulcer	2	
Esophageal varices	2	
Subhepatic abscess	1	4

was one postoperative death. Reoperation for recurrent stricture was necessary in five patients.

Hepatocholangiojejunostomy with a Roux-en-Y jejunal segment and the "fish-mouth" technic of managing the proximal hepatic duct is an effective operation for treatment of benign hepatic bile duct stricture when a mucosa-to-mucosa anastomosis cannot be done or fails.

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Discussion

DR. J. ENGLEBERT DUNPHY (San Francisco): We have recently reviewed just under 90 common duct reconstructions over a period of nearly 40 years, many of these going back to the days of Dr. Glenn Bell, and we have found that the best results occurred in patients that had Roux-Y reconstructions.

Similarly, the results of hepaticojejunostomy, not done precisely as Dr. Kirtley described it, but by buttressing the jejunal loop against the liver, without proper end-to-end mucosal sutures—the results here also were superior; so much so that we believe that the ideal form of reconstruction today, except in the acute, immediately identified injury, where end-to-end does seem to be satisfactory, is to proceed with a choledocho- or hepaticojejunostomy.

I have a feeling that healing in the biliary tract is quite different from almost any other site, and that the tendency to stricture formation develops over a matter of many years.

Several of our patients had their stricture develop 15 years or longer after what had been a perfectly satisfactory repair. In one case the stricture developed 30 years after a choledochoduodenostomy.

The advantage of the Roux-Y repair is that one can approach the second operation very much more easily than in any other type of repair. In our own experience when stricture has developed we have opened the jejunal loop, very much as was shown here by Dr. Riddell, and then with a probe in the stricture site have cut down on the stricture. Very often this stricture is just a thin membrane, and it can easily be converted, like a Heineke-Mikulicz, into a wide-open lumen.

I believe, however, no matter how we do these operations and how carefully we perform them, that the patients are never entirely free from the danger of late recurrent stricture.

When cholangitis develops, it is very tempting to treat it with antibiotics. There is immediate improvement. The patient is well for a little while—but has more trouble later. Particularly in younger patients, we are asking for the development of biliary cirrhosis, portal hypertension, and a relatively short-life span.

For this reason we feel that when cholangitis—repetitive cholangitis—occurs, it must be regarded as a sign of stricture, and requires re-exploration, which often can be carried out in a very successful and gratifying way. I have a suspicion that the reoperation in which the slit is made in the anterior wall of the duct only, so that the entire posterior wall is covered with mucosa, will probably have a lessened incidence of restricture formation than a complete circular closure.

DR. WALTMAN WALTERS (Rochester): I am very happy to discuss this paper, particularly after following Dr. Dunphy's excellent discussion, with which I agree with one exception. I will speak to that in a moment, at the termination of my 2 or 3 minutes of discussion of Dr. Riddell, Dr. Sawyers, Dr. Scott and Dr. Lane's excellent presentation.

There's no need to reiterate what has been said in the program's abstract; however, I have underlined three parts of it which are very important and worthy of favorable comment.

In the first place, it is to be noted that we have heard a report of 20 or 21 patients, carefully studied, operated upon for stricture of the common or hepatic—common hepatic—bile ducts, over a period of 20 years; and this is, to my knowledge, one of the longest periods of follow-up of a group of such cases.

Secondarily, the low mortality rate of 4% is admirable, and this, indeed, as we look at this entire picture, is a thing to be remembered, because anyone that can do any type of operation for stricture of the common or hepatic bile ducts and obtain 87% good or excellent results is doing a fine job, no matter what method of biliary intestinal anastomosis is used. If I might be allowed a few seconds to make a few philosophical remarks concerning varying operations by surgeons for the same surgical lesion, it would be that experience in the choice of different methods is frequently the result of broader experience and better results in the hands of each surgeon, even those working in the same hospital or medical group.

Frequently the comparative ease with which one particular