ASPECTS OF TREATMENT*

CHOLEDOCHOMETRY AND TRANSDUODENAL SPHINCTEROTOMY

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Summary

A total of 91 choledochometries and 26 sphincterotomies in 122 consecutive operations for biliary disease are analysed. Simple techniques for these procedures are described and the problems presented are discussed.

Introduction

IN GREAT BRITAIN peroperative choledochography† has become increasingly popular as a routine aid to diagnosis of biliary tract disease. But choledochometry, which is used extensively on the Continent, has gained little foothold here. Anatomy and the stone loom large, but physiology and the duodenal papilla are perhaps neglected.

By using a simple method of raising the syringe containing contrast medium rather than squeezing it, developed independently but similar to that described by Hess[1], an attempt has been made to evaluate the use of choledochometry and to develop a more logical approach to duodenal papillary disease based on the physiology as well as the anatomical appearance of the biliary tree.

A technique for the procedure of sphincterotomy is also described which is safe, simple, controlled, and adequate.

Choledochometry

Technique. Many may associate the idea of choledochometry with elaborate electronic or barographic types of equipment. In the procedure used here Caroli's original idea of radiomanometry[2] has been simplified to use only equipment that is commonly available. A simple graduated measurement stand has been constructed by the London Splint Company. It can be attached to any convenient irrigation or transfusion stand (Fig. 1).

A No. 9 plastic umbilical cannula (Portex Ltd. Ref. 2/100/09) is attached by its Luer fitting to the lower end of a standard blood transfusion giving set. The tube of this is then cut through transversely just below the drip chamber and the cut end of the tube pushed on to the Luer end of a disposable 50-ml syringe from which the plunger has been removed. The drip control is released slightly until the tube and catheter are completely filled. Bubbles can be avoided if each

†'Choledochography', rather than 'cholangiography', is the more correct term.

*Fellows interested in submitting papers for consideration with a view to publication in this series should first write to the Editor.

successive length of tubing is held vertically below the syringe level, allowing the fluid to climb up slowly.

The cystic duct stump is catheterized. This technique is oft-described current practice. An umbilical cannula has a rounded end and lateral holes so that it slides in easily and there is no blockage as the end bears on the wall of the choledochus. The cystic duct is clamped as near to the gallbladder as possible. A further clamp is placed on the neck of the gallbladder, which is removed and haemostasis secured. A transverse incision is made in the cystic duct close to the forceps. One of the dangers of using the cystic duct is the possibility of pushing stones or debris on into the choledochus. At this stage, therefore, it is essential to milk the cystic duct backwards from the choledochus towards the small incision using a pair of cholecystectomy forceps. It is surprising how often a small stone or debris is thus delivered. Avoidance of air-bubbles is obviously important. It is unnecessary to catheterize under a pool of saline[1] and

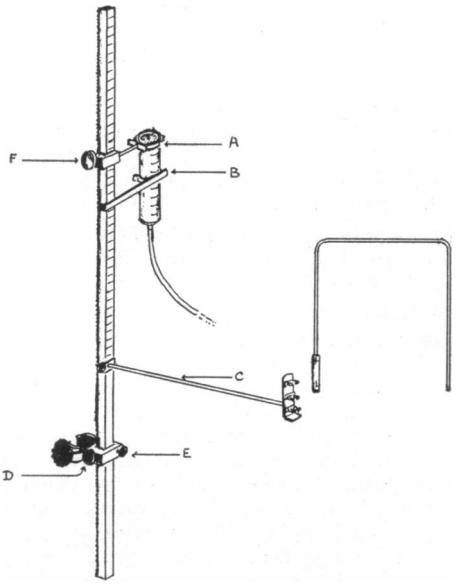


Fig. 1. Apparatus for choledochometry.

it is sufficient to have the radio-opaque fluid issuing very slowly at the time of catheterization.

The cannula is introduced to the 5-cm mark and retained by means of a No. 1 chromic catgut ligature tied with a single knot round the outside of the cystic duct. The forceps are then removed from the stump. The tubing is tethered to the towels to avoid drag, and all swabs, retractors, and instruments are removed from the table. A lateral tilt has not been employed[3]. The syringe is then unclipped and handed to an assistant, who fixes it in clip A (Fig. 1) on the stand with the flange of the syringe resting on the clip. The marker B is then attached to the syringe and slid down to the upper level of the fluid with the arm registering against the graduated scale. The stand is wheeled nearer the operating table so that the arm (C) with its small upright can pass under the lifted sterile drapes. On this small upright are three Terry clips and a small

base-plate. The sterile U-piece is now inverted and the thicker-ended arm is pushed into the clips (with the sterile drape between) and bedded down on the base-plate. Zero-marking on the graduated scale now corresponds to the free end of the inverted U-piece.

The whole scale and arm can be moved up or down by knob D, working by pinion against a toothed rack on the opposite face of the scale, until the tip of the U-piece is level with the centre of the choledochus. This level is fixed by tightening the fixation screw (E), the U-piece is discarded, and the whole stand moved away from the table again. The syringe holder can be raised or lowered along the same toothed rack by a further pinion and knob (F).

Measurement of choledochometry readings. The syringe is raised until the marker rests at the 5-cm mark and the drip control is opened fully. At this pressure bile will usually flow back visibly along the catheter, indicating free flow. The syringe is raised slowly centimetre by centimetre until the flow of bile is seen to be reversed back into the choledochus, and over the next 2-3 cm of raise the level in the syringe will continue to fall and then stop—this represents filling of the biliary tree and the amount usually varies between 2 and 10 ml, or more in a very dilated duct.

Yield pressure and X-ray. Further raises of a centimetre at a time produce no change until suddenly the fluid level starts to drop steadily and continuously. This is the end-point, or yield pressure of the papilla, and it should be read from the top of the fluid level. When the syringe is lowered it fills up again and the end-point can then be retested.

An X-ray is taken at this point and should show the contrast medium in the duodenum to prove that yield has occurred. If the yield pressure is low a complete outline of the biliary tree is not always obtained.

The drip control is now closed and the syringe raised to the 35-cm mark. The control is opened and there is now rapid flow. The moment the level of fluid has fallen by 10 ml a further X-ray is taken. This invariably provides an excellent outline of the biliary tree at a controlled pressure of 35 cm H_2O sustained for only 5–10 seconds, as the syringe is lowered to zero immediately the film has been taken. Originally the plunger was placed back in the syringe and a forced flow induced by pressure to obtain this radiograph. In one case, however, a mild pancreatitis followed, so it is considered that the above controlled pressure is safer. If a multiple-change casette holder is available on the operating table there is much to be said for taking an initial picture when only 2 ml has run in, as over-dense dye shadowing may obscure a small stone[3].

Difficulties. Sometimes the cystic duct cannot be catheterized because of smallness or stenosis. It is a mistake to use a smaller catheter as too much inertia is added to the system, and erroneously high yield pressures are obtained. Various methods of introducing a cannula directly into the choledochus have been tried to obtain a satisfactory choledochometry reading. Plastic intravenous cannulae are too rigid and the open end tends to impinge on the wall of the choledochus. Safe puncture in the confines of a deep hole makes the procedure difficult even with a large slotted needle on a solid Luer-ended handle. It is easier if two small stay-sutures are first placed close together, taking small transverse bites in the choledochus. This is usually flattened by retraction. A gentle pull on the stay-sutures restores the local cross-section of the choledochus to a rounded triangle, if not to its normal circle. The simplest method is to make a just-sufficient nick between the stay-sutures, which are then tied together with a single surgeon's knot to secure the standard umbilical cannula after it has been passed into the choledochus for 3 cm. After removal of the catheter a single suture suffices to close the small hole.

Results of choledochometry

Choledochometry was performed at operation in 91 out of 122 consecutive cases of biliary disease. The reasons for failure in the remaining 31 are shown in Table I. In 70 of the 91 the yield pressure lay between 7 and 18 cm H_2O (contrast), with the majority (58) in the 10–15-cm range (Fig. 2). Sixteen readings between 20 and 26 cm H_2O are analysed

TABLE I

REASONS FOR FAILURE TO PERFORM CHOLEDOCHOMETRY IN 31 CASES

Immediate transduodenal sphincterotomy	15
Failed trials with various introducers	7
Needle choledochography	5
Hydatid disease	1
Iodine sensitivity	1
X-ray failure	1
No radiographer	1

in Table II. Four other patients had yield pressures between 34 and 40 cm H_2O; three had stones in the choledochus and one a primary papillitis. A high reading of 38 cm H_2O occurred when a Stoke-on-Trent catheter was tied into the cystic duct. As Torsoli[4] suggests that there is a pressure resistance at the junction of the cystic duct with the

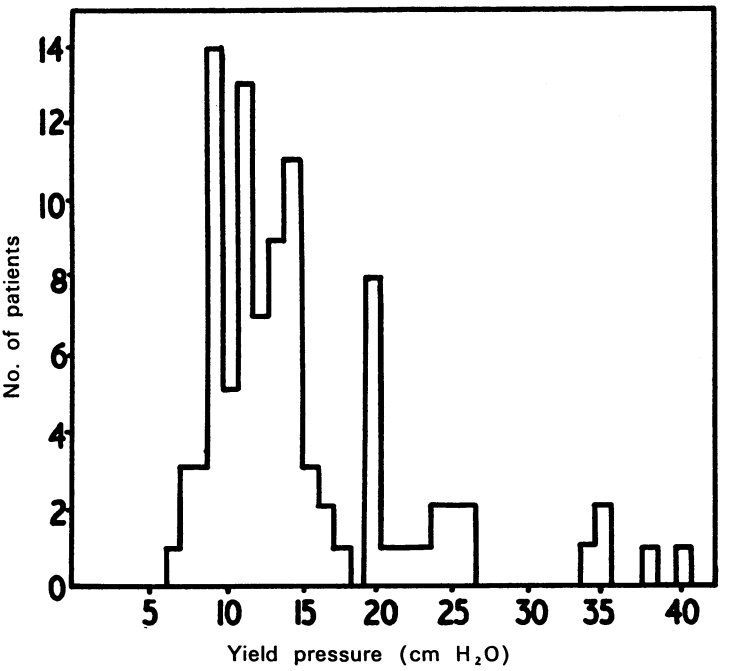


Fig. 2. Yield pressures on choledochometry in 91 cases.

choledochus it may be that this type of catheter is unsuitable for choledochometry, for the catheter holes should lie within the lumen of the choledochus.

Premedication with opiate. The readings were performed at operation under halothane anaesthesia. In the first 45 cases no opiate was given for premedication. In the remaining 46 cases morphine was given one hour before operation. If the high readings are omitted (see above and Table II) comparable histograms (Fig. 3) show that morphine has

TABLE II

ANALYSIS OF 16 YIELD PRESSURE READINGS BETWEEN 20 AND 26 CM H_2O

Small catheter	5
Papillitis	2
Stones in the choledochus	2
Cannula placed in the choledochus	1
Unexplained	6

no appreciable influence on choledochometry readings under conditions of halothane anaesthesia, although it is well known that morphine in the conscious patient increases sphincteric tone.

Comment. Choledochometry will not solve all the problems attendant upon the lower end of the choledochus and the duodenal papilla, but it is a useful addition to choledochography. In patients with a past history of jaundice and a normal choledochogram the finding of a normal yield pressure on choledochometry will save the patient unnecessary choledochotomy, bouginage, and T-tube drainage. In this series 39

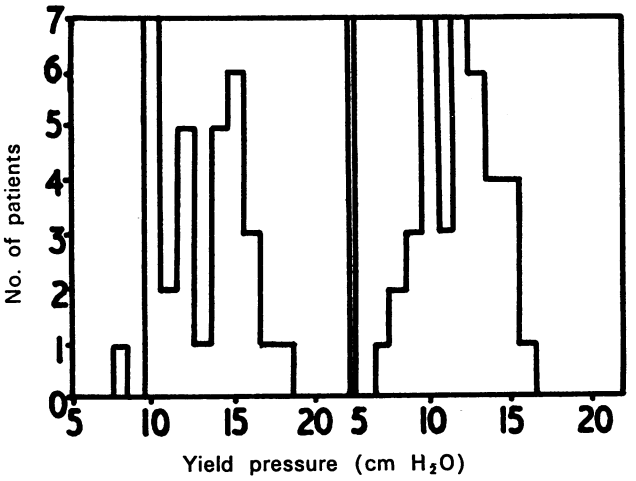


Fig. 3. Yield pressures on choledochometry; (left) 45 patients without morphine; (right) 46 patients with morphine.

patients with cholelithiasis had a past history of jaundice; 18 of these had normal choledochography and choledochometry. In 21 patients sphincterotomy was indicated and performed. Three examples will serve to illustrate the value of choledochometry as an aid to indications for sphincterotomy:

Case 10: A grossly raised yield pressure together with a too easily palpable papilla were the main reasons for performing sphincterotomy. A primary papillitis was found.

Case 12: This patient had a raised papillary yield pressure with a history of recurrent pancreatitis, so choledochometry was supportive evidence for performing sphincterotomy.

Case 122: The pressure was grossly raised and the papillary end of the choledochus was indistinct on the choledochogram. A secondary papillitis was was found on exploration of the papilla and sphincterotomy was performed.

Six patients had high choledochometry readings with normal choledochogram and nothing more was done than simple cholecystectomy. Apart from the one case of mild pancreatitis no morbidity could be attributed to the performance of choledochometry.

Sphincterotomy

Technique: The duodenum must be thoroughly freed behind and, in particular, below. It is then held up by two widely spaced stay-sutures. If the diameter of the duodenum is greater than 3 cm an oblique incision from laterally above to medially below can subsequently be closed in line. If the diameter of the duodenum is less than 3 cm, however, it is prudent to make a longitudinal incision which is later closed transversely to avoid narrowing. The incision need not be longer than 4 cm, or at most 5 cm, and should be sited ¾ above and ¼ below the previously palpated papilla. If the papilla is impalpable the incision is made ¼ above and ¾ below the lower border of the head of the pancreas.

Stay-sutures are inserted at the mid-edges and ends of the incision. The papilla is then palpated within the duodenum. There is such variation in size and firmness of the papilla in normality and disease that care must be taken not to mistake the papilla minor for the main papilla; the former lies 2–3 cm above the latter and always in the upper part of the duodenal incision. With one fingertip on the papilla for location, its body is grasped lightly with tissue forceps (Hardy and Davenport[5]) and lifted up. A stay-suture taking a firm bite is then inserted above the forceps, which are discarded. The opening in the papilla is then sought with a probe 1 mm in diameter or the eye-end of a fair-sized straight needle. It has never been necessary to pass a sound down the choledochus to discover this opening.

Surprisingly often the probe will enter the pancreatic duct unless it is held very flat, and care must be taken to ensure that the probe is actually in the choledochus. A larger probe follows and then a grooved probe is inserted. The secret of constant control and haemostasis is the use of a fore-oblique stitch on each side before cutting, and the grooved probe greatly facilitates the safe insertion of the first and often the second pair of stitches.

The initial two stitches, using 00 chromic catgut on atraumatic needles, are sited at 9 o'clock and 1 o'clock facing the papilla (Fig. 4; (1) and (2)). The pancreatic duct orifice is usually in the midline of the papilla posteriorly, but

occasionally it is a little to the medial side and so the first stitches must be sited to avoid this structure. There is often not much muscle in the rim of the papilla, which may, for a millimetre or two, be simply a mucosal fold; these first stitches therefore need to go in about 0.5 cm and emerge approximately 1 cm apart. The two ends of each stitch are clipped without tying and gently retracted. The groove of the probe is rotated to 11 o'clock and a cut made with fine scissors exactly to the level of the emergent stitches (Fig. 4 (3)). It will be found that each stitch swings round on to the cut surface and the weight of the clips is sufficient to control haemorrhage (Fig. 4 (4)).

This process is repeated every 4 mm. The grooved probe can be withdrawn after the second cycle. Thereafter the duodenal mucosa tends to run over the opening and may need holding back for the completion of each stitch with equal bites of choledochus and duodenum. The number of stitch-and-cut pro-

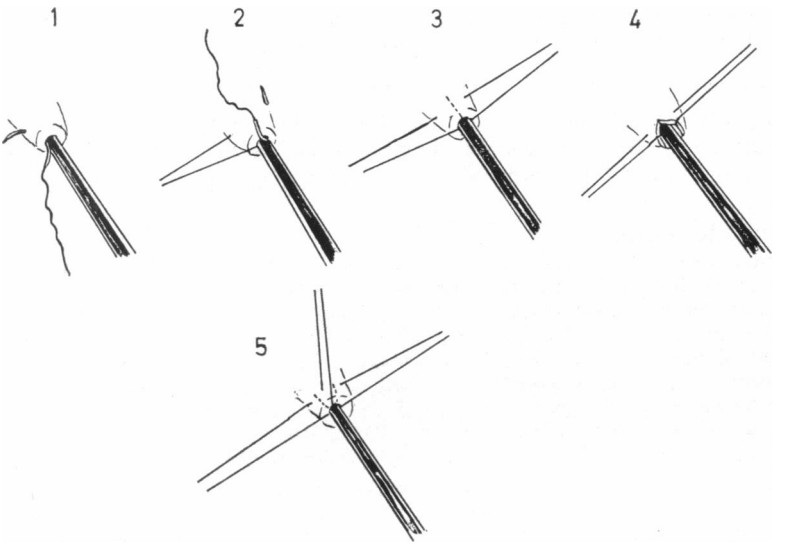


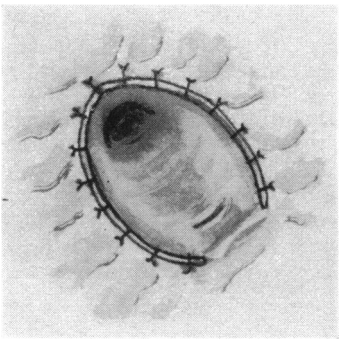
Fig. 4. (1) Fore-oblique stitch at 9 o'clock. (2) Fore-oblique stitch at 1 o'clock. (3) Line of division at 11 o'clock. (4) After division with the stitches swung round on to the cut surfaces. (5) Method of biopsy using a third stitch.

cesses multiplied by 4 gives approximately the length of the sphincterotomy in millimetres. The sequence should be continued until the choledochus is seen as a distinct separate edge. This may occur with a sphincterotomy of 1-2 cm, but in one case it was necessary to extend it to 2.4 cm. It is advisable to achieve a sphincterotomy of 2 cm even if the hole into the choledochus is made no larger after the first 1 cm. The reason for this is to allow for subsequent contracture by scarring of the sutured edges.

When the last cut has been made *it is vitally important* to insert a further fore-oblique stitch on each side, without cutting between, and a third stitch at the very end of the sphincterotomy incision. This ensures that there shall be no posterior leakage between the choledochus and the duodenum.

Finally, each stitch is examined to be sure that both layers are properly included before tying. Any faulty stitch is replaced and each one is reclipped after tying. Before cutting, the suture ends are relaxed to check that absolute haemostasis has been achieved (Fig. 5).

If a papillary biopsy is required a third initial stitch is placed at 11 o'clock and a cut made on each side. Slightly wider fore-oblique stitch-bites (Fig. 4; (5)) are required as long as the biopsy continues in length. Usually 3 sets of stitching and cutting are sufficient for biopsy purposes.



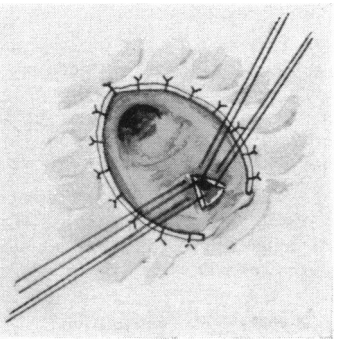


Fig. 5 (left). Completed sphincterotomy 24 mm long.
Fig. 6 (right). Secondary sphincterotomy on the pancreatic duct orifice.

Case analysis of sphincterotomies

In this series of 122 patients, 26 needed sphincterotomy for a variety of reasons listed in Table III.

TABLE III

ANALYSIS OF INDICATIONS FOR PERFORMING SPHINCTEROTOMY IN 26 CASES

Stones in the choledochus	17
Papillitis, iatrogenic	1
secondary	3
primary	1
Recurrent pancreatitis	3
Hydatid disease	1

Choledocholithiasis. In all 17 cases there was a secondary papillitis (see below) described as marked in 14 and with only slight thickening in 3. In one case the papilla was found in the superior wall of a posterolateral duodenal diverticulum, but sphincterotomy was uneventful. In another case a choledochoduodenal fistula had formed over a stone 2 cm above the papilla and this was incorporated in the sphincterotomy.

Pancreatitis. Each of the 3 patients with recurrent pancreatitis needed a secondary sphincterotomy of the pancreatic duct orifiice (Fig. 6).

Case 2: This lady suffered 5 attacks of pancreatitis in 4 months with a serum amylase of over 50 Wohlgemuth units on 3 occasions. An overall weight of 19 stone (120 kg) and scattered fat necrosis made operation a little difficult. The gallbladder contained stones and was removed. A choledochogram was normal, but the choledochometry reading was high at 25 cm H_2O. Pancreaticograms showed a dilated duct. The pancreatic duct orifice was tight and therefore a secondary sphincterotomy was performed. In the 3 years since operation she has remained symptom-free.

Case 4: This man had a serum amylase of 12.5 Wohlgemuth units on 2 occasions at the time of cholecystectomy 2 years previously. He continued to have pain under the left costal margin. At operation his papilla was firm and 1 cm in diameter. There were no stones in his choledochus, but the pancreatic duct would not admit a 2-mm probe and double sphincterotomy was performed. He has remained free of symptoms.

Case 5: This man had acute pancreatitis 3 years previously with a serum amylase of 50 Wohlgemuth units. He continued to suffer recurrent epigastric pain and nausea. His papilla was grossly thickened and the pancreatic duct orifice narrowed. Double sphincterotomy has relieved his symptoms.

Papillitis. (See discussion).

Age. The oldest patient to undergo sphincterotomy was 93. Four patients were between 80 and 85, 3 between 75 and 79, and 3 between 70 and 74.

Morbidity. One patient developed postoperative pneumonia, and minor chest complications affected 2 others. A cystic duct ligature slipped after removal of a gangrenous gallbladder and cystic duct and had to be redrained on the 5th day. Wound infection occurred in one patient. No fistulae or evidence of leakage from the sphincterotomy occurred. Pancreatitis did not ensue in any of these cases. The safety and lack of any morbidity has seemed remarkable. Most patients have been discharged from hospital on the 9th or 10th day.

Mortality. Two patients out of 122 died. Each was a lady of 85 years suffering from obstructive jaundice of 4 weeks' duration. One patient was already in congestive failure and the other died from aspiration bronchopneumonia.

Late results. One patient still cannot tolerate fried foods but is taking full milk and butter in her diet. The remainder are symptom-free on a varied diet.

Discussion

Kehr's T-tube was first devised in 1898 at a time when accurate diagnosis of biliary disorders was unknown, and yet its continued common usage may be due to an antiquated approach to the surgery of

choledocholithiasis when our diagnostic ability has been so much strengthened by peroperative choledochography and, in particular, by choledochometry. It is still common practice to open the choledochus and to remove stones by instrumentation. The papilla is often assaulted with rigid sounds to establish its patency. Sometimes false passages are made or the papilla so forcibly dilated that the reactive spasm and oedema may produce blockage.

Although Maingot[6] states that no morbidity ever follows the use of a T-tube, this is probably not the experience of every surgeon. Now that drainage bags are often slung from the underbed rail excess drainage can be a problem but may be countered by raising the bag or, better, by inserting a Y-tube with filtered end in the drainage system externally and fixing it to the chest wall, thereby preventing siphonage. If a large volume of drainage persists a residual stone or oedema must be suspected. However soft and well-made a T-tube is, its shoulders must be larger than the tube itself, and therefore the hole in the choledochus and its track must be widened on withdrawal. If drainage of the choledochus must be used, then a single small tube inserted downwards towards the papilla is adequate as a safety-valve and for postoperative radiography. Removal is easy and there is no enlargement of the track.

Is bile duct drainage of any kind necessary? If the stones in a choledochus can be removed easily and gently, if the choledochogram shows no further stones and a normal anatomy, if the yield pressure of choledochometry is 15 cm H_2O or below, and if the ampulla is not forcibly sounded, then there is adequate evidence to support the surgeon in closing the choledochus without tube drainage. He has established the existence of normal anatomy and physiology, he has removed the stones which threatened his patient, and he has avoided producing an iatrogenic papillitis.

Comments on sphincterotomy

If transduodenal sphincterotomy is simple and safe and has no side effects on the patient, then removal of stones from the choledochus via an adequate sphincterotomy might logically be preferred to the standard technique of choledochotomy and T-tube drainage. Many of the stones can quite simply be milked out[7]. A few need crushing slightly before being withdrawn through the narrowest portion of the duct, but instrumentation is remarkably easy and the access approach and angle all seem right[5]. Even access to stones high in the hepatic ducts is not, surprisingly enough, at all difficult. The small residual stone and biliary mud are no problem for they are subsequently washed out by bile. The very large stone cannot, of course, be removed in this manner, but fortunately large stones go with large ducts, usually including a shortened and widened cystic duct. If the cystic duct is split up and this slit

extended, often no more than 0.5 cm obliquely into the choledochus, then the largest stone can be extracted without difficulty. With two or three stitches and a ligation of the cystic duct one can then easily close the minimal breach in the choledochus before proceeding to sphincterotomy.

Infection of the biliary tree goes with obstruction. After an adequate sphincterotomy there is no obstruction; the bile-washed tube keeps itself clean, and infection does not constitute a problem.

What other advantages does the advent of safe, simple sphincterotomy offer? There is no doubt that simple division of a short length of the anterior wall of the papilla, even by diathermy on a plastic probe, can be attended by considerable bleeding, difficult and sometimes dangerous to control by subsequent, haphazard stitching. Even with the method advocated by Rothwell-Jackson[8] after Earley and Hunt[9], bleeding may be quite troublesome if the cut is made before stitching. They rightly advocate an adequate sphincterotomy, calling it sphincteroplasty, presumably because the edges are stitched. With the method suggested here there is control of bleeding at all times, the anatomy is constantly obvious, the pancreatic duct orifice is easily found, and the necessary length of division is clearly determinable. If doubts about sphincterotomy are removed the surgeon is more ready to explore the papilla in cases in which the choledochogram is doubtful or the choledochometry reading high.

Papillitis. The normal papilla is only just palpable as a slight, bead-like resistance in the posterior duodenal wall. In cases of biliary disease with symptoms referable to the choledochus it is remarkable how often the papilla is thickened, stands out like a firm nipple, or has a caruncular appearance. This thickening and induration of the papilla has been called 'papillitis' in this paper. In the 6 cases in this series in which biopsy was performed the sections showed varying amounts of fibrosis, oedema, and inflammatory cell infiltration. In 2 cases there was a papilliferous fringe of the mucosal fold on the rim of the papilla. The papillitis has seemed to arise in 3 different ways, but future research may prove such division to be purely arbitrary:

Iatrogenic papillitis. No stones are found in the choledochus and the condition has presented some years after previous exploration of the choledochus, dilatation of the papilla, and T-tube drainage. In 2 cases before this series 12 and 14 years respectively elapsed before papillitis produced symptoms.

Secondary papillitis. Occurring in association with stones in the gall-bladder or the choledochus, or with a past history of jaundice. The 3 cases listed separately in Table II contained no stones in the choledochus although the gallbladder was inflamed and contained stones. In all there was a history of jaundice.

Primary papillitis. If the gallbladder is normal and there are no stones in the choledochus the papillitis is called 'primary'. Interest in the possible implications of choledochometry was first stimulated by a case of apparent primary papillitis long before this series:

A woman of 40 had for 3 years suffered frequent attacks of obstructive jaundice, fever, and pain under the right costal margin. A cholecystogram was normal. At laparotomy the gallbladder was normal and the choledochus 7 mm in diameter. The papilla felt thickened and on exploration was enlarged and firm. Sphincterotomy was performed and clear bile issued without stones or debris. She has had no symptoms in the 6 years since this operation.

In cases of papillitis it would seem logical to perform an adequate sphincterotomy whether the cause be a remorseless, slow, stenosing process or the relatively acute reactive thickening associated with the passage of a stone. Which cases have developed papillitis, or will do so, may possibly be elucidated by routine choledochometry, but many more cases are needed to establish evidence. Hess[1] maintains that sphincterotomy should be performed in cases with a choledochometry reading of 18 cm H_2O or higher, but this small series has not seemed to justify such dogmatism.

Secondary 'pancreatic' sphincterotomy. Rothwell-Jackson[8] reiterates the view that adequate sphincterotomy is the correct first-stage procedure for recurrent pancreatitis, and experience in this series and in previous cases supports this view. However, this in itself will not cure all cases, for the pancreatic duct orifice may be narrowed by the same process producing the papillitis or there may be obstruction distally in the pancreatic duct.

If the figure-of-eight arrangement of papillary musculature described by Hand[10] is visualized, then it seems logical that division of one loop, the main choledochus sphincter, will not always release a constriction of the other loop round the pancreatic duct orifice. This concept may help to explain the disrepute into which sphincterotomy, even if adequate, may have fallen in the treatment of pancreatitis.

Some guide must be adopted and, at the risk of being dogmatic, it is suggested that if the pancreatic duct orifice will not admit a probe 2 mm in diameter for 1 cm, then a secondary sphincterotomy should be performed on the duct orifice. This must obviously be made through the junction of the loops of the figure-of-eight but is effective in relieving stenosis. In one case, before this series, a small stone was easily lifted out of the pancreatic duct after this procedure.

If the serum amylase is raised, even slightly, on more than one occasion, then particular attention may well need paying to the possibility of pancreatic duct orifice stenosis and incline the surgeon to explore the papilla.

Pancreaticography. A further advantage of experience with a well-controlled sphincterotomy procedure is the ease with which pan-

creaticography can become part of a surgeon's repertoire. Distal obstruction of the pancreatic duct can be determined only by pancreaticography. While only proximal obstruction can be relieved by a sphincterotomy, obstruction of the distal portion of the duct may well demand treatment by some form of enteroanastomosis or by pancreatic resection. Even in the presence of papillitis or pancreatic duct orifice stenosis there may also be distal obstruction, so that pancreaticography is probably mandatory in cases of pancreatic disease.

Conclusions

It takes time to provide convincing answers to many of the problems still posed by the biliary tree. Justification for publishing this article and its approach to these problems lies in the hope that others may be doing similar work who will help to provide solutions to unanswered perplexities of bile duct surgery.

1. Will the incidence of stricture of the choledochus fall (*a*) if external bile duct drainage is abandoned? (*b*) if papillitis is recognized more frequently and dealt with adequately?

2. Will the incidence of iatrogenic papillitis and recurrent or residual stone be lessened if choledochotomy and bouginage are abandoned and the low approach via a sphincterotomy is used for removal of stones from the choledochus?

3. What is the role of the papillary sphincter? Statements handed on from book to book on the importance of retaining the sphincteric mechanism do not seem to be supported by clinical experience. Indeed, once the gallbladder has been removed there is no concentrating reservoir to accommodate the continuous flow of bile or to deliver accumulated bile on stimulus at a pressure capable of overcoming the resistance of the papilla, whether this relaxes or not. Does then the bile flow through the papilla at a constant pressure of secretion of 10–15 cm H_2O or does the papillary muscle become permanently relaxed? If the latter occurs, then this state is the same as after sphincterotomy, and freedom from soiling and infection depends on the choledochus being washed continuously.

4. Is papillitis sometimes a manifestation of neuromuscular dysfunction and does this explain the apparently slow build-up of the condition in some cases? The method of sphincterotomy described above allows easy biopsy and may encourage future study, for the histology of the papilla is notoriously difficult and varied.

5. Can recurrent pancreatitis be cured by double sphincterotomy if there is pancreatic duct orifice stenosis in the absence of more distal blockage?

6. In sphincterotomy for primary papillitis should the gallbladder

be removed? It remains as a contractile sac: will it ever fill in the absence of papillary yield pressure?

Perhaps the routine use of choledochometry on a wider scale, together with a greater readiness to explore and biopsy the papilla methodically by this simple sphincterotomy technique, may lead us to the answers to these problems.

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STATUTORY ANNUAL SUBSCRIPTION

As forecast in the President's Letter in July, Council has decided that the rate of subscriptions from Fellows must be increased. As a first step Council has resolved "that the statutory subscription of Fellows not resident in the United Kingdom be raised from £5 to £10 per annum, commening with the subscription due on 1st October 1973".

CHRISTMAS CARDS

Two new styles of College Christmas cards are now available from the office of the *Annals,* Royal College of Surgeons of England, Lincoln's Inn Fields, London WC2A 3PN.

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