CHOLEDOCHOLITHIASIS : DIAGNOSIS BY ULTRASOUND

ABDUL SAMAD SAKIJAN
MAIMUNAH ATAN

SUMMARY

The ultrasound findings of 100 patients with chloedocholithiasis documented by cholangiography and/or surgery were reviewed retrospectively. Common duct stones were detected in 45% of patients. This detection rate which is comparable with most series confirmed the lack of reliability of ultrasound in the diagnosis of choledocholithiasis. All the stones detected were in dilated common ducts. The main limiting factor was overlying bowel gas which impair visualisation of the lower part of the common duct. Despite the apparent insensitivity of ultrasound to detect common duct stones, the modality is still a valuable non-invasive screening diagnostic tool, because in positive cases, patients may be spared from invasive cholangiographic procedures.

INTRODUCTION

Ultrasound has proven to be a valuable non-invasive screening tool in the diagnosis of biliary tract disorders. It is highly sensitive and accurate in the diagnosis of gallstones and dilatation of bile ducts, but its role in the diagnosis of choledocholithiasis is less certain.[1] The success rate in the detection of common bile duct stones vary from 13 to 56%.[1-6] Such a broad range of sensitivity is probably related to patient selection and number, equipment used and experience of the operator.

Abdul Samad Sakijan, MBBS(Mal), DMRD, FRCR(UK)
Maimunah Atan, MBBS(Mal)
Department of Radiology
Faculty of Medicine
Universiti Kebangsaan Malaysia
Jalan Raja Muda
50300 Kuala Lumpur, Malaysia

This paper is a retrospective study to assess our experience in the use of ultrasound for diagnosis of choledocholithiasis, with a brief discussion of the factors affecting sensitivity.

PATIENTS AND METHODS

There were 100 patients in this study (53 females and 47 males.) Their ages ranged from 22 to 92 years. These patients were confirmed to have choledocholithiasis by cholangiography such as intravenous cholangiography (IVC), endoscopic retrograde cholangiopancreatography (ERCP), percutaneous transhepatic cholangiography (PTC) and/or surgery with operative cholangiography (Table I). Their ultrasound findings were retrospectively reviewed.

The ultrasound examinations were performed using Philips SDR 1500 real-time scanner with 3.5 mHz sector transducer. The indication for the ultrasound examinations was symptomatology referable to the biliary tract, primarily jaundice.

For the purpose of this study, the common hepatic duct and the common bile duct were considered as one structure, the common duct. This is because of the uncertain site at which the cystic duct joins the common hepatic duct to form the common bile duct. The common duct is arbitrarily divided into two parts: the proximal and the distal parts. The proximal part of the common duct is that segment from the porta down to the first part of the duodenum, whereas the distal part include that segment behind the duodenum and the intrapancreatic portion. The common duct is dilated when the calibre is 8 mm and more.[7] The diagnosis of choledocholithiasis was made when an intraluminal echogenic focus with acoustic shadowing was demonstrated (Fig. 1).

TABLE I
DEFINITIVE DIAGNOSIS OF
CHOLEDOCHOLITHIASIS

Modality	Number of Patients
IVC	4
ERCP	30
PTC	11
Surgery and Operative Cholangiogram	72

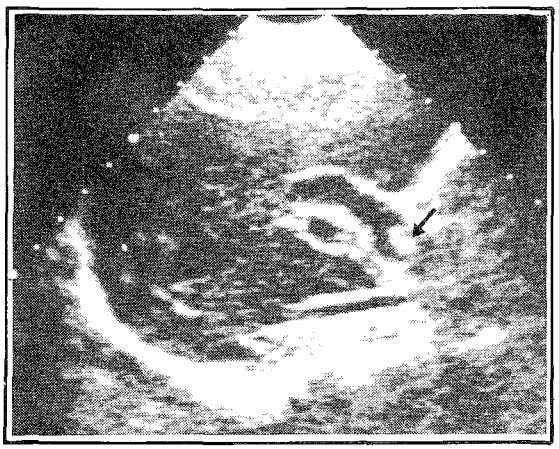

Fig. 1 a) Oblique ultrasound section showing an ecnogenic focus casting acoustic shadow within a dilated common duct (arrow) consistent with a calculus.

RESULTS

In 89 patients (89%), only the proximal part of the common ducts were seen. The ducts were dilated in 71 of these patients and in the remaining nine patients whose common ducts were seen in its entirety from the porta hepatis down to the pancreatic head region. The calibre of these dilated common ducts ranged from 8mm to 40mm.

Sonographic diagnosis of choledocholithiasis was made on 43 patients, based on the demonstration of intraluminal echogenic foci with acoustic shadowing. In another two patients, the intraluminal echogenic foci did not cast acoustic shadowing and the possibility of either calculi or intraluminal mass was suggested. At operation only stones were found. Thus, stones were actually detected sonographically in a total of 45 patients

Fig. 1 b) Operative cholangiogram confirmed the ultrasound appearances. The stone causing a filling defect within the duct (arrow).

giving a sensitivity of 45%. In 34 patients, the stones were seen in the proximal part of the common ducts, and in the remaining nine patients (including the two patients in whom the stones did not cast acoustic shadowing), the stones were detected in the distal part of the ducts in the region of the pancreatic head. All the stones sonographically detected were located in dilated ducts, and their sizes ranged from 5mm to 40mm.

The sole reason given for non-visualisation of the distal common duct was overlying bowel gas. In those cases where there was no apparent cause for the dilatation of the common ducts, further cholangiographic examinations such as ERCP or PTC was suggested (Fig. 2).

DISCUSSION

Our detection rate of 45% for common duct stones on sonography is comparable with most series,[1-6] which indicate that sonographic diagnosis of choledocholithiasis is often difficult.

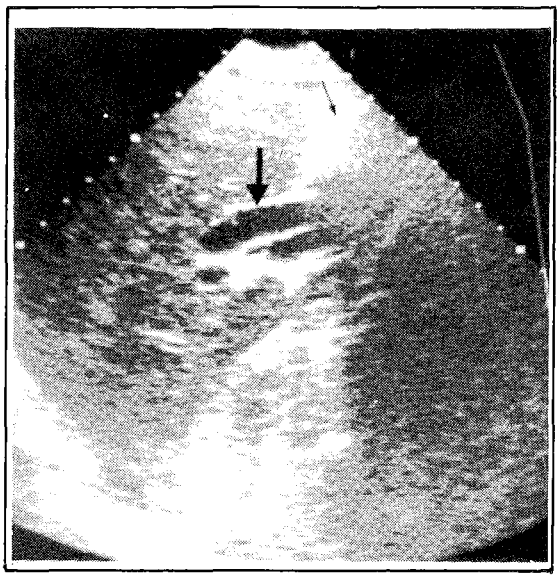

Fig. 2 a) Oblique ultrasound showing a mildly dilated proximal common duct. Bowel gas (small arrow) obscure the distal part of the duct.

This can be attributed to several contributary factors. The most common practical problem is the presence of overlying bowel gas in the duodenum and the adjacent colon which impair visualisation of the lower part of the common duct. Such a situation was encountered in 89% of our patients. The problem of detection is compounded by the fact that most common duct calculi often lie within the distal part and the ampulla.[4,5] Besides, even when the distal common duct including the intrapancreatic segment is well seen, an ampullary stone can still be missed.[4] Computerised tomography (CT) has been shown to be a better alternative non-invasive diagnostic option in the evaluation of the distal common duct and ampulla since overlying bowel gas does not pose a problem in visualisation.[4] However as a routine procedure, CT is expensive and would not be feasible, in addition to the fact that the facility is not widely available.

Modifications in the sonographic technique may help to increase the detection rate for stones in the lower common duct. Scans should be obtained through the pancreatic head and uncinate process with the patient upright in the transverse section. Scanning in the transverse section is usually superior because they facilitate

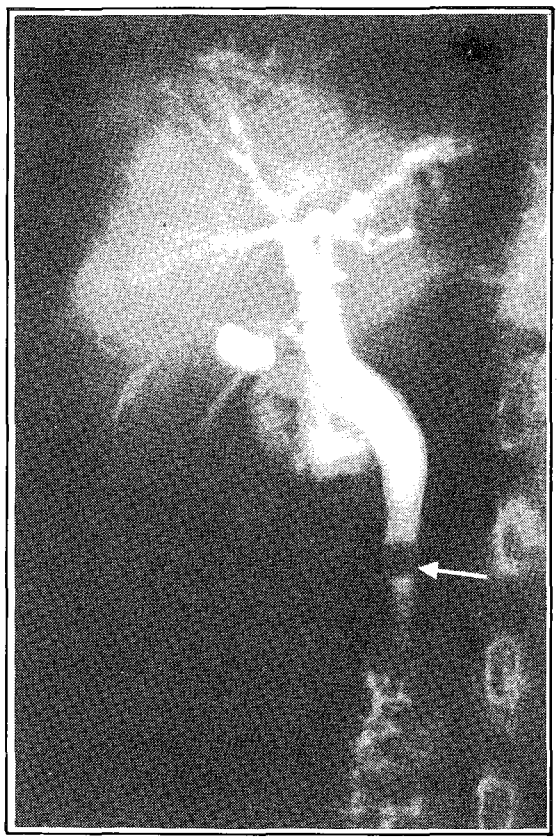

Fig. 2 b) PTC showed a filling defect wthiin the distal part of the common bile duct consistent with a calculus.

identification of surrounding anatomical landmarks.[5] Because of the echogenic nature of a calculus within the ampulla it can be difficult to distinguish it from adjacent pancreatic tissue and mucous within the duodenum.[5] The administration of small amounts of micro-bubbles containing water while simultaneously scanning the region of the ampulla frequently define the duodenum more clearly and allow better definition of the medial aspect of the pancreas.[5] Occasionally a non-visualised unimpacted stone will be evident only after placing the patient in Trendelenburg position allowing cephalad migration of the stone into a more visible position within the duct.[5]

The size of the common duct has been cited as a possible limiting factor. It has been found that detection of stones in normal ducts is more difficult than those in dilated ducts.[1-6] The detection rate for stones in non-dilated ducts

vary from 0 – 12%, whereas for stones in dilated ducts it varies from 20–37%.[1-6] We were only able to detect stones in dilated common ducts. An incomplete, intermittent or early obstruction has been postulated to be the cause for the lack of ductal dilatation. A stone must also be surrounded by a significant amount of bile for sonographic contrast, which is more likely if the duct is dilated, before it can be visualised as being separate from the duct wall and periductal soft tissue.[3] Thus, only stones in a dilated duct can be diagnosed with certainty,[4] although 64 – 94% of choledocholithiasis are associated with dilated extrahepatic ducts,[2-5] the presence of dilated ducts is not a reliable predictor of choledocholithiasis.[1] Gross *et. al.*,[1] found that 16 out of 44 patients with dilated ducts had choledocholithiasis and, hence, the value of positive diagnosis of duct dilatation in predicting the presence of common duct stones was 36%.

It has been noted that calculi may not cast acoustic shadowing.[8] Einstein *et. al.*,[3] found that one-third of choledocholithiasis did not exhibit acoustic shadowing. In such circumstances the stone can either be missed or that the intraluminal echogenic foci is misinterpreted as a tumour. Lack of acoustic shadowing is possibly related to the calibre of the duct, depth of duct, refractions and reflections from the duct walls.[3] Transducer frequency, focusing characteristics, varying ultrasonic beam incidence angle, and lowered system gain are important variables that can be manipulated in an attempt to demonstrate shadowing and thus enhancing detection of calculi.[3] It has also been shown that acoustic shadow is best seen when the stone lies within the focal zone of the transducer.[8]

The actual size of the stone probably does not play a significant role, as small tiny stones are imaged.[3] However, such small stones can be missed because acoustic shadowing may be inapparent if the size of the stones is smaller than the transducer beam width and wavelength.[8]

Sonographic appearances similar to those of stones may be due to any highly reflective structure in or adjacent to the common duct. Examples of these 'pseudocalculus' appearances are the origin of the cystic duct or cystic duct remnant, post operative scar from previous cholecystectomy, right hepatic artery, surgical clips and biliary air.[4]

In conclusion, evaluation of choledocholithiasis by ultrasound is often difficult. However, sonography is still a valuable non-invasive preliminary procedure for detection of common duct stones. A positive diagnosis is useful because patients will be spared from unnecessary preoperative invasive cholangiographic examinations. In the presence of a negative or indeterminated result, further evaluation may be required. Improved sensitivity from the examination can be obtained by proper choice of transducers and meticulous scanning techniques. Equally important contributory factors are the background experience and the skill of the ultrasonographer.

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