



Historical perspective 2017 in HPB surgery and interventional Approach

East meets West
Historical investigation
of non-operative biliary interventions

Takao Itoi¹, Hiroaki Shimizu², Todd H Baron³

¹ Dept. of Surgery, Gastroenterology and Hepatology, Tokyo Medical University, Japan

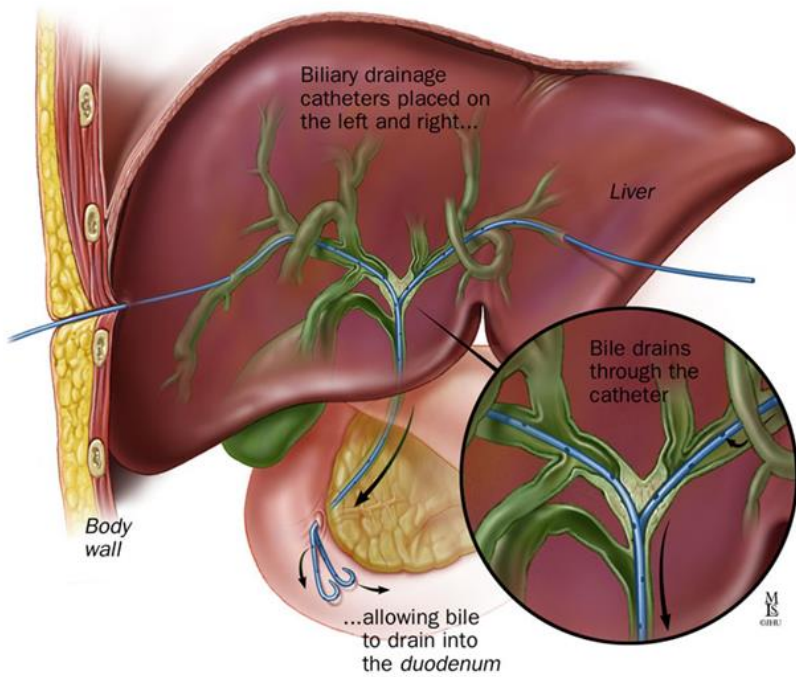
² Department of Surgery, Teikyo University Chiba Medical Center, Chiba, Japan

³ Division of Gastroenterology and Hepatology, University of North Carolina,



Biliary interventions

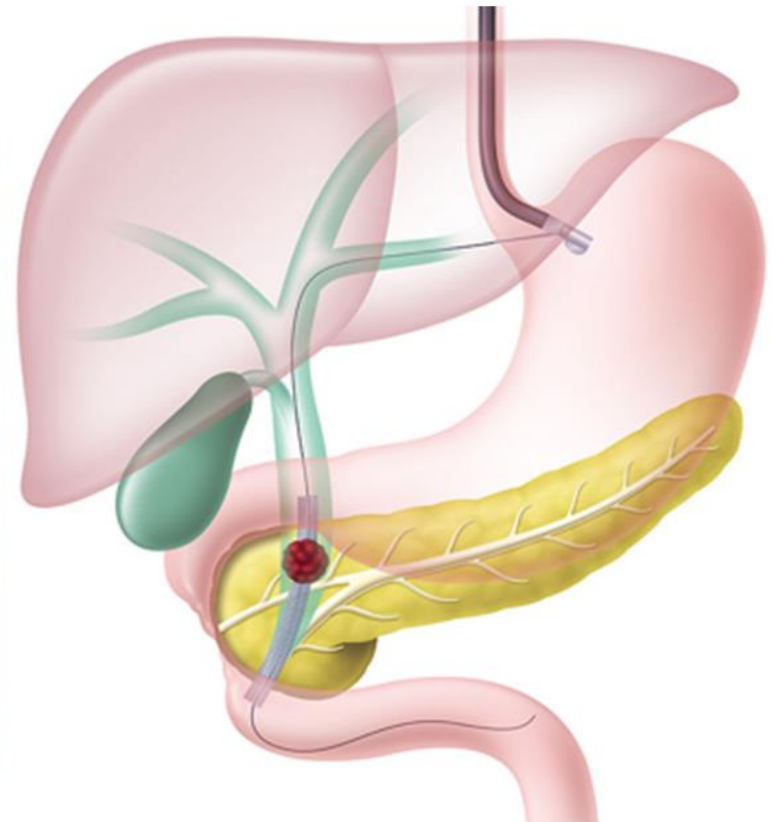
PTBD



EBD



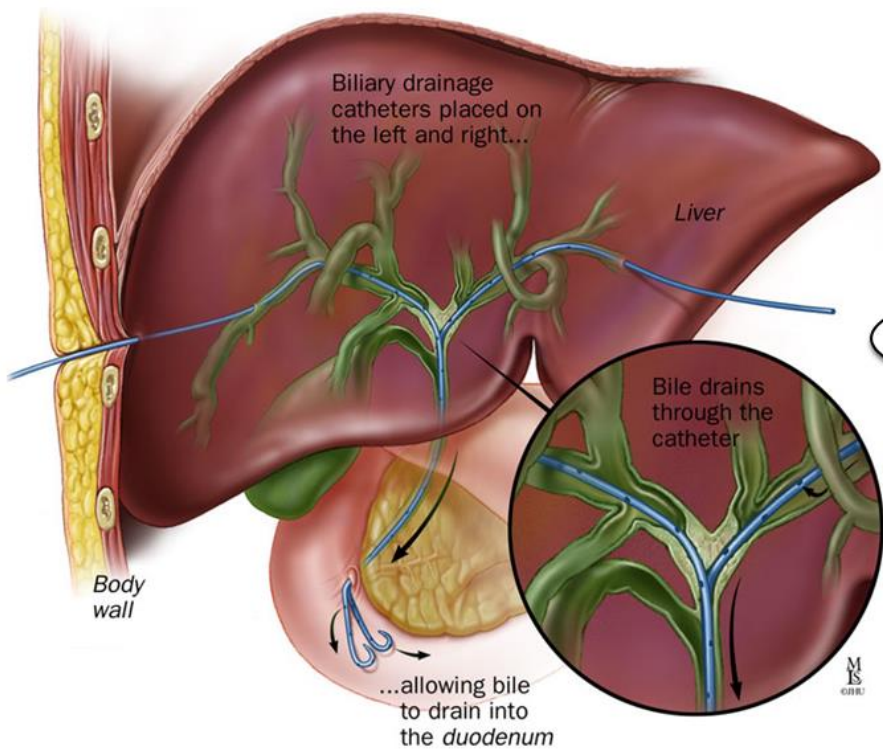
EUS-BD



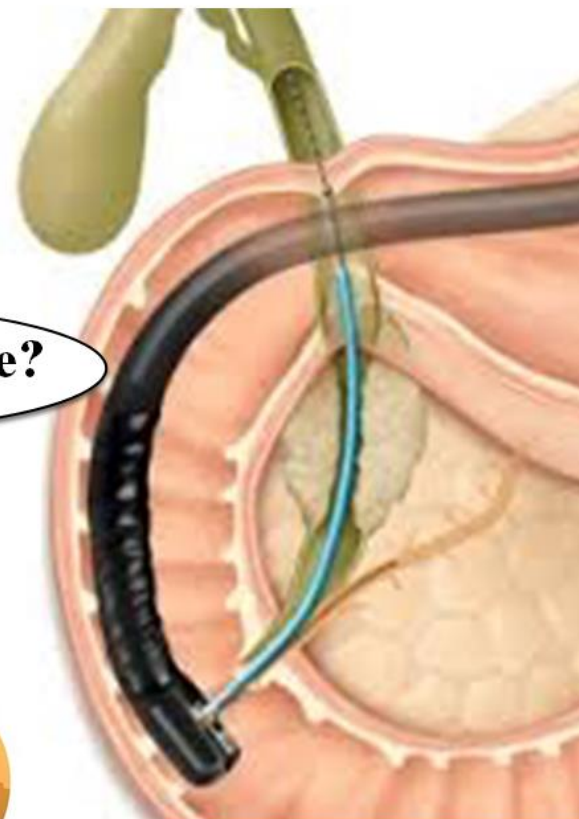


Biliary interventions

PTBD



EBD



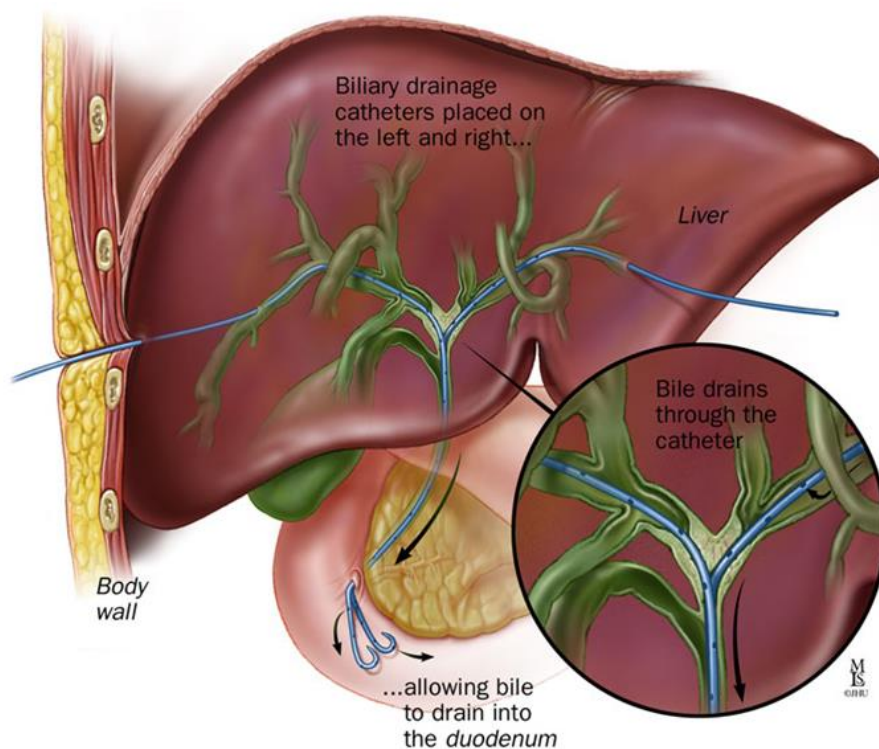
When, Who, Where?





Historical Review:

Percutaneous Transhepatic Cholangiography (PTC) & Percutaneous transhepatic Biliary Drainage (PTBD)





Percutaneous Transhepatic Cholangiography (PTC)

- Puncture of the **Gallbladder** (cholecysto-cholangiography)

1920 Burckhardt, Muller (Dtsch Z Chir 162, 1921) : German surgeon



→ Anticipating relief of colic attack and suppression of GB inflammation

- Puncture of the **Intrahepatic bile duct** (PTC)

1937 Huard P, Du-Xuan-Hop (Bull Soc med-chir de l'Indochine 15:1090,1937): French physician



→ Two cases with obstructive jaundice



* *Serious complications* (biliary peritonitis and hemorrhage)

* *Requirement of laparotomy after PTC*



1952.Carter RF, Saypol GM (JAMA, 148:253,1952)

PTC in a patient with obstructive jaundice due to carcinoma at the hilum of the liver

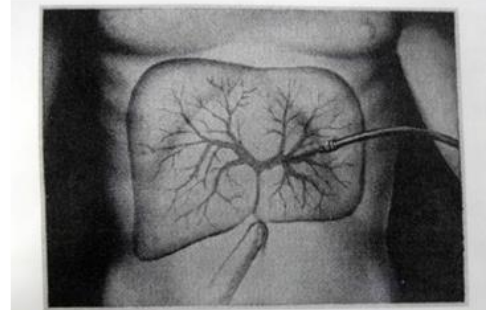


Fig. 5.—Insertion of a No. 17 spinal needle directly through the abdominal wall and liver substance into the left hepatic duct system. Note the finger of the left hand palpating the liver edge for orientation.

Cholangiogram



Fig. 7.—Transabdominal cholangiogram showing the needle in place, Iodopyracet compound solution, 15 cc., has been injected, and a complete obstruction of the hepatic ducts at the hilum is demonstrated.



Usefulness for Diagnosis of the Biliary Tract in Practice

Introduction of Roentgen Television Monitoring

1962 Evans JA, Glenn F (Radiology 78:362,1962)

1962 Arner O (Surgery 52:561,1962)



Puncture approach:

Safer and more accurate procedure

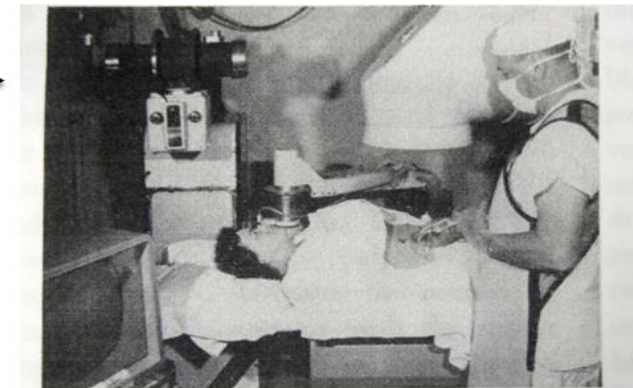


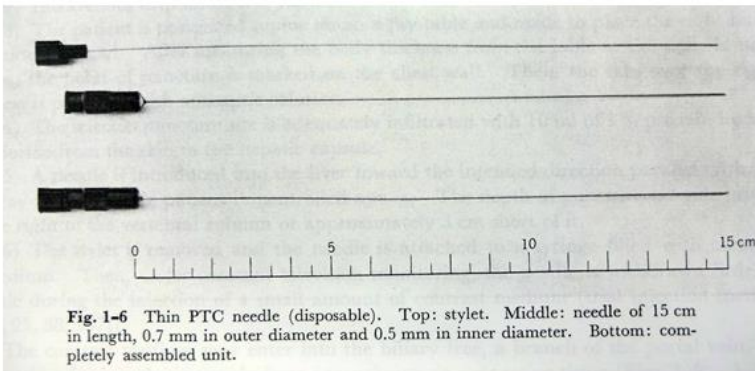
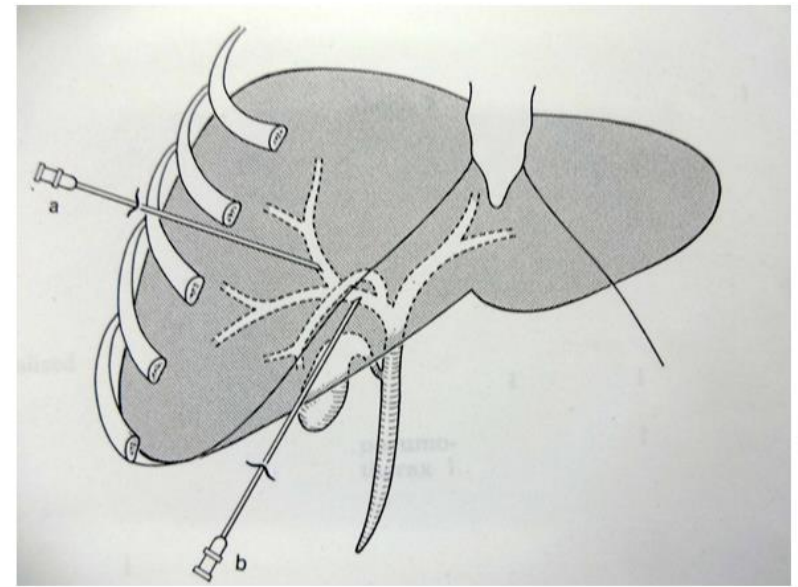
FIG. 1. Percutaneous transhepatic cholangiography is performed in the Radiological Department on a fluoroscopic table with a television monitor screen as a preoperative procedure.



Improvement of the Procedure and Equipment

- Puncture site and direction
 - a. Anterior approach
 - b. Lateral approach
- Puncture needle

Chiba needle:



Manufactured thin, flexible “skinny” needle

15 cm in length needle with a stylet

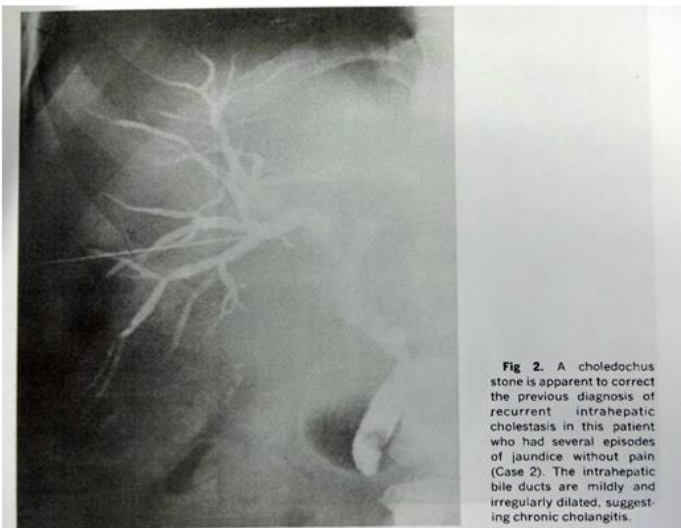
0.7 mm in outer diameter, 0.5 mm in inner diameter

Bevel angle of 30 degrees

1969 Tsuchiya K (Japan J Gastroenterol 66:438, 1969)



1970 Okuda K (Digest Dis 19:21, 1974)






Percutaneous Transhepatic Biliary Drainage (PTBD)

PTC with a drainage catheter for prevention of bile leak and hemorrhage (modified PTC)

1961 Kaplan A (Ann Intern Med 54:856,1961) 

1962 Shaldon S (Gastroenterology 42:371,1962)
:The catheter was left for 14 days



1962 Arner O (Surgery 52:561,1962) 

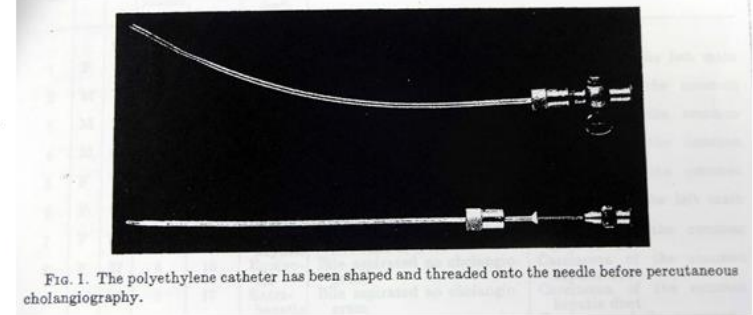


FIG. 1. The polyethylene catheter has been shaped and threaded onto the needle before percutaneous cholangiography.

PTC needle sheathed with a polyethylene catheter

1962 Glenn F (Ann Surg,156,451,1962)



Bile drainage for the relief of the obstructive jaundice after PTC : Catheterization of bile duct

Two step-procedure

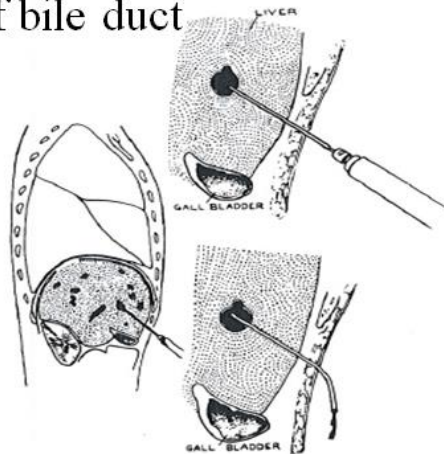


FIG. 3. A polyethylene tube supported by a needle is inserted to establish prolonged drainage or decompression of obstructed ductal system for diagnostic or therapeutic purposes.

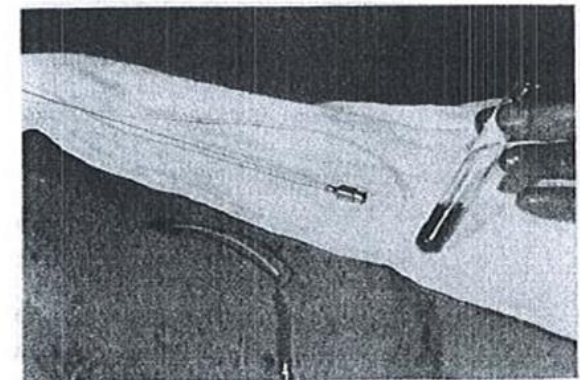


FIG. 4. Polyethylene tube in place draining bile. Decompression of ductal system and return of bile by nasogastric tube may aid in preparation of patient for extensive surgery.



PTBD for the treatment of obstructive jaundice after PTC

1969 Kaude JV (Radiology 93:69,1969) : The catheter was left for more than 2 months



1974 Molnar W (Am J Roentgenol Radium Ther Nucl Med 122:356,1974)



*“Relief of obstructive jaundice through percutaneous transhepatic catheter
-A new therapeutic method-”*

1978 Nakayama T (Gastroenterology 74:554,1978)

Two step-procedure



Adequate positioning of the catheter
using type J-guide wire

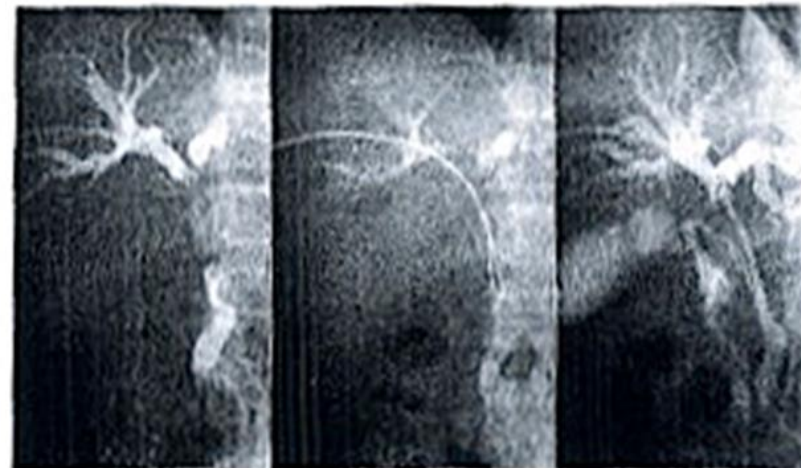


FIG. 6. Bile duct carcinoma immediately below the bifurcation. Left, catheter did not go through the tumor and positioning was not secure; middle, movable type J-guide wire was advanced through the tumor; right, catheter was advanced over the guide wire. This position is most secure for the catheter.



Direct percutaneous transhepatic cholangial drainage under fluoroscopic control

Two-step method: Intrahepatic biliary trees projected to 2-D plane under fluoroscopy

1972 Takada T (Biologie et Gastro-Enterologie Tome 5,528, 1972)

1973 Takada T (Int Surg 59:180,1974)

1976 Takada T (J Surg Oncology 8:83,1976)



Fig. 2. Procedure. I. First stage: percutaneous transhepatic cholangiography. II. Second stage: puncture for drainage under visual control by preceding PTC.



Fig. 3. Under fluoroscopic control of preceding PTC, the site of puncture is carefully chosen.

Puncture of a dilated bile duct in the perpendicular ventrodorsal direction under fluoroscopic control

Percutaneous non-operative Cholangioscopy

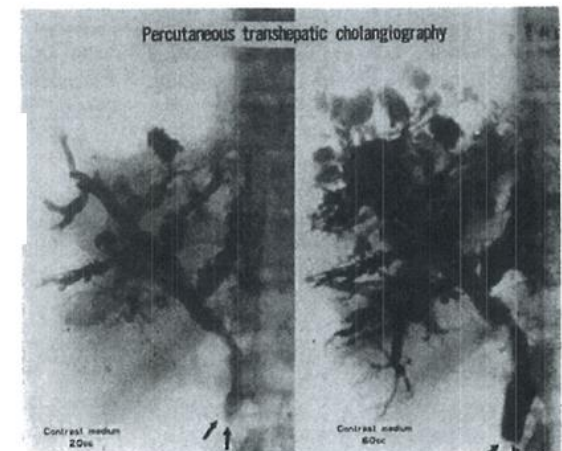


Fig 1. — PTC shows numerous communicating pyogenic hepatic abscesses with obstruction of the distal common bile duct. Left: After 20 cc of contrast material are introduced. Right: After 60 cc are introduced.

1972 Takada T (Excerpta Medica, 18th International Congress Series 257:81,1972)

PTCS and forceps biopsy after expanding the fistula of PTBD



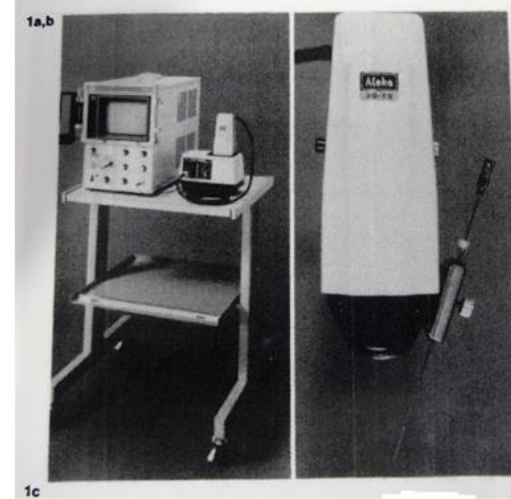


Ultrasound-guided PTC and PTBD

US-guided PTC

1977 Makuuchi M (Kanzo 57:435, 1977)

1978 Makuuchi M (Jpn J Surg 8:65, 1978)



Real-time sector-scanning system

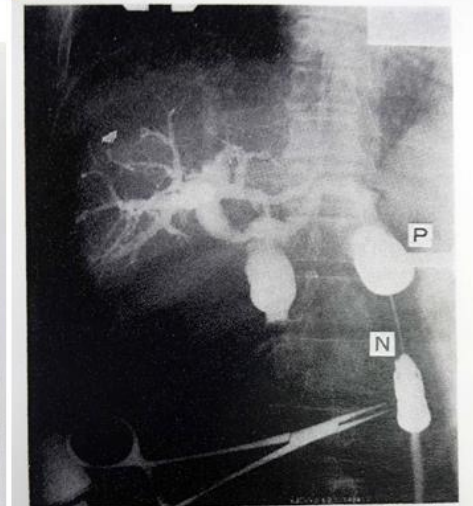


Fig. Echo guided percutaneous transhepatic cholangiography. N: PTC needle P: puncture transducer

UG-PTC

US-guided PTBD

Single-step procedure without cholangiography

1980 Makuuchi M (Radiology 136:165, 1980)

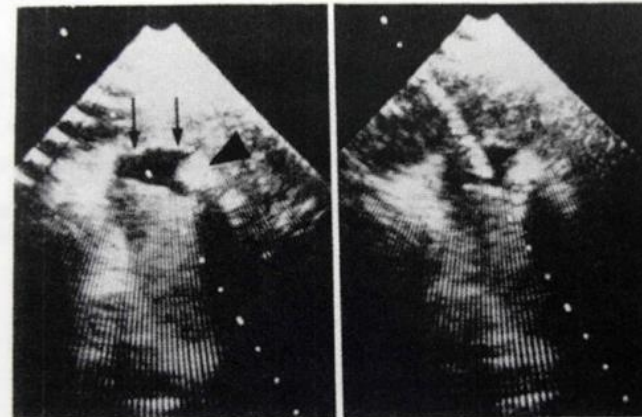


Fig. 6. Same patient as in Figure 5. Transverse sonograms using the seventh intercostal space show hepatolithiasis. a. Sonogram demonstrates the dilated bile duct (arrows) and hepatolithiasis (arrowhead) with an acoustic shadow. b. The PTBD needle was inserted into the bile duct using the broken line as a guide. A 3.5-MHz transducer was used.



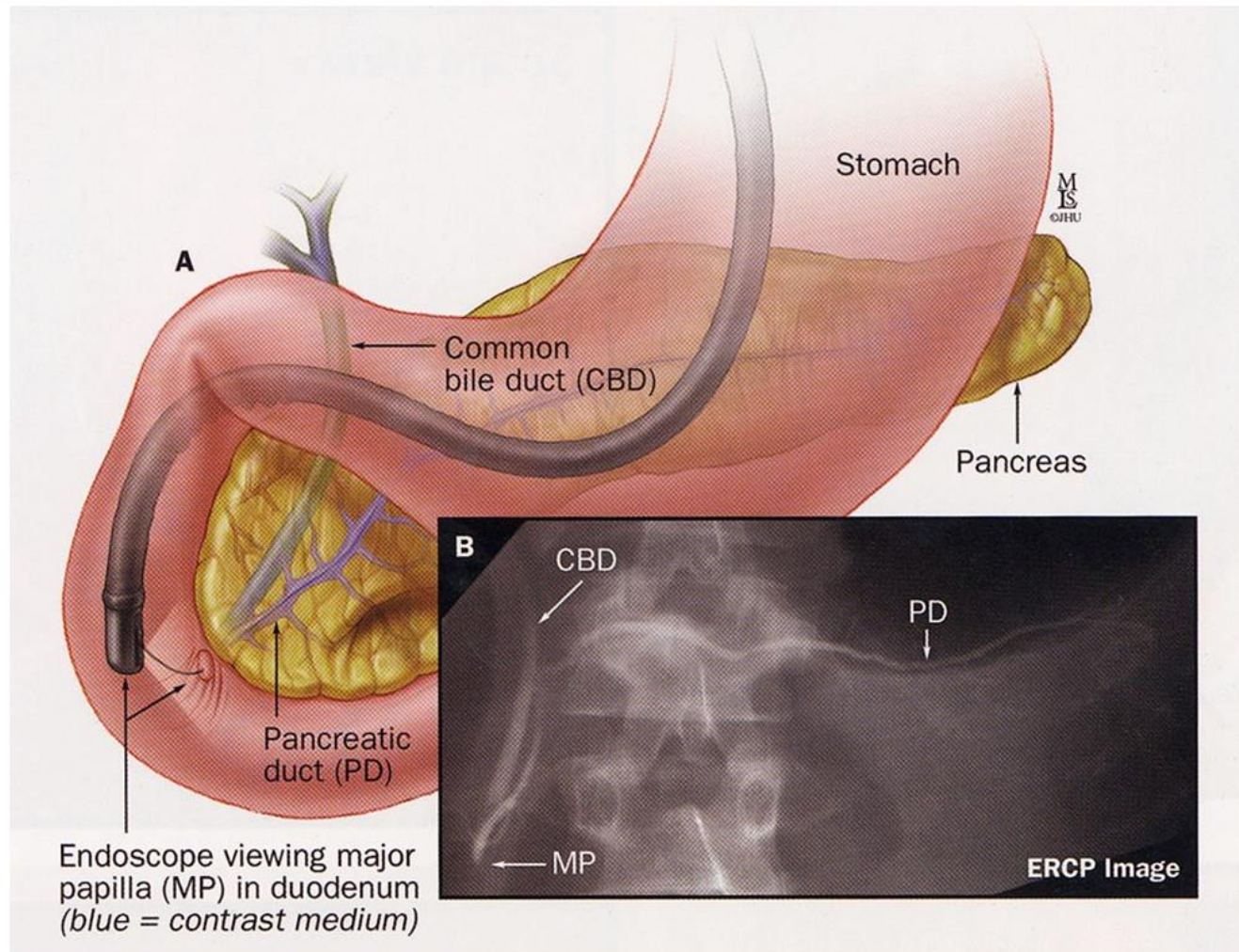
Fig. 9. Post-UG-PTBD cholangiogram shows the PTBD tube penetrating the bile duct (arrows).

Post-UG-PTBD Cholangiogram



Historical Review:

Endoscopic retrograde cholangiopancreatography (ERCP)





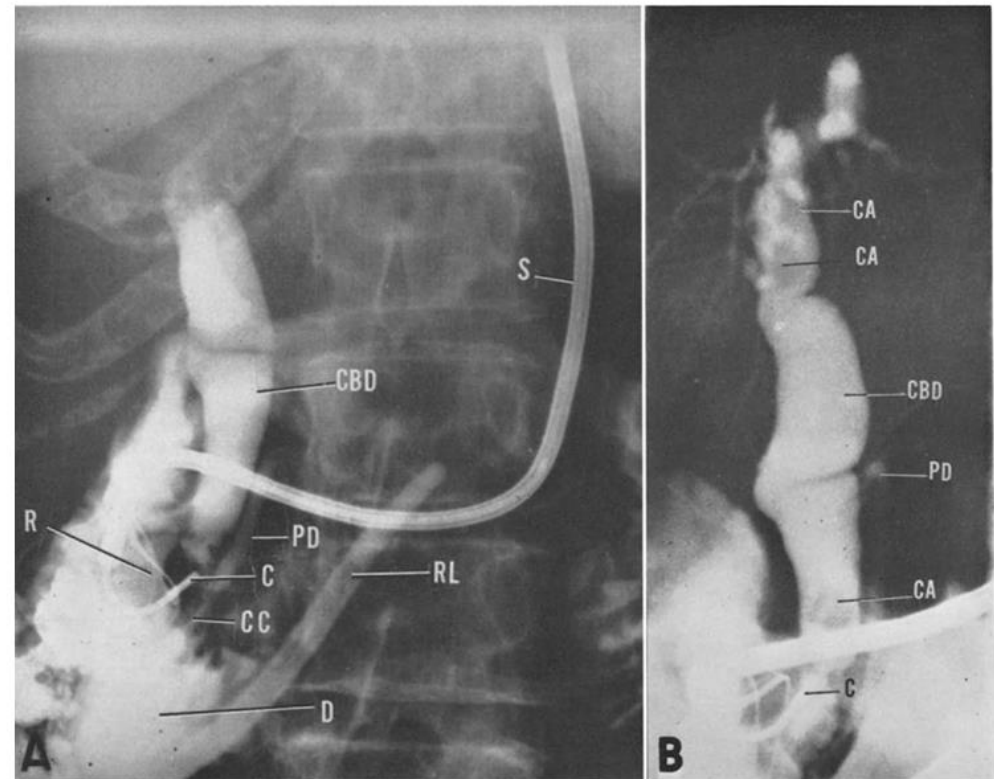
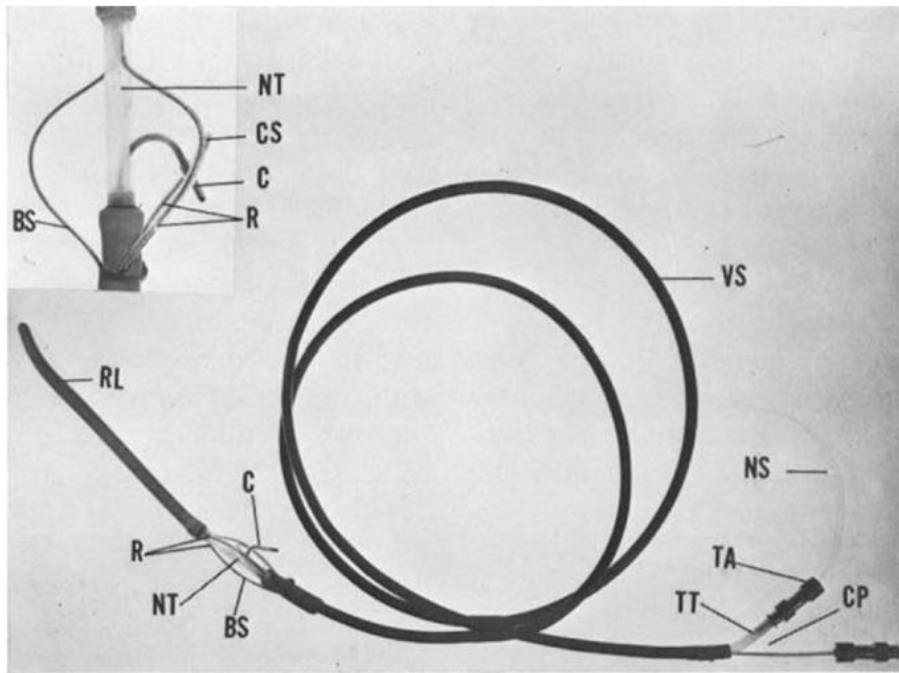
Retrograde cholangiopancreatography

Retrograde cholangiopancreatography using peroral cannula



1965 Ravinov et al (Radiology 1965;85:693-7): American radiologist

→ Anticipating endoscopic retrograde cholangiopancreatography

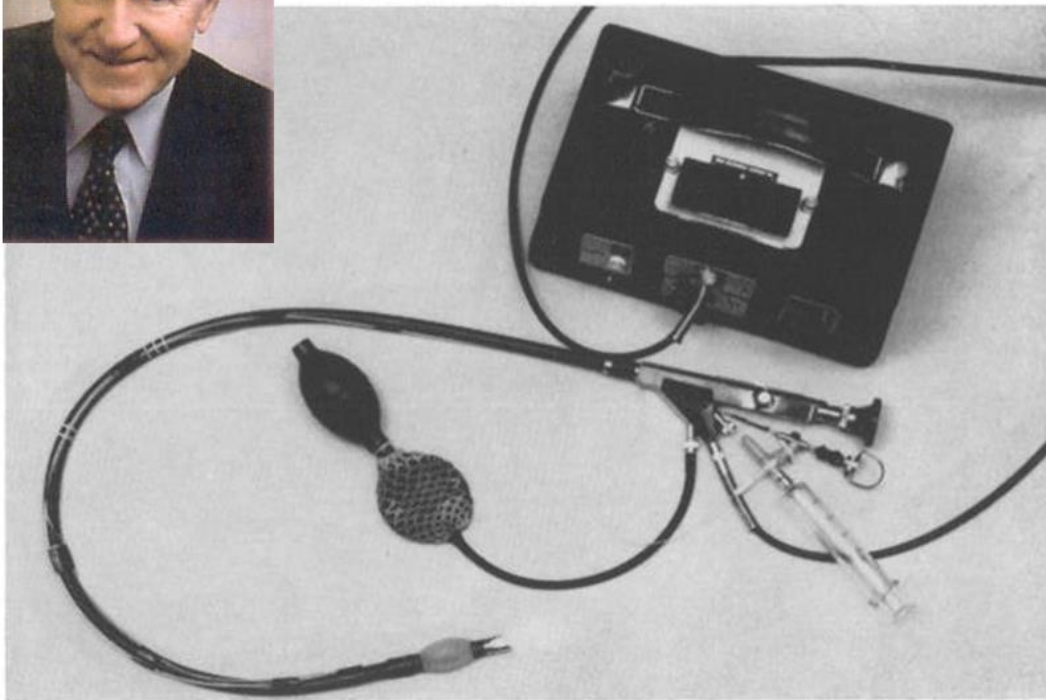
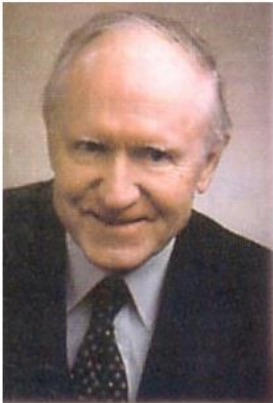




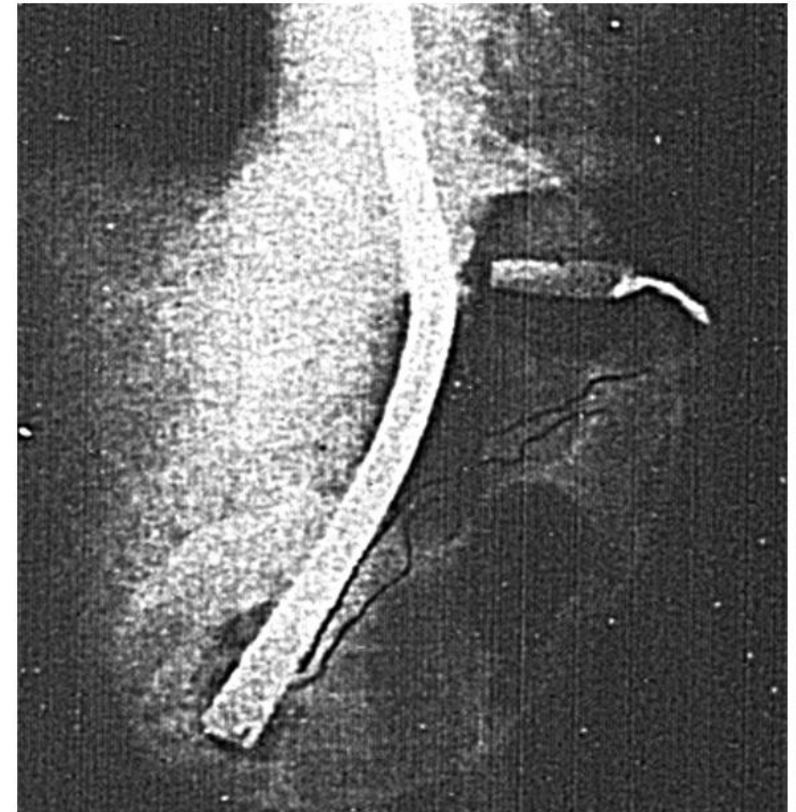
Endoscopic retrograde pancreatography

Endoscopic cannulation of the Ampulla of Vater

1968 MaCune WS et al (Ann Surg 1968;167:752-5): American surgeon



Only pancreatography



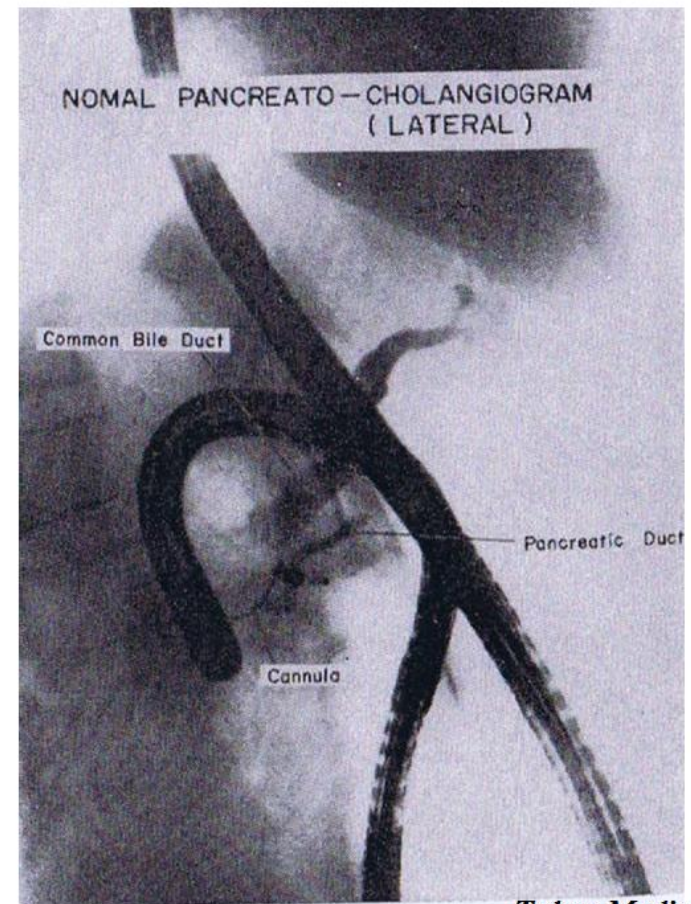
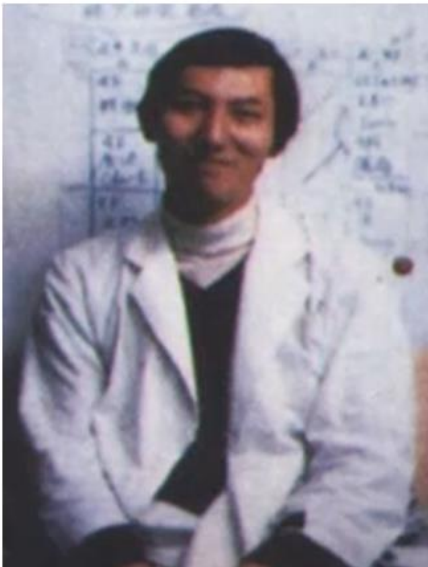


Endoscopic pancreatocholangiography (EPCG)

1970 Oi I et al (GIE;17:59-62/Endoscopy;2:103-6) : Japanese gastroenterologist



1970 Takagi K et al (Gastroenterology;59:445-52/Endoscopy;2-107-15).: Japanese surgeon





Endoscopic retrograde cholangiopancreatography (ERCP)

1972 Cotton PB (*Gut*. 1972;13:1014-25).: British gastroenterologist



Gut, 1972, 13, 1014-1025

Progress report

Cannulation of the papilla of Vater by endoscopy and retrograde cholangiopancreatography (ERCP)



Endoscopic sphincterotomy (EST)

1973 Classen et al (Med Tribune 1973;27: 1-5): German gastroenterologist



1973 Kawai et al (J Kyoto Pref Univ Med 1973;82:353-5): Japanese gastroenterologist



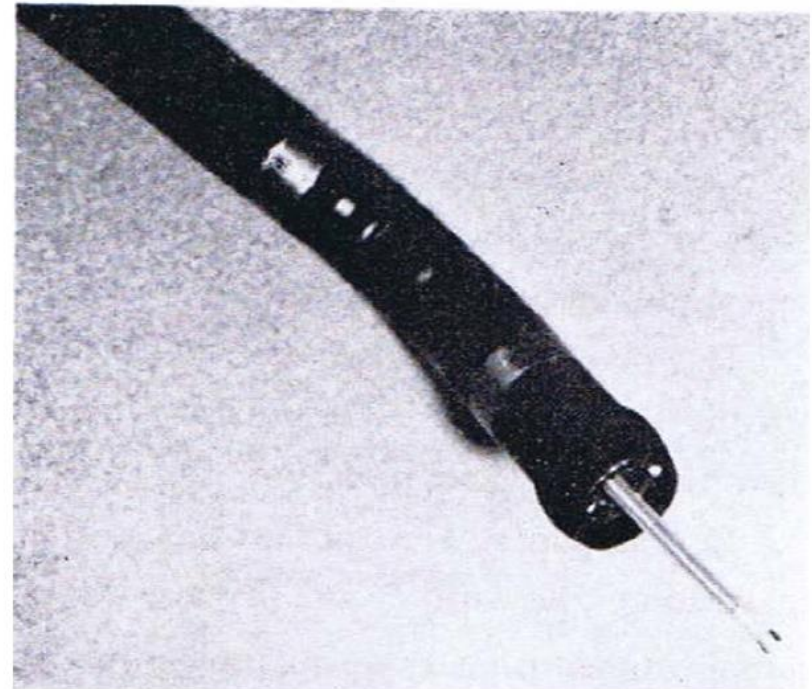
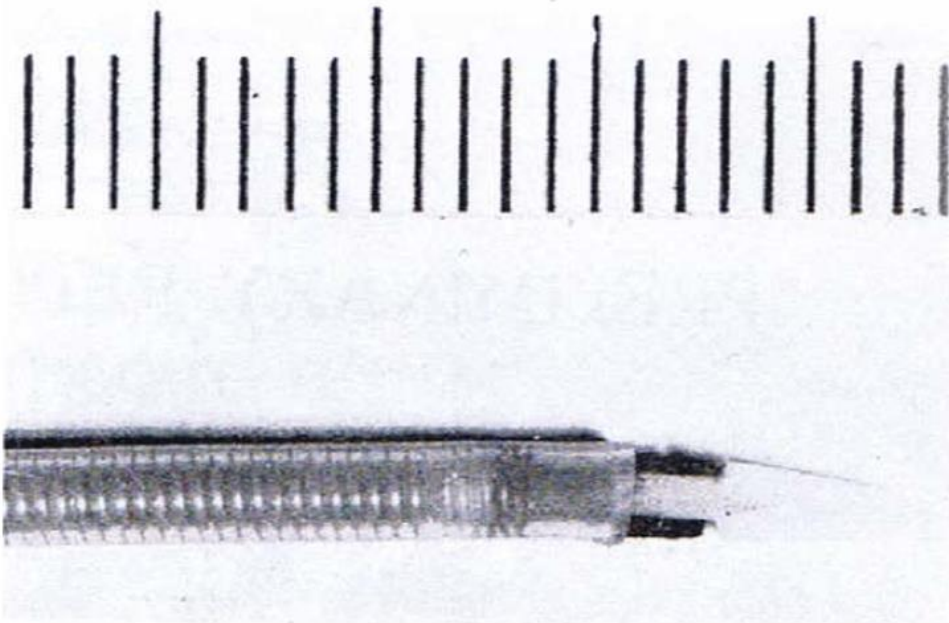


Original Works

PRELIMINARY REPORT ON ENDOSCOPICAL PAPILLOTOMY

KAWAI, K., Y. AKASAKA, Y. HASHIMOTO and M. NAKAJIMA

Kawai K, Nakajima M, et al. J Kyoto Pref Univ Med 1973;82:353-5.

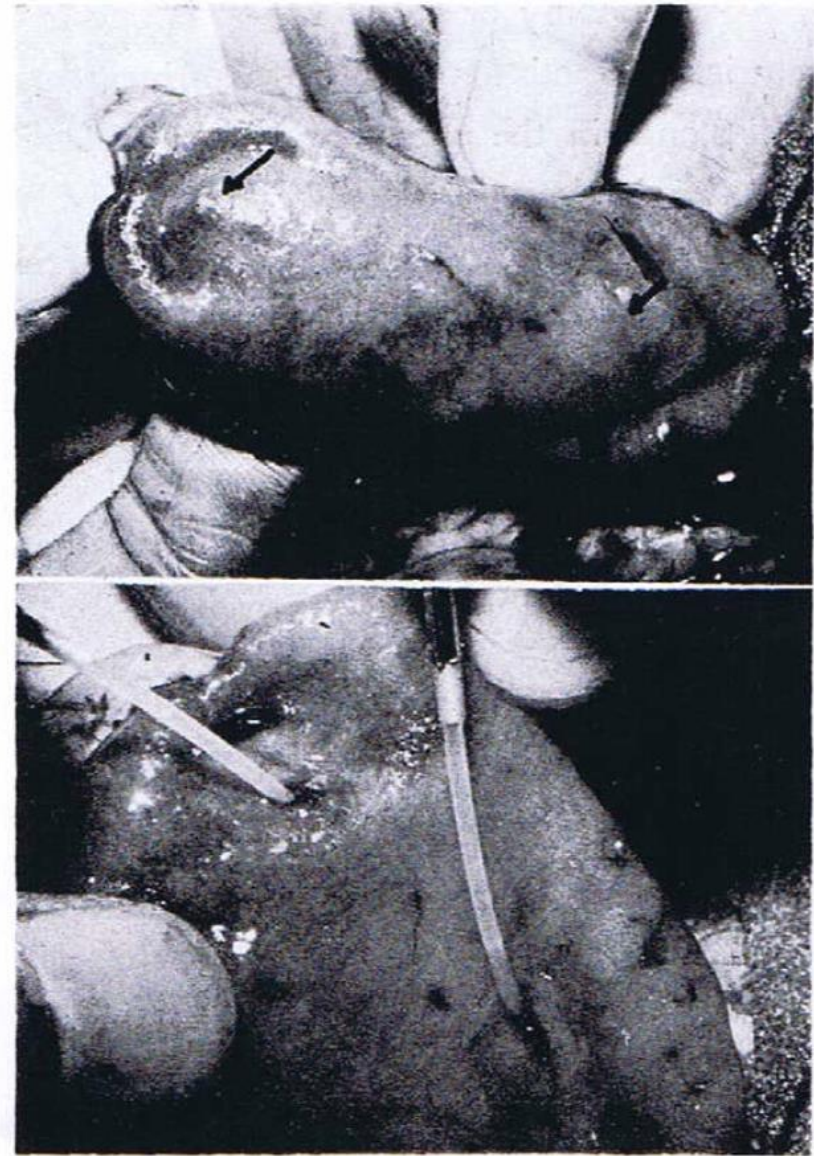




In this paper, we want to report the preliminary results of endoscopical papillotomy, concerning the utility of this method and complications using experimental animals.

MATERIAL

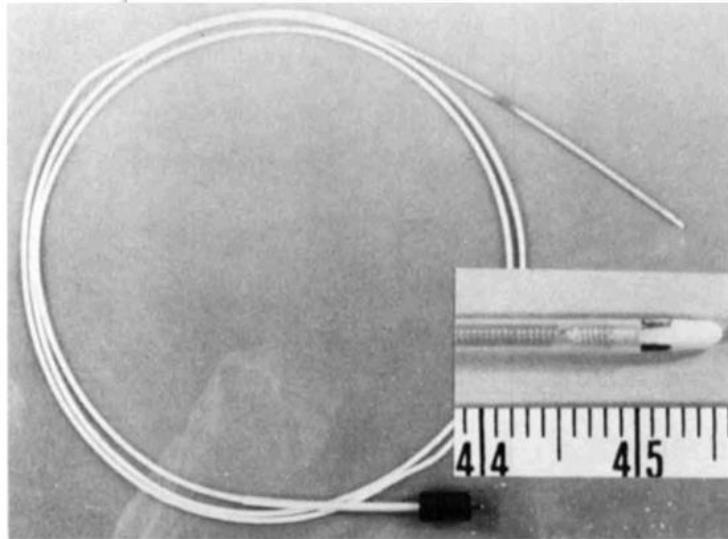
Using five adult dogs, weighing 7 kg on the average, first, we confirmed the orifice of pancreatic and common bile ducts after laparotomy followed by duodenotomy under Fluothane or ketalar anesthesia. Secondly, pancreato- and cholangiography were performed using 65% of angiografin through a venous catheter 3 Fr (atom), inserted through these two orifices (Fig. 1). Thirdly, we performed papillotomy using specially designed forceps (Fig. 2, 3), connected with ACOMA-II type (A. C. 100v, 1.5 kw) diathermy apparatus. Having confirmed no bleeding after papillotomy, we checked the pancreato-cholangiogram of these dogs 2 or 4



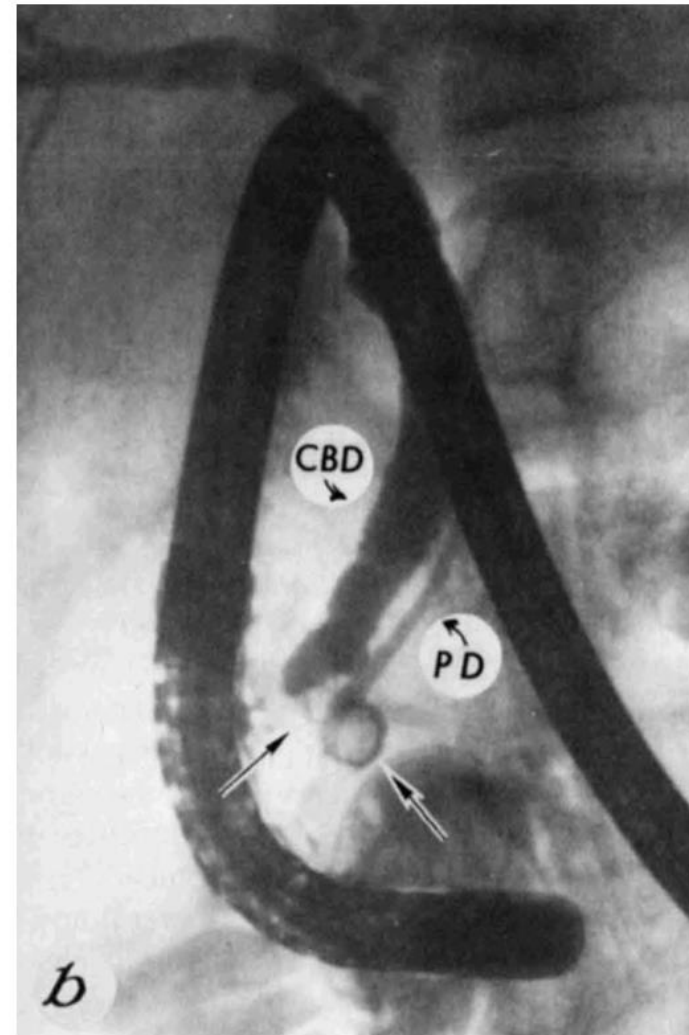
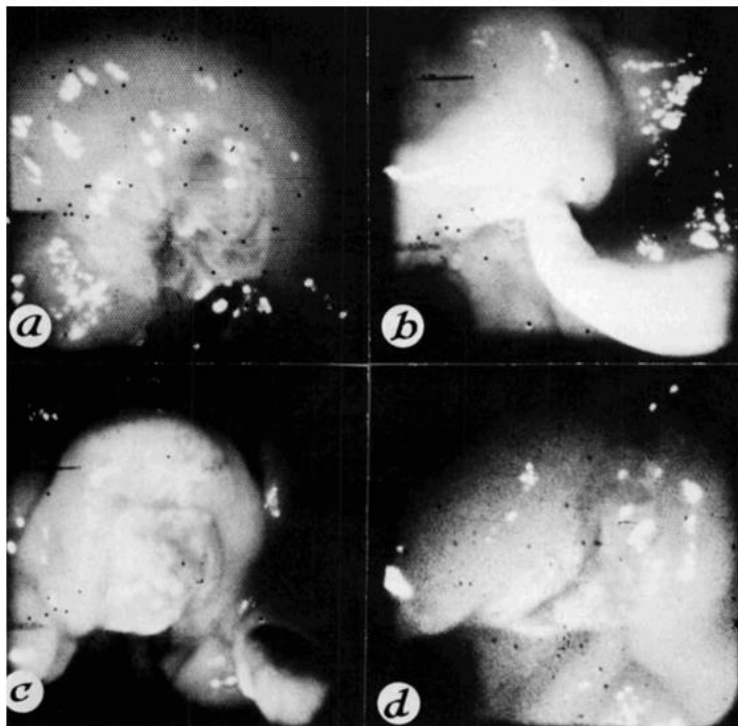


Endoscopic sphincterotomy of the ampulla of Vater

K. Kawai, M.D.
Y. Akasaka, M.D.
K. Murakami, M.D.
M. Tada, M.D.
Y. Kohli, M.D.
M. Nakajima, M.D.
Kyoto, Japan



Gastrointest Endosc 1974;20:148-51.





PERSPECTIVES

Back to the future: the first papillotomy at Erlangen

Classen M. *Gastrointest Endosc* 2000;51:637

In the beginning

Kawai K. *Gastrointest Endosc* 2000;51:637-8



Prof. Classen

Back to the future: the first papillotomy at Erlangen

In medicine, nothing is more difficult than to determine the proper approach to a specific situation and then to plot out successful therapy. This was the case on June 6, 1973, in Erlangen. A 59-year-old nurse was admitted to our department with jaundice and right upper abdominal pain. She had a cholecystectomy in the past. Clinical and laboratory results made extrahepatic obstruction likely. The course seemed clear: an ERCP with confirmation and localization of the site followed by laparotomy. However, this situation developed in a different manner. Since 1968, Ludwig Demling and I had repeatedly tried to reach the papilla of Vater through the pylorus by using various endoscopes. Finally, in 1970 we were able to inspect the papilla on a regular basis, which represented an “almost erotic fascination for endoscopists” (Ludwig Demling),¹ using the instruments of Olympus and Machida. In November 1970 we received the first JF duodenoscope from Olympus, and of the first 20 attempted cannulations, I was able to visualize either one or both duct systems 16 times. In one patient we had modestly dilated the orifice of the papilla with a regular polypectomy loop and considered the possibility of replacing surgical papillotomy with a less invasive approach. The papillotome of Erlangen—mainly invented by Ludwig Demling—is based on the polypectomy loop.

Now back to June 6th. The nurse’s papilla had a large diverticulum next to it. The ERCP clearly

demonstrated a stenosis of the papilla and a stenosis in the liver hilum. The papillotome of Erlangen was inserted into the bile duct and electric current was applied,² cutting in small increments until the yellowish biliary mucous membrane was visible. One stone was extracted with the Dormia basket.

Sadly enough, the patient’s jaundice persisted—probably due to the second stenosis. After negative forceps biopsies, we tried to endoscopically dilate the bile duct stricture using a balloon probe developed by our endoscopy nurse Rita Hohner. This procedure proved not to be completely satisfying, and the patient underwent successful surgery. This patient made it possible for us to perform the first endoscopic papillotomy as well as a gallstone extraction, a forceps-biopsy, and a balloon dilation. I performed regular checkups for many years and found no recurrence of stenosis. In March 1974 I left to continue my work in Hamburg. I will remember June 1973 in Erlangen because of its beautiful summer weather but mainly because of the first endoscopic papillotomy, which was associated with a massive response of my autonomic nervous system.

Dr. Meinhard Classen
Munich, Germany

REFERENCES

1. Demling L. Back to the future: the first papillotomy at Erlangen. *World Gastroenterology News* 1995;7.
2. Classen M, Demling L. Endoskopische sphinkterotomie der Papilla Vateri und steinextraktion aus dem ductus choledochus. *Dtsch Med Wachr* 1974;99:496-7.



Prof. Kawai

In the beginning

After the successful introduction of colonic polypectomy, we became interested in combining ERCP and electrosurgical techniques to incise the papilla of Vater. I searched the literature on surgical sphincterotomy or sphincteroplasty and found that a triangular papillotome was used successfully. Our design was a copy of this surgical knife, which was shaped like an arrowhead. After the point of the triangle was introduced into the papillary orifice, deeper insertion resulted in mechanical dilation of the opening. One edge of the triangle was electrically active and was used for experimental papillotomy in laboratory animals.

At the beginning of 1972, a push papillotome was designed by the Olympus technical group and enabled successful papillotomy without stenosis. We reported our experimental work in our university journal as "Report of endoscopic papillotomy" in 1973.¹ We waited to apply this technique on a patient.

The first case was a 48-year-old man with right hypochondrial pain after cholecysto-choledocholithotomy. ERCP confirmed a small residual stone at the end of the common bile duct. The patient refused a second laparotomy and the surgeon asked us to try endoscopic papillotomy (EPT), which was accomplished. One day later, August 10, 1973, ERCP showed the absence of a gallstone. The second case was a 29-year-old man, post choledocholithotomy, whose ERCP showed a residual round gallstone in the middle of the biliary tree. After EPT, we found a 5 × 5 mm cholesterol stone in the collected feces. Even after these two experiences, we were reluctant to ascribe the stone passage to the endoscopic treatment because of the possibility of spontaneous stone delivery.

However, the third case was very impressive and the effect of EPT was definite. In a 68-year-old woman, ERCP disclosed a dilated common bile duct and a giant stone. We asked the surgeon to permit EPT before laparotomy. Endoscopy showed swelling and hyperemia at the orifice of the papilla of Vater. After successful EPT, we awaited natural stone delivery. Two days later, the patient had colicky pain, and the next day we found a giant stone in the feces. The surgeon did not believe in our success, but at exploratory laparotomy, no stone was present. After this case we were convinced of the usefulness of endoscopic papillotomy.

Two years later we reported our experiences in "Endoscopic sphincterotomy" in the American Journal of Gastroenterology.² The outline of my and Professor Demling's presentation was introduced in OMGE News, World Gastroenterology, in May of 1995.³ Johann Wolfgang Goethe has said, "Science and art belong to the world as a whole and the barriers of nationality vanish before them."

Dr. Keiichi Kawai
Osaka, Japan

REFERENCES

1. Kawai K, Akasaka Y, Nakajima M. Preliminary report on endoscopic papillotomy. *J Kyoto Pref Univ Med* 1973;82:3 53-5.
2. Nakajima M, Kimoto K, Fukumoto K, Ikehara H, Kawai K. Endoscopic sphincterotomy of the ampulla of Vater and removal of common duct stones. *Am J Gastroenterol* 1975;64: 34-43.
3. Kawai K. Back to the future: the first papillotomy in Japan. *World Gastroenterology News* 1995;7.



Summary

Procedures	West	East
PTC	1937 Huard P	
PTBD	1962 Glenn F	
PTCS(Bx)		1972 Takada T
ERCP	1968 MaCune WS	
EST	1973 Classen M	1973 Kawai K