

Roux-en-Y Hepaticojejunostomy: A Reappraisal of its Indications and Results

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A critical evaluation is made of 131 patients submitted to choledochal or hepaticojejunostomy. The main indications for hepaticojejunostomy were iatrogenic strictures of CBD (60 patients), and choledocholithiasis with markedly dilated duct (41 patients). The overall mortality rate was 4% representing principally renal hepatic failure, bile peritonitis and bleeding. The complications following hepaticojejunostomy included only in one case biliary fistula which required reoperation. The long-term results of 80 patients available for a followup study were as follows: 63 patients (78.7%) were symptom-free at 2-13 years followup; 8 patients had brief episodes of cholangitis which responded to antibiotic and corticosteroid treatment; 9 patients required reoperation for stricture of anastomosis. These overall results are a strong argument for hepaticojejunostomy which, compared with choledochoduodenostomy, avoids the hazards of the so-called sump syndrome and of the reflux of enteric contents in the CBD. An increased incidence of peptic ulcer disease in the patients submitted to hepaticojejunostomy was not observed. In very high strictures and in reinterventions anastomosis between left hepatic duct and Roux-en-Y jejunal limb was carried out. The results achieved with this technique, which was performed in 26 patients, were about the same following hepaticojejunostomy.

DESPITE voluminous literature on the treatment of choledocholithiasis and benign obstructions of common bile duct (CBD), there are few studies in which an attempt has been made to suggest the indications for each surgical procedure. Three operations have been commonly employed for the correction of these lesions, namely sphincteroplasty, choledochoduodenostomy and hepaticojejunostomy. It is generally agreed that sphincteroplasty is the procedure of choice in the treatment of lithiasis of distal CBD and stenosis at the sphincter of Oddi.^{9,15,20,26} Conversely, choledochoduodenostomy is usually advised in patients

with choledocholithiasis, iatrogenic stricture, inflammatory stenosis and chronic pancreatitis.^{1,4,7,8,22} Moreover, there is a fairly uniform pattern in limiting the extent of indications of hepaticojejunostomy only to the strictures in the proximal CBD caused by surgical trauma.^{3,17}

The purpose of the present paper is to advocate hepaticojejunostomy as opposed to choledochoduodenostomy in treating obstructions of proximal as well as distal CBD. In addition, hepaticojejunostomy is advised as the most appropriate procedure also in patients with choledocholithiasis and markedly dilated duct. Specific indications and contraindications for hepaticojejunostomy have been determined by the immediate and long-term results of 131 patients operated upon at the 2nd Surgical Clinic of the University of Rome during the years 1960-73.

Operative Technique

Of the total of 140 operations performed in 131 patients, there were 114 anastomoses between CBD and Roux-en-Y jejunal limb. In addition, 26 anastomoses between left hepatic duct and jejunum were performed according to the technique first described by Hepp and Couinaud⁶ (Fig. 1), six of which were carried out for recurrence of CBD stricture following hepaticojejunostomy. The choice of the Hepp procedure, employed when sufficient CBD tissue was not present, was supported by the rationale that the first portion of left hepatic duct parallels the hilum of the liver and is easier to dissect than right hepatic duct which directly goes into the hepatic parenchyma. Moreover this portion of left hepatic duct does not cross any blood vessel and does not receive any biliary duct. The anastomosis between left

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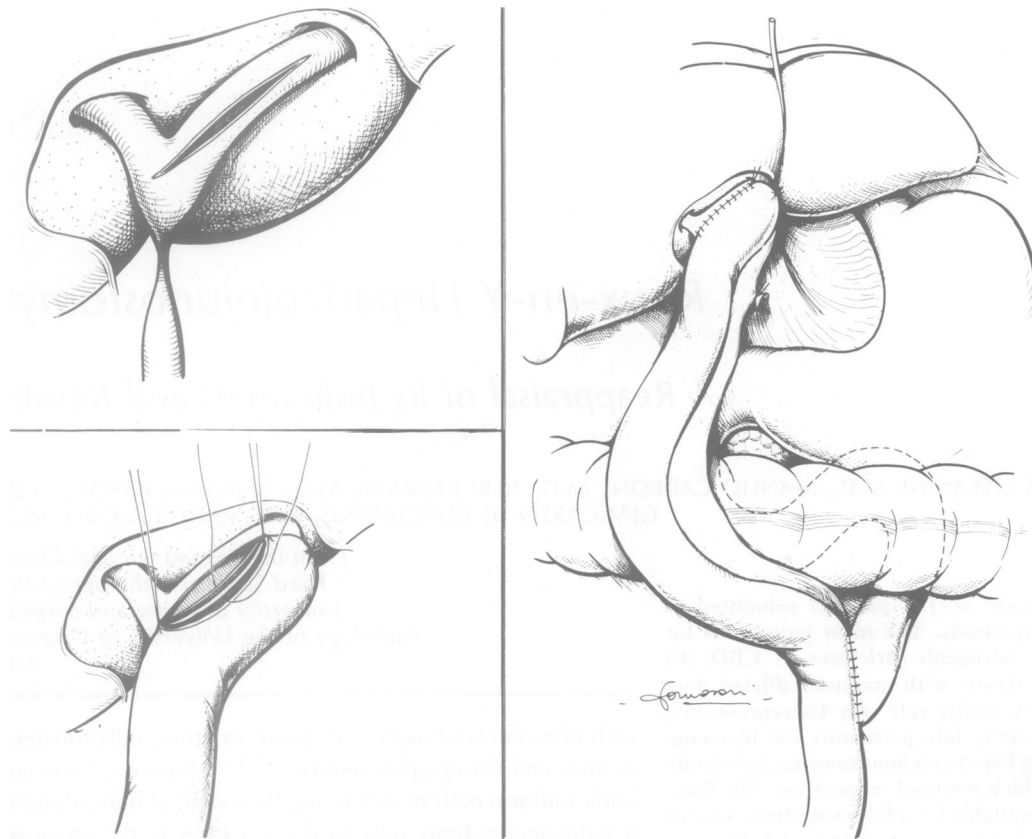


FIG. 1. Technique for anastomosis between left hepatic duct and Roux-en-Y jejunal limb, according to Hepp and Couinaud.

hepatic duct and the jejunal limb was fashioned in a side-to-side manner, while the hepatico or choledochojejunostomy was performed in an end-to-side manner. The Roux-en-Y jejunal limb was transected at 30–35 cm from the ligament of Treitz, where the mesentery is of sufficient length to permit its being delivered into the hilar region of the liver, and was placed in antecolic position. The anastomosis of both procedures was made using interrupted 3-0 chronic catgut sutures in the inner layer, and 3-0 silk sutures in serosal layer. In recent years, a single layer of interrupted 3-0 silk sutures with atraumatic needles was preferred. A fenestrated straight catheter across the anastomosis and brought out through the jejunal limb was routinely used. In the patients with choledocholithiasis it was employed only to drain and to splint the anastomosis and was removed in two or three weeks. Conversely, in patients with iatrogenic stricture the tube was placed as a stent to allow fibrous tissue to mature without narrowing. In these cases the stent was left in place for 40–60 days (Fig. 2). Only two patients had a transhepatic tube placed as described by Smith.¹⁹

Clinical Material

Of the 131 patients who underwent hepaticojejunostomy, 51 were male and 80 were female. The age range was 31–73 years, with an average of 56 years.

Indications for hepaticojejunostomy in 131 patients

operated upon are summarized in Table 1. In 74 patients the bile duct stricture was due to operative injury incurred during the course of other surgical procedures. The extrahepatic biliary tree was damaged during cholecystectomy in 59 cases and during gastrectomy in five cases, while the stricture occurred after choledochoduodenostomy in six patients and after choledochotomy and Kehr-tube in four patients. Bile duct stricture and fistula by surgical injury

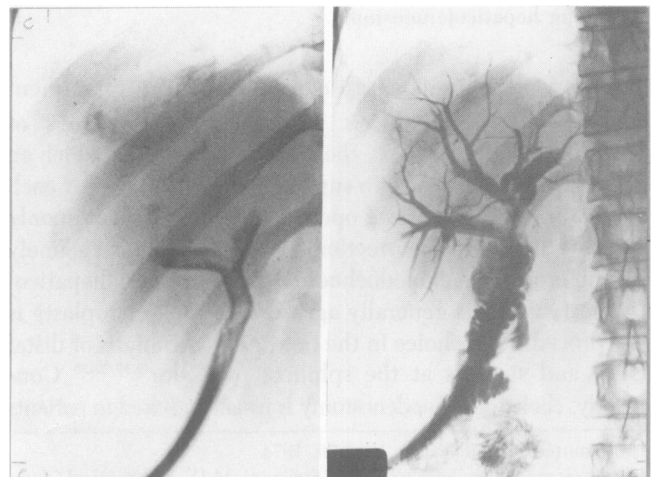


FIG. 2. Radiograms showing the use of transanastomotic drainage as a stent in a patient submitted to hepaticojejunostomy.

TABLE 1. *Indications for Hepaticojejunostomy in 131 Patients*

	No. of cases	%
Iatrogenic stricture	60	47
Choledocholithiasis (CBD diameter over 1.5 cm)	41	32
Iatrogenic stricture and fistula	14	11
Wide inflammatory stenosis	5	3
Chronic pancreatitis	5	3
Choledocholithiasis and fistula	3	2
Congenital choledochal cyst	3	2
Total	131	100

were found in 14 patients, three of which had a complete excision of biliary tree recognized at operation (Fig. 3). Indication for hepaticojejunostomy in 41 patients was choledocholithiasis with common duct markedly dilated (Fig. 4), in five patients chronic pancreatitis (Fig. 5) and in five patients wide inflammatory stenosis with choledocholithiasis (Fig. 6).

The surgical procedures performed before hepaticojejunostomy are shown in Table 2. Of 131 patients, 119 had previously one operation, 62 had two operations, 14 had three operations and 2 had four operations before they were admitted to the 2nd Surgical Clinic of the University of Rome. The average number of operations per patient in this series was 2.4, including the 140 hepaticojejunostomies. In 12 patients with cholelithiasis, choledocholithiasis and widely dilated common duct, hepaticojejunostomy was performed as the first procedure.

Mortality, Morbidity and Long-term Results

In 131 patients submitted to hepaticojejunostomy there were six postoperative deaths, one due to bile peritonitis, one due to cardiac failure and three due to renal hepatic failure. The sixth patient who had biliary cirrhosis died of bleeding from esophageal varices. Consequently, the overall mortality rate is about 4%. However, it was lowered to 3% in the last years with increasing experience in these techniques. Only one patient who had choledocholithiasis, biliary fistula and markedly dilated duct died following hepaticojejunostomy. The others had biliary duct stricture due to operative injury and were previously submitted to several attempt of surgical repair to achieve adequate biliary drainage. Two of these patients died following hepaticojejunostomy performed in our clinic.

The overall morbidity was 13.5% representing principally atelectasis or pneumonitis, subphrenic abscess, hepatic renal failure and bleeding. Only in one case following hepaticojejunostomy biliary fistula developed that required reoperation.

Of 127 patients surviving to operation, 80 (61%) were available for a followup study. The long-term results of the patients submitted to hepaticojejunostomy are shown in Table 3. Sixty-three patients (78.7%) were symptom-free at

2–13 years followup and consequently have maintained a functioning anastomosis without development of recurrent stricture. All the patients in whom hepaticojejunostomy was performed as first procedure were followed for long periods and had no signs of cholangitis. Among the patients with good results are included the cases of chronic pancreatitis who are relieved from symptoms related to biliary obstruction, but maintained symptoms due to pancreatitis. Eight patients with fair results have had brief episodes of cholangitis which responded to antibiotic and corticosteroid treatment. Finally, stricture of hepaticojejunostomy requiring reoperation developed in nine patients (Table 4). Seven patients surviving to reoperation have been followed 1–4 years and have generally done well. No significant difference in the immediate and long-term results was found to be in patients undergoing hepaticojejunostomy and in patients submitted to Hepp procedure.

Discussion

Hepaticojejunostomy has been used for many years generally to overcome iatrogenic stricture of CBD.^{3,23} Conversely, there was a wide variation in the indications for



FIG. 3. Cholangiogram obtained at operation in a patient with biliary stricture due to the complete excision of CBD during cholecystectomy.

choledochoduodenostomy, including stricture or inflammatory stenosis of CBD, stenosis at the sphincter of Oddi, chronic pancreatitis and choledocholithiasis with markedly dilated duct.^{8,17,22}

On the basis of accumulated experience, a critical reappraisal of these indications is needed.

The current criticisms against an enlargement of indications of hepaticojejunostomy are: 1) the high operative mortality; 2) the difficulty in technical performance; 3) the risk of peptic ulcer; 4) the inadequate long-term results.

The review of the literature shows that the mortality rate of hepaticojejunostomy ranges from 3.7%¹⁰ to 6.6%.¹¹ In our 131 patients submitted to 140 hepaticojejunostomies the death rate was 4% and has dropped to 3% in recent years with increasing experience in the technical details. Consequently, the operative risk of hepaticojejunostomy is about the same of choledochoduodenostomy (0-8%, with a mean of 3%).²²

As for technical difficulties, it should be emphasized



FIG. 4. Operative cholangiogram in a patient with choledocholithiasis. The entire ductal system is distended, with marked enlargement of CBD (over 2 cm in diameter).



FIG. 5. Operative cholangiography showing a marked enlargement of the proximal ductal system, and a wide stenosis of the lower portion of CBD in a patient with chronic pancreatitis.

that the only difference between end-to-side choledochoduodenostomy and hepaticojejunostomy is the preparation of Roux-en-Y jejunal limb. This is at present currently employed in several surgical procedures and is easily and rapidly performed with the increasing practice. Conversely, the Hepp procedure poses technical problems that are related to the severity of lesions. In any case, the management of these conditions requires major surgery. In addition, the inverse correlation between technical difficulties reported in the operative notes and the eventual result, has been suggested by many surgeons.^{11,25} The practical advantages of hepaticojejunostomy compared with choledochoduodenostomy are that it is most flexible in its application particularly when dealing with strictures high in the hilum of the liver, that a possible restenosis can be more easily managed, and that if a fistula does occur, it is much more difficult if it occurs in the duodenum than in the defunctionalized jejunal limb.

Recently, it has been suggested by many surgeons¹³ that



FIG. 6. Operative cholangiogram in a patient with choledochitis. Note the generalized enlargement and thickening of the bile ducts, the wide stenosis of the distal common duct, and a stone impacted in the ampulla.

the diversion of alkaline bile from the duodenum will result in an increased incidence of peptic ulcer disease. A review of the literature shows that the incidence of peptic ulcer disease in patients treated with a Roux-en-Y hepaticojejunostomy ranges from 8%²⁵ to 22%¹ of the cases. In the experience of Lindenauer¹¹ hepaticojejunostomy was not associated with an increased incidence of peptic ulcer disease. This evidence is supported by the present series, showing that only 4 patients (5%) of the total of 80 cases reviewed and evaluated, developed peptic ulcer disease. The diagnosis of peptic ulcer was established radiologically, and three patients were treated medically with good results, while the fourth required a vagotomy and pyloroplasty. Despite our findings, we agree with others¹³ that a complete evaluation of peptic ulcer potential is mandatory, and postoperative protection of patients with a proclivity to ul-

cer disease is essential. Moreover, in patients with peptic ulcer demonstrated before operation, vagotomy and pyloroplasty should be always associated to hepaticojejunostomy.

Finally, the effectiveness of hepaticojejunostomy is indicated by the evaluation of the long-term results. Usually, the absence of cholangitis for two or three years is consistent with a good result in the majority of instances.^{2,7} In fact, the presence of cholangitis is diagnostic of some degree of biliary obstruction,¹¹ and is an excellent indication that an inadequate anastomosis is present.

Good or fair results were obtained from 75–80% of the patients submitted to choledochoduodenostomy.^{5,13,17} In the present series the long-term results were excellent or good in 79% of the cases and fair in 10%. Satisfactory results in 87% of the patients treated are reported by Lindenauer,¹¹ and Way and Dunphy.²⁵ In reviewing over 900 cases with benign obstruction of CBD, Warren²⁴ emphasized the good results of hepaticojejunostomy that provides better chance of a definitive cure than ent-to-end anastomosis. This is in keeping also with the findings of White²⁶ and of Longmire and Rongel.¹²

Recently, it has been increasingly suggested that choledochoduodenostomy is the best approach to remove CBD stones and to overcome biliary obstructions.^{4,7,14}

However, it is clear that disadvantages of this procedure are: 1) the cul-de-sac of the intrapancreatic portion of CBD which is an important factor of stasis and plays a determinant role in developing choledochitis; 2) the reflux of duodenal contents which favours the occurrence of “ascending” cholangitis; and 3) the management of possible restenosis which poses technical difficulties.

Nevertheless, it has been emphasized that these adverse effects of choledochoduodenostomy may be limited making an adequate stoma, at least 2.5 cm in diameter, to avoid stasis and cholangitis.^{4,8} Moreover, despite the reflux of duodenal contents into CBD, no increased incidence of

TABLE 2. Procedures Performed in 119 Patients Before Hepaticojejunostomy

First Procedure	No. of Cases
Cholecystectomy	77
Cholecystectomy, choledochotomy and Kehr-tube	11
Cholecystectomy and papillostomy	10
Cholecystectomy and choledochoduodenostomy	8
Cholecystectomy and choledochotomy	8
Gastrectomy	5
	119
Subsequent Procedures	
Papillostomy	31
Choledochoduodenostomy	19
Hepaticojejunostomy	14
Choledochotomy and Kehr-tube	12
End-to-end anastomosis	2
	78
Total	197

In 12 patients hepaticojejunostomy was performed as first procedure

TABLE 3. Long-term Results of 80 Patients Submitted to Hepaticojejunostomy

	CBD Stricture (51 cases)		CBD Lithiasis (29 cases)		Total (80 cases)	
	No. of cases	%	No. of cases	%	No. of cases	%
Good	40	78.4	23	79.1	63	78.7
Fair	5	9.8	3	10.3	8	10
Poor	6	11.8	3	10.3	9	11.3

cholangitis in absence of obstruction and stasis is reported.^{7,14} In addition, the presence of "blind" segment of CBD between anastomosis and duodenal papilla is not considered of practical surgical significance.¹⁴

In spite of these data, the present review shows that choledochoduodenostomy is unadvisable because of the hazards associated with the pathophysiologic consequences of the procedure. Of 131 patients submitted to hepaticojejunostomy, eight had previously a cholecystectomy and choledochoduodenostomy and 19 a choledochoduodenostomy. Of the total of 47 patients who underwent choledochoduodenostomy in our Clinic before 1960, two died (4.5%) and nine (20%) required hepaticojejunostomy. Most of these patients developed cholangitis, recurrent stones and obstruction of the CBD. Indications for choledochoduodenostomy were choledocholithiasis (28 cases), stricture by surgical injury (12 cases), stenosis of the sphincter (four cases), wide CBD stenoses (four cases) and chronic pancreatitis (one case). This evidence is in keeping with the findings of Jones,⁹ Olivier,¹⁶ and Smith¹⁸ who have

stated that choledochoduodenostomy should only be used if no other alternative is possible. Consequently, in our experience at present choledochoduodenostomy is performed only in patients submitted to gastrectomy, in whom duodenal loop is excluded from the enteric contents and provides excellent protection against reflux. Moreover, an end-to-side anastomosis between CBD and duodenum is always employed to avoid the so-called sump syndrome in that the cul-de-sac accompanying choledochoduodenostomy is excluded from the biliary flow.

All the conditions which indicate choledochoduodenostomy in our opinion may be at best treated with hepaticojejunostomy or sphincteroplasty. In patients with iatrogenic stricture, choledocholithiasis or stenosis at the sphincter of Oddi with markedly dilated duct, wide stenosis of CBD and choledochal cyst, a routine hepaticojejunostomy is the procedure of choice. Conversely, in patients with choledocholithiasis or stenosis at the sphincter of Oddi and diameter of CBD less than 1.5–2 cm sphincteroplasty is the preferred operation.²⁰ In these cases

TABLE 4. Patients Reoperated for Stricture of Hepaticojejunostomy

Sex	Age	Previous Operations	Indication for Hepaticojejunostomy	Result After First Hepaticojejunostomy	Result After Second Hepaticojejunostomy
F	44	cholecystectomy (1958) choledochoduodenostomy (1960) Kehr-tube (1961)	stricture of choledochoduodenostomy	cholangitis 2 months after	died in fifth post-operative day for renal hepatic failure
F	34	cholecystectomy (1958) choledochotomy and Kehr-tube (1960)	biliary fistula	cholangitis 1 month after	died in third post-operative day for cardiac failure
M	28	cholecystectomy (1962) choledochotomy and Kehr-tube (1963) choledochoduodenostomy (1963)	stricture of choledochoduodenostomy	cholangitis 6 months after	symptom-free at 1 year followup
F	39	cholecystectomy (1964) choledochotomy and Kehr-tube (1966)	recurrent lithiasis	cholangitis 1 year after	symptom-free at 2 years followup
M	56	cholecystectomy and papillectomy (1966)	recurrent lithiasis	cholangitis and stones 1 year after	symptom-free at 3 years followup
F	46	cholecystectomy (1968) choledochoduodenostomy (1968)	stricture of choledochoduodenostomy	cholangitis and biliary fistula 4 months after	symptom-free at 3 years followup
F	30	cholecystectomy and choledochoduodenostomy (1968)	stricture of choledochoduodenostomy	cholangitis 5 months after	symptom-free at 4 years followup
F	55	cholecystectomy (1969)	complete excision of CBD	cholangitis 8 months after	symptom-free at 2 years followup
M	35	cholecystectomy (1970)	recurrent lithiasis	cholangitis 1 year after	symptom-free at 2 years followup

sphincteroplasty provides at the same time: 1) a more rationale treatment of papillitis, ampullary stones and chronic pancreatitis related to gallstones; 2) an easy and safe approach to the CBD for exploration and stone removal; and 3) a prevention of the biliary stasis and recurrence of stones. However, when a markedly dilated duct is present sphincteroplasty is not effective in preventing biliary stasis because of the discrepancy between CBD size and papillary opening, and therefore hepaticojejunostomy is required.

In conclusion, several conditions which indicated choledochoduodenostomy may be at best treated with hepaticojejunostomy, which provides a low mortality (3%) and satisfactory long-term results in 89 per cent of the cases. It is not adequate treatment for pancreatitis related to alcoholism, that should be treated with denervative, derivative or resective procedures according to the circumstances.²¹ On the basis of accumulated data, a limitation of the extent of indications of choledochoduodenostomy seems to be advisable.

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