

Choledochojunorrhaphy with Internal T-tube Splint of Silicone Rubber

(choledochojunorrhaphy/silicone rubber T-tube/obstructive jaundice)

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Several palliative operations are performed for obstructive jaundice caused by an unresectable malignant tumor in the region of the head of the pancreas, duodenum, and hepatic duct. These procedures are not ideal as there are losses of bile in the external drainage, obstruction of the anastomosis by tumor invasion and ascending biliary tract infection in cases of internal drainage. Failure of sutures is lethal in these poor risk patients. Choledochojunorrhaphy plus the application of an internal T-tube splint of silicone rubber should keep the drainage patent for a longer period.

MATERIALS AND METHODS

Insertion and Fixation of T-tube

The peritoneal cavity is entered through an upper midline incision, and the lesion related to the obstructive jaundice is examined for resectability. Cases of an unresectable malignant tumor at the head of the pancreas and duodenal region are the best indication for this procedure, however, this approach can also be used in cases when the tumor is located in the common hepatic duct, proximal to the cystic junction. First, the choledochus is opened by the usual technique and a T-tube, made of 100% silicone rubber (polydimethyl-siloxan), as thick as possible, is inserted into the choledochus. The hepatoproximal arm of the T-tube with several side holes aids in draining bile from uninserted duct and is inserted deep into the right or left hepatic duct beyond the duct junction. The lengths of the hepatodistal arm and foot of T-tube are 2 cm and 5 cm, respectively. The choledochotomy is then tightly closed and one of the sutures of the upper and the lower border is made through the wall of the T-tube (Fig. 1-a). Should the tumor be located in the upper area of the bile duct and hepatic hilum, following cholecystectomy, the choledochus is opened and the hepatoproximal arm of the T-tube is inserted into the dilated hepatic duct beyond the lesion. A silicone rubber T-tube, with adequate solidity and elasticity, can maintain potency of the drainage tract against invasion of the cancer.

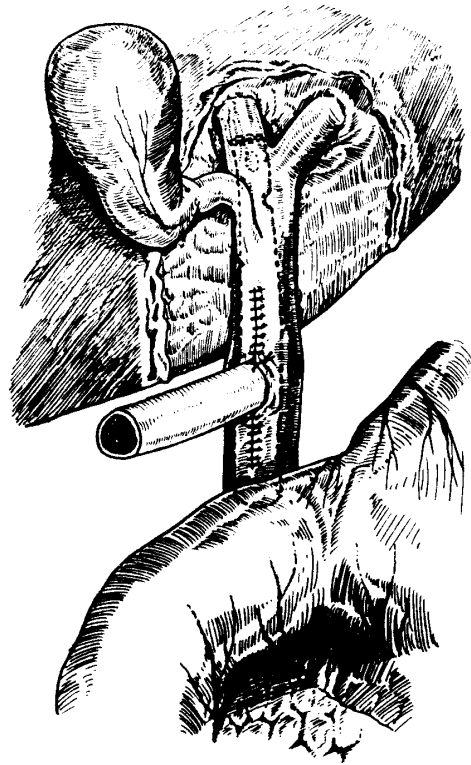


Fig. 1-a. Insertion and fixation of T-tube.

Preparation of the Jejunal Loop

The jejunal loop is prepared according to the procedure of choledochojejunostomy with Roux-en-Y. The jejunum is amputated at 15 cm anal level from the Treitz ligament, the anal end of jejunum being lifted, and a retrocolic Roux-en-Y anastomosis is performed at 30–40 cm to the anal level of the amputated jejunal end (Fig. 1-b).

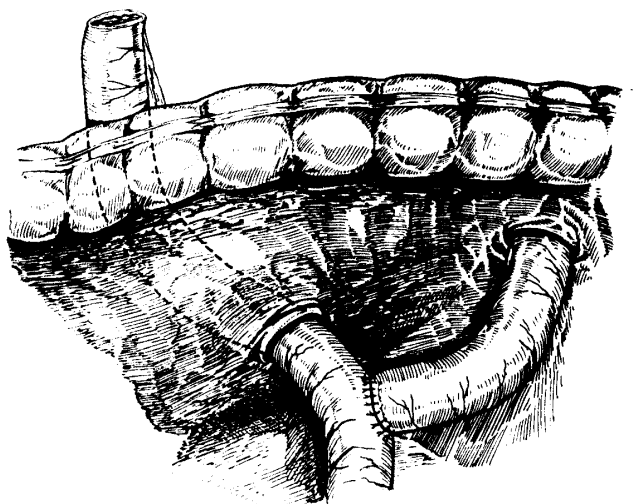


Fig. 1-b. Preparation of the jejunal loop.

Closure of the Jejunal End

The jejunal loop end is closed by a two layer suture yet the canal is left

so as to insert the T-tube. A purse-string suture is then made around the canal (Fig. 2-a).

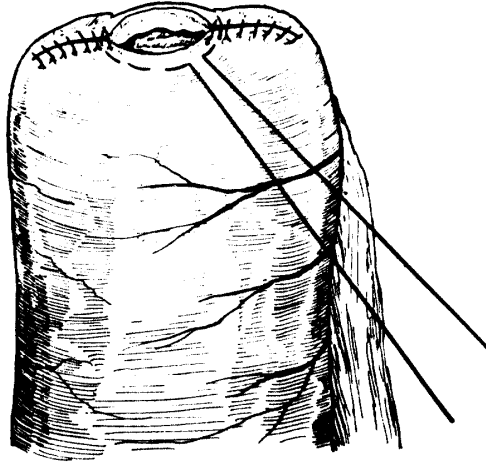


Fig. 2-a. Closure of the jejunal loop.

Insertion of the T-tube Foot into the Jejunal Loop

Taking care not to expose the jejunal mucosa, the T-tube foot is inserted into the canal of the jejunal loop, and the purse-string suture is tied. The jejunal loop and the foot of the T-tube are fixed closely to the choledochus (Fig. 2-b).

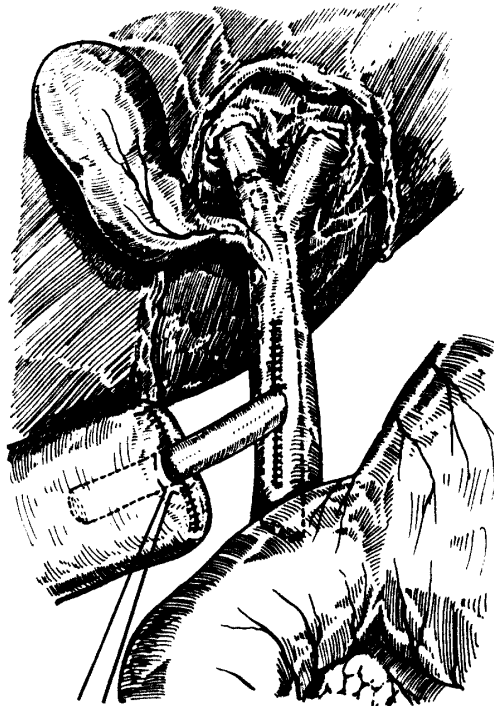


Fig. 2-b. Insertion of the T-tube into the jejunal loop.

Suture between the Jejunal Loop and the Choledochus

Choledochojejunorrhaphy is performed all around the jejunal loop by interrupted sutures between the seromuscular layer of jejunal loop and the choledochal serosa. Winslow drainage is applied (Fig. 3).

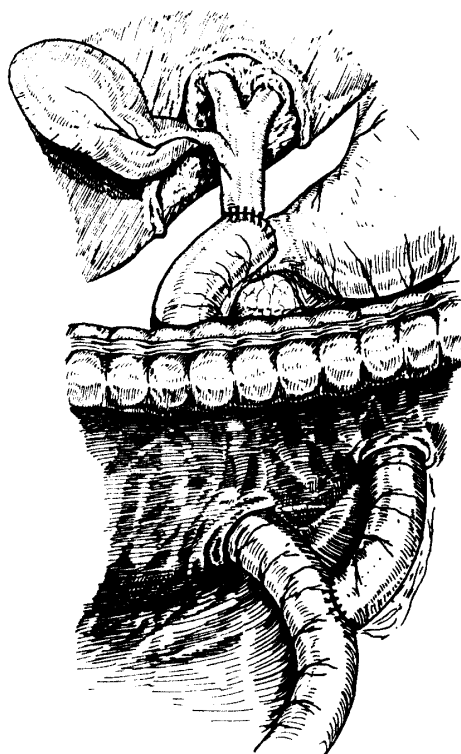


Fig. 3. Suture between the jejunal loop and the choledochus.

CASE REPORT*Case 1*

A 72 year old man was admitted our hospital for jaundice, abdominal distress and hepatomegaly. A dull edge of the liver was palpable at 2 fingers width in the right hypochondrial region and positive Courvoisier's sign, and epigastric tenderness were evident. Laboratory findings on admission are shown in Table I. Percutaneous transhepatic cholangiography (PTC) revealed a complete stenosis in the terminal choledochus, dilatation of the intrahepatic bile duct and choledochus above the stenosis. Endoscopic retrograde cholangiopancreatography (ERCP) showed interruption and stenosis of the head of the pancreatic duct and extensive dilatation of caudal duct. Under a diagnosis of cancer of the head of the pancreas, PTC drainage was performed. On the 7th day after drainage he had an elevated temperature and abdominal pain, and the PTCD was not draining. Laparotomy was immediately performed. The PTCD tube had pulled off into the free peritoneal cavity, causing a bile peritonitis, and an egg sized tumor of the pancreas head and invasion into the transverse mesocolon were evident. As

TABLE I. *Laboratory Findings at Admission of Case 1*

WBC	9000	/mm ³	Na	138	mEq/l
RBC	400	10 ⁴ /mm ³	K	4.5	mEq/l
Hb	11.9	g/dl	Cl	104	mEq/l
Ht	34.7	%			
PLT	26,6	10 ⁴ /mm ³	PTT	33.2	sec
T. P.	6.3	g/dl	CHE	769	IU/l
Alb.	3.8	g/dl	ALP	512	IU/l
A/G	1.3		LDH	431	IU/l
T. Bil	12.7	mg/dl	BUN	12	mg/dl
D. Bil	10.8	mg/dl	CREA	0.6	mg/dl
GOT	268	IU/l	Amy	485	IU/l
GPT	174	IU/l			

radical surgery was not deemed feasible, external drainage of the choledochus with a silicone rubber T-tube and abdominal drainage were applied. The postoperative course was uneventful and the jaundice gradually decreased. As the patient insisted on being discharged, a choledochojejunorrhaphy with internal T-tube splint, formerly inserted into the choledochus, was performed on the 41st postoperative day. The jaundice further decreased after the second operation. Color of the stool reverted to normal and he was discharged from our hospital on the 18th day after this procedure. The transition of the jaundice and the volume of drainage during the hospitalization are shown in Fig. 4. The silicone rubber T-tube with an X-ray marker, used as the splint, is shown on a plain abdominal X-ray film at the time of discharge (Fig. 5). Further increase in the abdominal pain, jaundice and liver dysfunction did not occur, but 4 months after discharge, he re-entered our hospital complaining of general malaise, but abdominal distension due to ascites. He expired 9 days later. Autopsy revealed no ascending biliary infection and the lumen of the T-tube was patent.

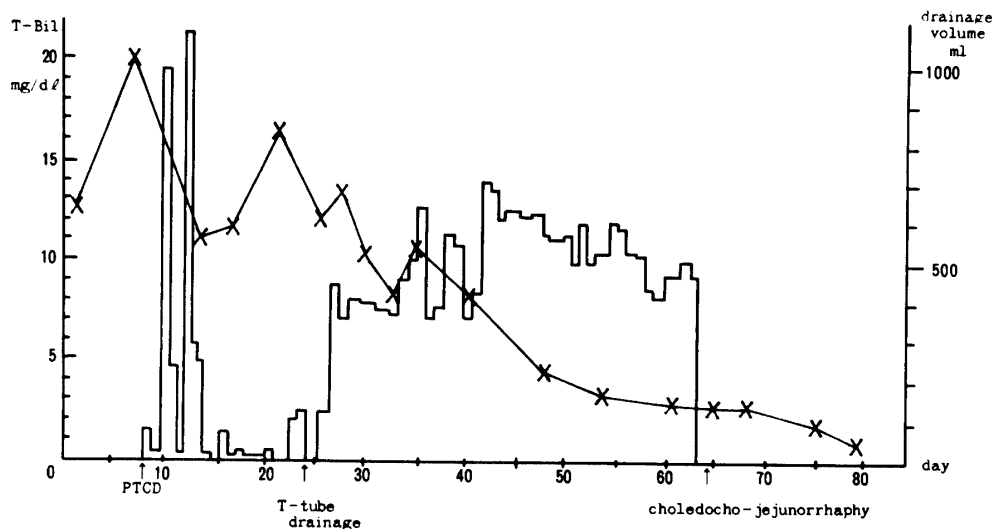


Fig. 4. Transition of jaundice and drainage volume in Case 1.

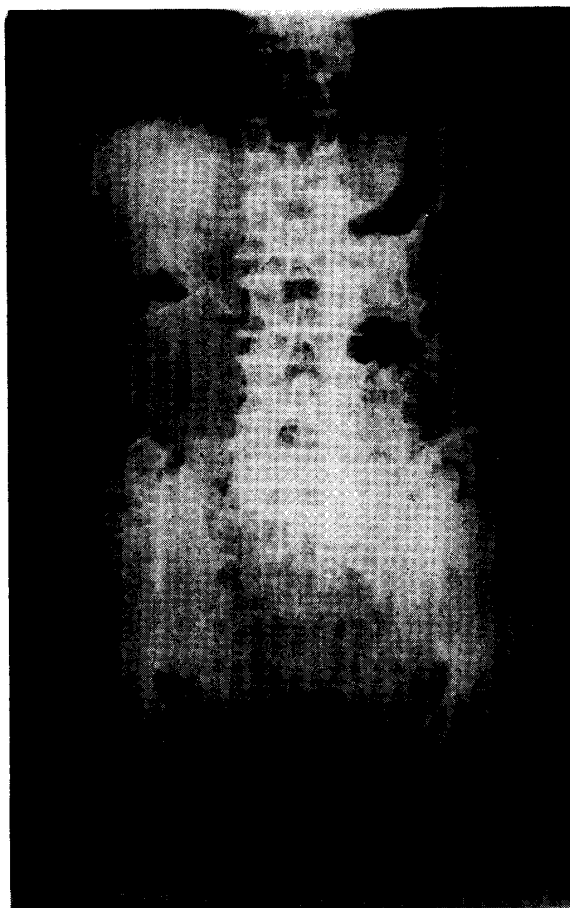


Fig. 5. Plain abdominal X-ray film at the time of discharge. X-ray marker of the T-tube is shown.

Case 2

A 66 year old man with jaundice and epigastric distress entered our hospital. A highly distended gall bladder was palpated in the right hypochondrial region. Laboratory findings are shown in Table II. PTC,

TABLE II. *Laboratory Findings at Admission of Case 2*

WBC	6900	/mm ³	Na	136	mEq/l
RBC	297	10 ⁴ /mm ³	K	4.3	mEq/l
Hb	9.6	g/dl	Cl	105	mEq/l
Ht	27.6	%			
PLT	21.9	10 ⁴ /mm ³			
T. P.	5.3	g/dl	CHE	549	IU/l
Alb.	3.1	g/dl	ALP	113	IU/l
A/G	1.4		LDH	255	IU/l
T. Bil	3.9	mg/dl	BUN	29	mg/dl
D. Bil	3.2	mg/dl	CREA	1.1	mg/dl
GOT	23	IU/l	Amy	257	IU/l
GPT	62	IU/l			

formerly performed at another hospital, showed stenosis of the cystic junction

and dilatation of the intrahepatic bile duct, therefore, cholangiocarcinoma originating in the cystic duct junction was suspected (Fig. 6). Drainage from

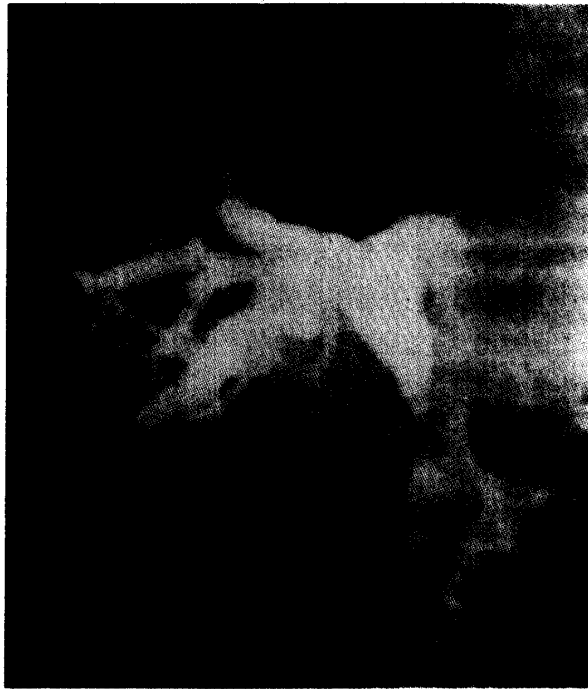


Fig. 6. PTC of Case 2. Stenosis of cystic duct junction is shown.



Fig. 7. Postoperative T-tube cholangiography of Case 2.

PTCD was satisfactory and laparotomy was carried out on the 15th day. Invasive cholangiocarcinoma, suspected to have originated in the cystic duct junction, invasion into the stomach along the lesser curvature up to cardia, and metastasis to the ascending colon and Treitz ligament were evident. The common hepatic duct was opened following cholecystectomy, and a silicone rubber T-tube was inserted through the tumor for external drainage. The postoperative course was uneventful, and the jaundice gradually decreased. T-tube cholangiography was performed 6 months later and as shown in Fig. 7, kept the drainage tract patent against invasion of the cancer. The transition of total bilirubin and drainage volume are shown in Fig. 8.

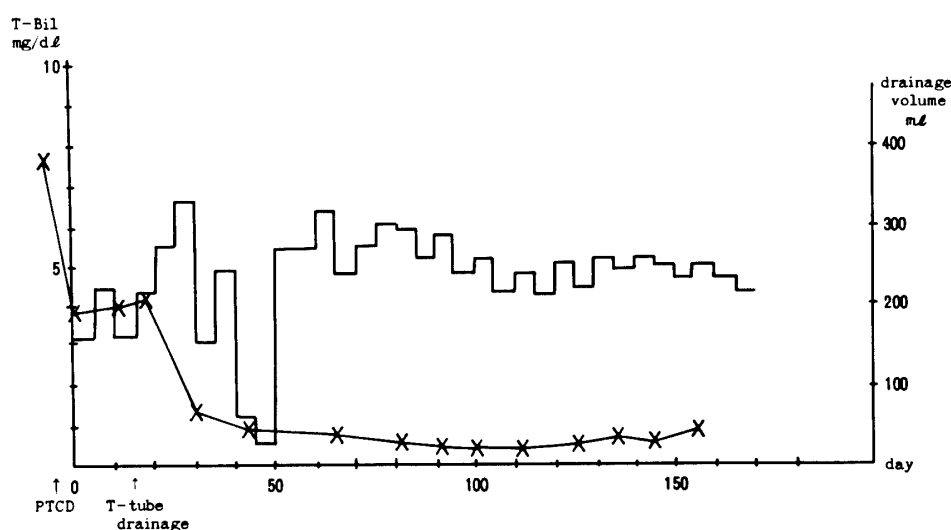


Fig. 8. Transition of total bilirubin and drainage volume in Case 2.

DISCUSSION

Internal drainage, as a procedure applied to diminish obstructive jaundice, is preferred to external drainage, because the former does not only lose bile but also maintains physiologically the hepato-enteric circulation and the secretion of bile. Anti-cancer agents prescribed as immunochemotherapy inhibit the growth of malignant tumor in the region of the head of the pancreas and duodenum, for a long time in some cases. There are reports that the growth of tumor in these regions is gradual. Terblanche *et al.* reported that 6/10 patients in whom palliative operation for jaundice due to carcinoma of main hepatic duct junction was carried out, using T-tube drainage and radiation therapy, survived over one year (1). In the statistics prepared in Japan in 1974 (2) the number of patients in whom a palliative operation was done to diminish jaundice for unresectable tumor in the pancreas and ampullary region included 1279 with internal drainage and 328 with external drainage. The procedure ordinarily applied is cholecystojejunostomy, followed by choledochojejunostomy and choledochoduodenostomy. However, these procedures carry a risk, in that these anastomosis located near the tumor will probably be obstructed by the invasion of the cancer early in the postoperative course,

and the drainage will necessarily be decreased. In addition to ascending biliary tract infection, these are the greatest disadvantages of internal drainage. Furthermore, it must be emphasized that the rate of death in palliative operation is high with pancreas head cancer, 22.8%, ampullary cancer, 19.2%, cancer occurring in the terminal choledochus, 27.9%, respectively. The case of operative death probably includes failure of sutures in the anastomotic region. Choledochojejunorrhaphy with an internal splint of 100% silicone rubber T-tube should aid in the prevention of these problems of internal drainage, such as choledochojejunostomy and choledochoduodenostomy.

Prevention against Failure of Sutures

In this procedure, the serosal layer of the choledochus and the seromuscular layer of the jejunal loop are sutured together with the T-tube as a bridge. Therefore, the rate of failure of the sutures is low even in the high risk cases with complications such as ascites, hypoproteinemia, and biliary tract infection. If the T-tube can be inserted and fixed to the bile duct, the jejunal wall need not always be sutured to the choledochal serosa. Connective tissue around the T-tube and tightly adhered serosa of other organs are also available for suturing. In Case 1, the jejunal wall was sutured, partially to the choledochal wall and partially to the duodenal wall.

Prevention of Ascending Biliary Tract Infection

Differing from usual choledocho-enteric anastomosis, in which the mucosa was directly sutured together, the bile duct and digestive canal are sutured to each other on the serosa with the silicone rubber T-tube as a bridge. The distance between the choledochojejunorrhaphy and the Roux-en-Y anastomosis is about 40 cm, so that the enteric content will not likely regurgitate into the bile duct. Thus, the risk of ascending biliary tract infection will probably be low.

Prevention for Obstruction of the Anastomosis

When a choledocho-enteric anastomosis is done to diminish the jaundice, the anastomosis may be obstructed early in the postoperative course due to invasion of the cancer located near the anastomosis. Regardless of the procedure, the anastomosis involves granulation and the scarring phase. Particularly, in cases complicated by biliary tract infection, postoperative scarring stricture is inevitable. The stricture will diminish the drainage effect of the anastomosis. One of the advantages of this procedure is to keep the anastomosis patent by applying a silicone rubber T-tube, with an adequate elasticity, solidity and little biological reaction, inserted as an internal splint. Therefore, in Case 2, the inserted T-tube maintained the drainage intact, even though the invasion of the cancer was obvious around the T-tube. The chemical strength of silicone rubber against bile is questionable. We examined the mechanical quality of the silicone rubber T-tube inserted into the choledochus for 6 months and found no change in elasticity, solidity and anti-tensitve quality. Niloff reported that in 1/8 patients, a vitallium endoprostheses for unresectable intrahepatic cholangiocarcinoma was applied and the

patient survived for over 5 years (3). Burcharth reported that the maximum survival time of 58 patients, in whom was inserted a polyethylene permanent endoprosthesis beyond the obstruction by PTC technique, was 580 days (4).

Application of the silicone rubber T-tube plus the administration of anti-cancer agents should lead to an increase in the rates of long-term survival.

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