LOCAL EXPERIENCE OF PERCUTANEOUS TRANSHEPATIC CHOLANGIOGRAPHY

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SYNOPSIS

Percutaneous transhepatic cholangiography is a procedure which can be carried out in most radiological departments. 95 examinations performed locally are analysed. The studies were made on 92 patients mainly for the investigation of jaundice. A modified technique was adopted in which an intrahepatic duct was intubated with a polyethylene tube by a lateral approach. A high rate of success was achieved. The procedure was well tolerated by the patient and the complication rate was found to be low. Most of the patients investigated had obstructive jaundice in whom 22 showed biliary stones, 18 recurrent pyogenic cholangitis, 14 carcinoma of the pancreatic head and 7 cholangiocarcinoma. There were 4 cases of medical jaundice. The method was found to have a high index of diagnostic accuracy. In experienced hands, a failed attempt may be considered a reliable indication of absence of extrahepatic obstruction.

When jaundice becomes persistent, recurrent or progressive, two big questions are raised:

1. Is this obstructive or intrahepatic cholestatic jaundice?
2. If obstructive, what is the cause of the obstruction?

Not infrequently, clinical, biochemical and conventional X-ray studies do not provide the information.

A sophisticated radiological method, percutaneous transhepatic cholangiography plays an increasingly important role in the management of jaundice of undetermined cause. The method is also used in the investigation of post-operative jaundice. Further, it has been adopted as a palliative measure to provide long-term drainage of the biliary system in patients with obstructive jaundice in whom operation is contra-indicated.

As early as 1937, Huard and Dɔ-Xuan-Hop from Indo-China reported successful attempts at percutaneous puncture of the bile ducts in jaundiced patients with injection of lipiodol to confirm biliary obstruction. Carter and Saypol's single case in 1952 was accredited as the first complete percutaneous transhepatic cholangiogram in the English literature. Sporadic reports have since appeared and up to 1966, a total of 1218 cases was collected from the world literature and reviewed by Seldinger who added 138 cases of his own.

The procedure consisted basically of introducing a flexible steel needle through the skin into the liver, intubating an intrahepatic bile duct and injecting a contrast medium to opacify the biliary system. The majority of workers advocated an anterior subcostal approach though some preferred a lateral intercostal route. Refinement of technique came with the introduction of a fine polythene tube or catheter for cannulating the biliary ducts (Arner *et al*, 1962; Shaldon *et al*, 1962). The polythene tube was threaded tightly over a steel needle to facilitate percutaneous insertion.

None of these methods, however, was found to be free of occasional serious complications, the most important being bile peritonitis. The complication rate was minimised by immediate laparotomy when it was conclusively established that the jaundice was obstructive in nature.

MATERIAL AND METHOD

Between 1967 and 1971, 92 patients submitted to percutaneous transhepatic cholangiography and in 3 of these, for reasons indicated below, the examination was repeated. The patients were predominantly adults but there were 3 children in the study-group with ages of 1¾, 5 and 6 years. There were 78 Chinese, 8 Malays, 5 Indians and 1 Eurasian in the series, reflecting fairly closely the ethnic composition of our population.

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The method adopted has previously been described (Yu and Yin, 1969). The examination was carried out under local anaesthetic without premedication except in the paediatric cases when general anaesthesia was used. The lateral approach in the midaxillary line was preferred. A.P.E. 160 polyethylene tube was fashioned sleeve-wise on a 20-gauge needle which measured approximately 15 cm. long. The needle-cum-catheter was inserted through the skin into the liver so that its tip lay in the region of the porta hepatis. The needle was immediately withdrawn leaving the polythene tube behind. This catheter was connected to a syringe containing Urografin 60%. Injection of the contrast medium was made under fluoroscopic (or image intensifier-television) control while the catheter was slowly withdrawn. A variety of flow-patterns of contrast could be observed on the fluoroscopic screen depending upon whether the injection was made into a biliary duct or vein or into the liver parenchyma (Fig. 1). Once a bile duct was intubated, injection of Urografin was continued until optimal filling of the ductal system was achieved. Films were taken in supine, prone and erect positions with additional views wherever indicated, to show the site, extent and nature of any obstruction present. The polythene tube was left in situ with the outer end anchored to the skin. The tube was slowly extruded by the patient's normal respiration and in this way, sealing of the track in the liver substance was more effectively achieved.

Of the 95 examinations, 79 were carried out on patients with jaundice and 16 on patients without jaundice. An analysis of the indications for percutaneous transhepatic cholangiography is presented in Tables I and II. In all our patients, oral cholecystography and/or intravenous cholangiography had either failed to produce adequate results or were considered unlikely to succeed.

The procedure was performed in most icteric patients to elucidate the cause of jaundice. Repeat examinations were done on 3 patients. In 2, these were follow-up study because earlier attempts were unsuccessful. In the third, two successful attempts were made pre-operatively and post-operatively for repair of a traumatic stricture of the common bile duct. Of the anicteric cases, 11 out of the 16 examinations were carried out to assess the integrity of the choledochoenterostomy in patients complaining of intermittent colicky pain in the right hypochondrium and/or mild recurring jaundice.

RESULTS

Percutaneous transhepatic cholangiography was successful in 86 attempts out of 95. The causes of failure are analysed in another paper (Yu and Oon, to be published) but basically it is shown to bear a close relation to the size of the intrahepatic biliary ducts.

92 cholangiograms were performed on adults without premedication and using local anaesthetic only. It was found that 70 tolerated the examination without undue discomfort, 20 complained of moderate pain while only 2 patients suffered pain sufficiently severe as to interfere with the procedure. The two cases of poor tolerance were due most probably to excessive injection of contrast substance into the portal tract and liver capsule.

No serious complication was encountered in the series. In 78 studies, laparotomy was carried out within 48 hours with the vast majority within 12 hours of the investigation. In only 4 cases was there a sizeable accumulation (more than 100 ml.) of blood and/or bile in the peritoneal cavity; in 14 a moderate amount was noted while in 60 cases the peritoneum was practically free of blood and bile. In the remaining 17 cases in whom no operation was carried out or delayed a week or more after the procedure, only one showed a clinical picture of shock but improved with conservative management.

An analysis of the results of the 86 successful transhepatic cholangiograms is presented in Table III. There were 21 patients in whom the presence of calculi in the common bile duct was the cause of the obstructive jaundice. (Fig. 2). Out of these, 9 also had stones in the gall-bladder and the incidence of co-existing gall-stones would probably be higher as the gall-bladder was, for technical reasons, not well visualised in the series. In most cases the calculi were radiolucent. The common bile duct showed dilatation of a moderate to severe degree. The calibre measured from 14 to 26 mm. with a mean of 18·5 mm. (normal: less than 10 mm.). The stone was usually impacted at the ampulla of Vater and characteristically produced a claw-like defect in the opacified common bile duct. When seen lying in the stem of the common bile duct, they might present the typical facetted outline and cause varying grades of obstruction.

There were 18 patients with recurrent pyogenic cholangitis (or biliary mud syndrome) in the study group (Fig. 3). The hallmark of the condition was the finding of biliary mud or sludge filling up and distending the stem of the biliary tree by the action of bile flow and gravity. It might be semisolid taking the form of tubular casts or it might be more inspissated, and in the latter state it was recognised as concrements of irregular shapes and sizes. The biliary mud might be extensively present throughout the biliary tree. The common bile duct was severely dilated with a calibre width ranging

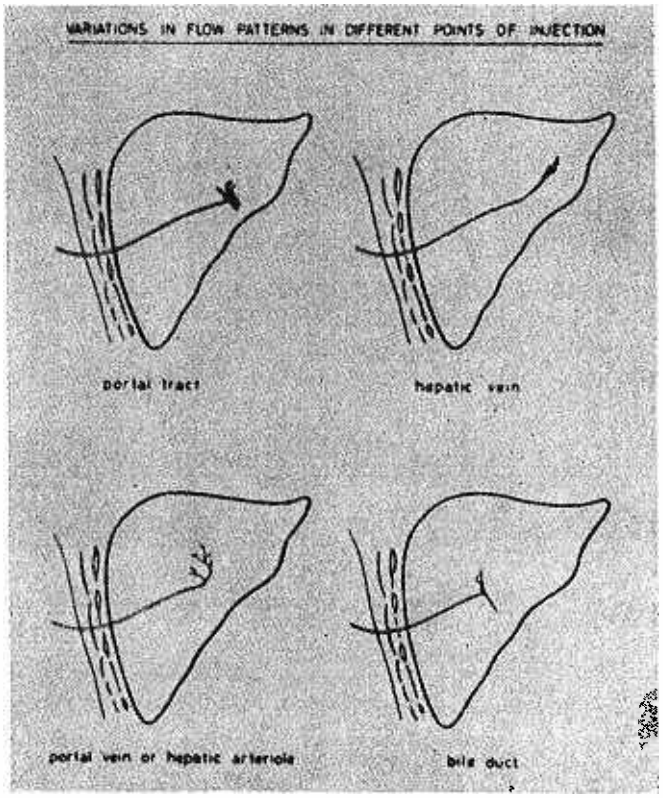

Fig. 1. Diagram showing variation in the flow pattern of contrast substance depending upon the site of injection as viewed by fluoroscopy.

Fig. 2. Biliary Calculi. 62 year old male Chinese suffered from relapsing jaundice for two years. Transhepatic cholangiogram shows a large radiolucent stone lying at the lower end of the common bile duct producing moderate dilatation of the common ducts and major intrahepatic branches. The gall-bladder is also opacified and shows a cluster of radiolucent calculi.

TABLE I

INDICATIONS OF 79 TRANSHEPATIC CHOLANGIOGRAMS CARRIED OUT ON ICTERIC PATIENTS

1. Jaundice of undetermined cause	65
2. Immediate or late post-cholecystectomy or post-operative jaundice	11
3. Others	3
TOTAL	79

TABLE II

INDICATIONS OF 16 TRANSHEPATIC CHOLANGIOGRAMS CARRIED OUT ON ANICTERIC PATIENTS

1. Assessment of choledocho-enterostomy		
i. in recurrent pyogenic cholangitis	5	
ii. suspected leakage of choledocho-duodenostomy	1	
		6
2. Assessment of integrity or morphology of the biliary tree		
i. Following removal of choledochal cyst	1	
ii. Following repair of surgical stricture of c.b.d.	1	
iii. Repair of c.b.d. during cholecystectomy due to abnormal junction of g.b. to c.b.d.	1	
iv. Anastomosis of aberrant right hepatic duct to duodenum during cholecystectomy	1	
v. Stab wound with right partial hepatectomy and repair of c.b.d.	1	
		5
3. Cholecystitis for elective surgery		3
4. Others		2
TOTAL		16

from 13 to 25 mm. and a mean of 20·6 mm. Stenosis of the intrahepatic ducts was occasionally seen. The affected biliary ducts appeared rigid and pipe-like and lacked the tortuous and beaded appearance encountered in other forms of biliary obstruction. The latter feature was considered diagnostic of the condition of recurrent cholangitis and has not been previously recorded.

Carcinoma of the head of the pancreas was diagnosed in 14 patients. (Fig. 4). Characteristically there was marked dilatation and elongation of the common bile duct (range: 20-30 mm.; mean: 24·5 mm.). The terminal portion was invariably displaced inwards and showed an irregular cut-off. Medial dislocation of the lower end of the common bile duct was not considered an exclusive sign of the condition as it was not infrequently seen with choledocholithiasis (in about 30% of cases). The gall-bladder, if opacified, showed extreme dilatation in accordance with Courvoisier's law but again this was not pathognomonic of pancreatic head carcinoma. The cholangiographic picture was complicated by the presence of metastasis in the porta hepatis in 2 cases giving rise to complete obstruction in the common hepatic duct. The ductal branches in all 14 cases were extensively dilated and rather tortuous but the normal tapering was preserved. It also showed a beaded or sacculated appearance reflecting the integrity of its smooth musculature.

Cholangiocarcinoma was encountered in 7 patients (Fig. 5). In 3, a malignant stricture measuring 15, 30 and 40 mm. respectively was present. In the remainder, metastasis to the lymph nodes of the porta hepatis had occurred producing total occlusion of the common bile duct by extrinsic compression.

There was a total of 9 failed attempts at percutaneous transhepatic cholangiography (10·6%). In 2 patients, a second attempt was made and this proved to be successful in one and unsuccessful again in the other. All patients with failed transhepatic cholangiography, with the exception of one, were however subjected to laparotomy as the diagnosis was in doubt. Inspection and liver biopsy showed that in 5 cases, the jaundice was non-surgical due to active chronic hepatitis, hepatitis with pancreatitis, drug jaundice, cirrhosis and liver metastases. One patient had gall-stones but the liver was normal. The case not operated on was a child of 1¾ years with biliary atresia, subsequently confirmed by needle biopsy.

DISCUSSION

Though the majority of investigators favour an anterior approach, a lateral intercostal route was adopted by us. The reasons for this preference have been expounded by Wiechel (1964). A horizontally held needle with its polythene tube is more easily observed at fluoroscopy; there is less likelihood of accidental puncture of the gall-bladder; a longer travel of the needle through the liver substance promotes early spontaneous closure of its tract; the chance of creating a porto-ductal fistula is lessened as bile ducts are directly ventral to the intrahepatic vessels; and lastly, the success rate is enhanced as the ramification of bile ducts is greater in the sagittal than in the frontal plane.

In a jaundiced patient when extrahepatic obstruction is suspected, percutaneous transhepatic cholangiography provides a reliable means of confirming or disproving it. Even when the biliary obstruction is clinically obvious, the procedure gives an accurate pre-operative picture of the extent and often the exact nature of the lesion. Clear anatomical demonstration is particularly important in cases of stricture of major bile ducts especially when surgical attempt is hampered by existing fibrosis. Recurrent pyogenic cholangitis is commonly seen in our practice. In this condition, oral cholecystogram and intravenous cholangiogram are usually not helpful. Transhepatic cholangiography is valuable in its diagnosis as well as in the follow-up assessment of the efficacy of the choledocho-enterostomy constructed to promote drainage of the bile ducts.

Even when performed by an experienced operator with the exercise of due care, the procedure carries a certain amount of risk. It should only be undertaken with surgical facilities readily available to deal with complications. For these reasons, percutaneous transhepatic cholangiography should not be carried out on patients in poor general condition. If these precautions are observed, the risk incurred is a small price to pay for the substantial benefit that can be derived. Patients with inoperable cancer in whom percutaneous transhepatic cholangiography is undertaken as a palliative measure for long-term drainage must also be reasonably fit.

The information gained from the 86 successful cholangiograms has, on the whole, been accurate as well as useful in the management and surgical planning of the patients. One of the lapses in interpretation occurred in a case of cholecystolithiasis in which an ill-defined filling defect in the common bile duct was erroneously diagnosed as a calculus. This was not confirmed at laparotomy despite a careful search by the surgeon and it was thought on retrospect to be caused by an air-bubble or an enlarged lymph node at the porta hepatis.

TABLE III

FINAL DIAGNOSIS OF 86 TRANSHEPATIC CHOLANGIOGRAMS

Biliary Calculi		22
In the common bile duct	12	
In the common bile duct and gall-bladder	9	
In the gall-bladder only	1	
Inflammatory Conditions		21
Recurrent pyogenic cholangitis	18	
Cholecystitis	1	
Empyema of the gall-bladder	2	
Malignant Conditions		29
Carcinoma of head of pancreas	14	
Cholangiocarcinoma	7	
Carcinoma of ampulla of Vater	4	
Metastasis to porta hepatis	2	
Inoperable gastric carcinoma for palliative drainage	2	
Miscellaneous		14
Trauma to common bile duct with or without stricture	6	
Ascaris in common bile duct	2	
Viral hepatitis	2	
Others	4	
TOTAL		86

Fig. 4. Carcinoma of the head of pancreas. 55 year old female Malay presented with jaundice and abdominal pain for six weeks. The liver was considerably enlarged. Extreme dilatation of the stem and branches of the biliary tree is shown on transhepatic cholangiogram. The branches are sinuous but retain normal tapered appearance. The terminal portion of the common bile duct is markedly displaced to the left by the tumour. The gall-bladder is moderately distended.

Fig. 3. Recurrent pyogenic cholangitis. 34 year old female Chinese in whom cholecystectomy and exploration of the common bile duct were carried out 4 years ago. She had since suffered from recurrent bouts of jaundice and right hypochondrial pain. Transhepatic cholangiogram reveals a large collection of biliary mud and calculi in dilated and rigid intrahepatic ducts. The common hepatic and bile ducts are dilated but are free of inspissated bile and stones.

Fig. 5. Cholangiocarcinoma. 60 year old male Chinese presented with deepening jaundice for 2 months and hepatomegaly. Transhepatic cholangiogram reveals an irregular stricture of the common bile duct, involving the lobar branches especially the left. The biliary tree shows the effects of severe backpressure but otherwise the ducts are intrinsically normal.

A shortcoming of percutaneous transhepatic cholangiography is that the gall-bladder may not be adequately opacified. If calculi are clearly demonstrated in the common bile duct and the gall-bladder is not well filled with contrast substance even on the prone view, no further attempts are made to do so. The normal surgical practice in these circumstances requires the removal of the gall-bladder. Except in one, 20 patients with choledocholithiasis with or without co-existing calculi in the gall-bladder were correctly diagnosed. The single error occurred in a case of total occlusion of the lower end of the common bile duct produced by a stone and thick bile, wrongly interpreted as carcinoma of the pancreatic head. The mistake was not a serious one as surgical intervention was indicated for relief of the biliary obstruction.

It has been our experience that the biliary tree in recurrent pyogenic cholangitis, opacified at cholangiography, shows characteristic changes. The appearance of the biliary system in this condition has been described by Ho (1961) using post-operative cholangiography and by Weyde and his colleagues (1966) using percutaneous transhepatic cholangiography. The presence of biliary mud in dilated bile ducts has been remarked upon.

Little emphasis has, however, been made on what we regard as another typical and diagnostic feature seen in this disease. In other forms of obstructive jaundice, the branches of the biliary tree are not only dilated but tortuous as well; they retain their normal tapering and show a beaded or sacculated appearance. In recurrent cholangitis, they are dilated and are pipe-like and not greatly elongated. This correlates well with autopsy findings. It has been shown that as a result of repeated infection, the walls of the biliary ducts are permanently damaged giving rise to dilatation and rigidity of the affected ducts (Cook *et al*, 1954).

Carcinoma of the head of the pancreas and cholangiocarcinoma showing typical features on transhepatic cholangiogram present little difficulty in diagnosis. However, the malignant growths, especially the latter may metastasise to the lymph nodes at the porta hepatis, thereby occluding the common ducts. The radiological appearance in these cases cannot often be differentiated from other forms of malignancy such as gastric carcinoma with spread to the portal lymph nodes. The picture is also similar to that seen when the common hepatic duct has been inadvertently sutured as a result of previous surgery. In the latter case, however, differentiation with the assistance of the patient's history is usually a simple matter.

There were 9 unsuccessful attempts at transhepatic cholangiography. In the majority of these, it was subsequently established there was no extrahepatic biliary obstruction and the intrahepatic bile ducts were found to be normal in calibre. This suggests that in good hands, a failed attempt is a reliable indication of absence of extrahepatic obstruction. The deduction coincides with the experience and view of other workers in this field (Wiechel, 1964; Seldinger, 1966).

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