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Can cholangiography be safely abandoned in laparoscopic cholecystectomy?

A Gillams FRCR
Senior Registrar in Radiology

R C G Russell MS FRCS
Consultant Surgeon

S Cheslyn-Curtis MS FRCS
Senior Registrar in Surgery

W R Lees FRCR
Consultant Radiologist

Departments of Radiology and Surgery, The Middlesex Hospital, London

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The introduction of laparoscopic cholecystectomy, improvements in ultrasound technology and the success of endoscopic sphincterotomy have raised new questions regarding the role of intraoperative cholangiography. Our aim was to analyse the ability of preoperative clinical and ultrasound assessments to detect common duct stones in 86 patients with symptomatic cholecystolithiasis who then underwent cholangiography after percutaneous cholecystolithotomy. Six patients gave a history suggestive of common duct stones (either jaundice, cholangitis or pancreatitis). Ultrasound showed a dilated common duct in four patients (normal <6 mm), and one of these had a stone demonstrated in the duct. The latter patient and one other with a dilated common duct had stones on cholangiography (which were extracted at ERCP), no stones were demonstrated in the other two. Ultrasound correctly identified common duct stones in two and excluded common duct stones in four others with a history suggesting the presence of stones. For patients undergoing laparoscopic cholecystectomy we would advocate the use of preoperative ultrasound instead of intraoperative cholangiography, and that endoscopic retrograde cholangiopancreatography is performed in the small number of patients shown to have a dilated duct or common duct stone.

The role of intraoperative cholangiography has again become a topic for debate, particularly with the advent of laparoscopic cholecystectomy which requires additional technical skill to achieve adequate cholangiography. The advocates of the technique stress its value in determining the presence or absence of duct stones and, perhaps, more importantly its clear delineation of the anatomy. Those not in favour of the technique point out that many duct injuries occur despite a cholangiogram or before it can be undertaken *(1)*. Furthermore, the procedure has failings, a high false-positive rate, technical failure, and an increased operative time of up to 30 min. Many consider that the problems of the common duct stone and anatomical variations can be more easily managed by better preoperative assessment with cholangiography and an improved operative anatomical assessment, and operative technique with a more careful anatomical dissection *(2,3)*. Finally, it is questioned whether operative stone removal with choledochotomy is less satisfactory than routine endoscopic stone removal in association with an improved preoperative assessment *(4)*.

It is debatable whether ultrasound alone can fulfil the role of providing the ideal preoperative assessment and having the advantage over other techniques of being cost-effective, safe and non-invasive. A study was therefore undertaken to compare a preprocedural ultrasound assessment and direct cholangiography in 86 patients who had a successful percutaneous cholecystolithotomy.

Correspondence to: Mr R C G Russell MS FRCS, The Middlesex Hospital, Mortimer Street, London W1N 8AA

Patients and methods

Of 283 patients referred for non-operative treatment of their gallstones, 220 (78%) were eligible for percutaneous cholecystolithotomy *(5)*. The remaining 63 were excluded for technical reasons; either because the gallbladder was intrahepatic (5%) or was small, thick-walled and non-contractile (17%) *(6)*. Percutaneous cholecystolithotomy was performed successfully in 100 patients with symptomatic gallstones. All patients were assessed clinically, and ultrasound of the gallbladder and biliary tree was performed before the procedure. Clinical features suggestive of the presence of stones in the common bile duct including jaundice, cholangitis or pancreatitis or a history of these were noted. Liver function tests were not measured routinely.

Ultrasound was performed using either an Acuson 123 or ATL with a 3.5 MHz or 5 MHz probe. The size and number of the gallstones, the thickness of the gallbladder wall and the gallbladder volume before and after fat stimulation were measured. The bile ducts were inspected for calculi and/or dilatation. The common duct was measured just caudal to the junction of the right and left hepatic ducts with the patient lying in the left lateral position. A diameter of greater than 6 mm was considered abnormal (*7*).

The patients then underwent percutaneous cholecystolithotomy; a percutaneous tract into the gallbladder was established using a combination of ultrasound and fluoroscopy. This tract was dilated up to 24–30G and a modified nephroscope introduced into the gallbladder so that the stones could be removed under direct vision. Stones were either removed intact or cracked mechanically or with electrohydraulic lithotripsy and the fragments removed (*5*). After the procedure, a drain was left in the gallbladder for 10 days. A tubogram was performed via the gallbladder drainage catheter at the end of the procedure and again at 10 days, before removal of the gallbladder drain.

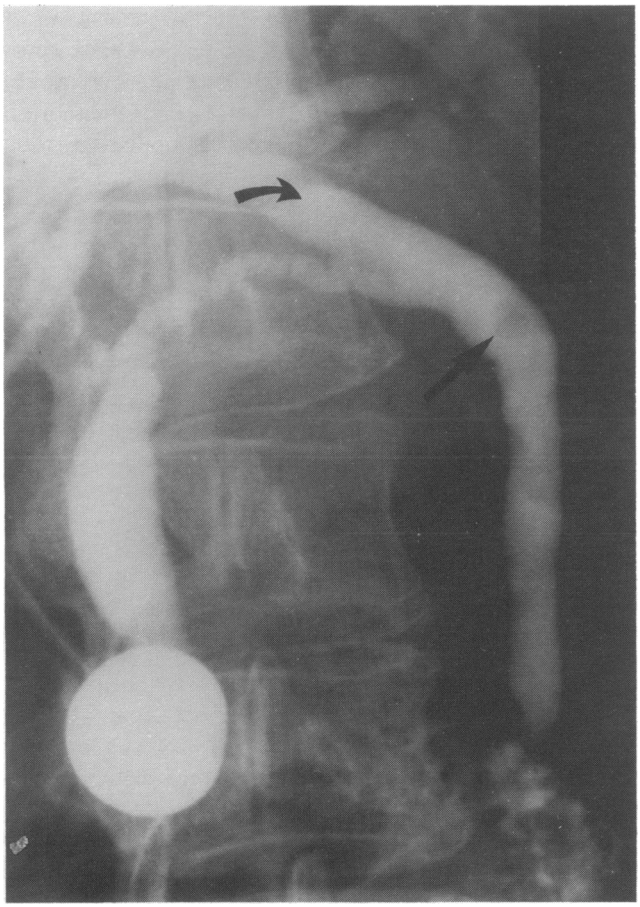

Figure 1. Tubogram showing a calculus within the common bile duct (straight arrow). Dense contrast is seen within the balloon of the Foley catheter which was used to drain the gallbladder. Common duct measurements were made just caudal to the junction of the right and left hepatic ducts (curved arrow).

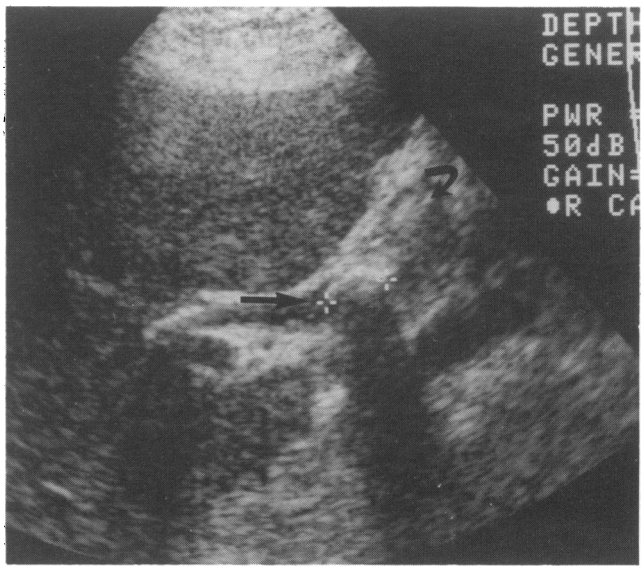

Figure 2. Ultrasound showing a stone with distal acoustic enhancement (straight arrow) within a dilated common duct (curved arrow).

Between 40 and 70 ml of dilute contrast (half-strength Conray 280®) was injected via the tube until there was adequate filling of the intrahepatic ducts. The biliary tract was inspected for residual calculi and duct dilatation. The distal common bile duct was examined for the normal tapering configuration and a free flow of contrast into the duodenum. The bile duct diameter just caudal to the junction of the right and left hepatic ducts was measured. Where the diameter of the drainage catheter was known, the diameter of the catheter within the gallbladder was measured on the tubogram film. Using the equation:

$$\text{'actual' bile duct diameter} = \frac{\text{measured bile duct diameter} \times \text{actual tube diameter}}{\text{measured tube diameter}}$$

it was possible to correct for any magnification caused by different X-ray tube–film distances. The cholangiograms of 88 patients were available for review at the time of the study. Of these, 86 were considered technically adequate and these patients (median age 56 years (range 18–89 years); male:female 1:2.8) were included in the study.

Results

Of the 86 patients, six had a relevant past history: three of jaundice, one of cholangitis and two of pancreatitis. At the time of the procedure two patients were jaundiced and one had had a recent attack of pancreatitis. The composition, number and size of the gallstones was noted at the time of percutaneous cholecystolithotomy. The median stone size was 10 mm (range 3–30 mm) and the median number of stones was five (range 1–800). A total of 68 patients had functioning gallbladders on the ultrasound assessment.

Table I. Results of ultrasound and cholangiography in 86 patients

Common duct diameter	*Ultrasound*	*Cholangiogram*
Normal Median	5 mm	5 mm
($n=82$) Range	2–6 mm	2–11 mm
Abnormal diameters	7 and 9 mm	No stones
($n=4$)	12 and 14 mm	Common duct stones

Eighty-two patients had normal bile ducts on ultrasound and no stones on cholangiography. In these patients the median common duct diameter at ultrasound was 5 mm (range 2–6 mm) (Table I).

On ultrasound, three patients had an enlarged common bile duct (7, 9 and 12 mm in diameter), one of these was jaundiced. One patient had a calculus in the cystic duct with dilatation proximal to the stone and a normal common duct diameter. At 1 week after the ultrasound examination this patient was admitted with severe right upper quadrant pain and jaundice. Repeat ultrasound showed that the cystic duct stone had moved and was now obstructing the common bile duct, which was dilated to a diameter of 14 mm and cholangiography confirmed a single 8 mm common bile duct stone. Cholangiography demonstrated a solitary 11 mm stone in one other patient; this was one of the patients who had duct dilatation on ultrasound (diameter = 12 mm) and was jaundiced. The other patients with a history of jaundice, cholangitis or pancreatitis did not have bile duct stones at the time of the procedure. The median common duct diameter on cholangiography in these patients was 5 mm (range 2–11 mm). Neither stones nor any other biliary pathology to account for duct dilatation was demonstrated on the tubogram in the other two patients with duct dilatation on ultrasound.

The two patients with common duct stones underwent percutaneous cholecystolithotomy in the usual way. The biliary tree was decompressed via the gallbladder drain, resulting in satisfactory resolution of jaundice. Endoscopic retrograde cholangiopancreatography, endoscopic sphincterotomy and stone removal were then performed as an elective procedure. The ducts were cleared in both patients without complication and the gallbladder drain was then removed.

Discussion

This study shows that only two patients in a cohort of 86 patients with symptomatic biliary disease had stones in their common bile duct, and two further patients had abnormal ducts but no stones. Ultrasound was able to detect these patients and missed no stone. Consequently, the two patients with stones were treated by endoscopic sphincterotomy without the need of further assessment or open choledochotomy.

Intraoperative cholangiography has been advocated to detect 'unsuspected' common duct stones and to delineate the anatomy in the hope that this will reduce the change of bile duct injury *(8,9)*. Limitations of the technique include a false-positive rate of between 1.8% and 18% *(10,11)*, resulting in an unnecessary common duct exploration. The morbidity attendant to common duct exploration with or without stone removal is well documented *(1,2)*. Furthermore, there is no evidence that intraoperative cholangiography does reduce the incidence of iatrogenic injury at the time of cholecystectomy. A review of iatrogenic bile duct injury in Sweden revealed that in 27 of 62 patients (42%), the bile duct had already been injured at the time of the cholangiogram *(1)*. Intraoperative cholangiography lengthens the operation time and is less cost-effective than the alternative of ERCP and stone extraction which also has a lower morbidity and lower rate of retained stones *(13,14)*.

Previous ultrasound studies have shown a clear correlation between common duct size and the presence of stones *(15)*. Furthermore, ultrasound has been shown to be highly accurate in identifying bile duct dilatation (sensitivity 96%, specificity 95%) *(16)*.

It is proposed that the continued use of intraoperative cholangiograms is questionable in view of their inability to prevent duct injuries, their relative low yield of positive results and their expense. On the other hand, it is suggested that a policy of careful preoperative ultrasound and selective endoscopy, where there is doubt about the presence or absence of a stone or anatomical abnormality, is a better and more cost-effective approach to the bile duct stone.

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