Role of computerized tomography in diagnosis of atypical gall bladder and common bile duct stones

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ABSTRACT

Objective: To assess the value of computerized tomography as an adjuvant to ultrasound in the diagnosis of atypical gallbladder and common duct stone disease.

Methods: Real time ultrasound scanning for the gallbladder and common duct was performed in the routine manner. High resolution computerized tomography images were subsequently obtained for the region of interest.

Results: Computerized tomography resolved undetermined results as follows: 1. Non shadowing gallbladder debris (6 points), 2. Focal gallbladder wall thickening (2 points), 3. Stone obscured by calcified gallbladder wall (3 points), 4. Non visualized gallbladder double arc shadow (4 points), 5 and 6. Impacted gallbladder neck and common duct stones (18 points), computerized tomography gave false positive diagnosis in (2 points).

Conclusion: Computerized tomography provided an effective and reliable means for the diagnosis of atypical gallbladder calculi when ultrasound was imprecise or the findings contradicted the clinical presentation. Finally if gallbladder neck or common duct stones are suspected, in addition to computerized tomography other imaging techniques such as magnetic resonance cholangio pancreatography or endoscopic retrograde cholangiopancreatography in addition to computerized tomography may be needed to avoid false positive diagnosis prior to surgery.

Keywords: Atypical gallstones, common duct stones, ultrasound, computerized tomography, magnetic resonance cholangio pancreatography.

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Ultrasound is now established as the most accurate method for demonstrating cholelithiasis, however to avoid false positive or false negative diagnosis in equivocal and suboptimal examinations, other imaging techniques, such as oral cholecystography (OCG),[1] and computerized tomography (CT) could be performed. Although OCG is well tolerated, reliable and gives reproducible results,[2] it is considered a lengthy and tedious procedure which requires preparation and is now outdated and of limited use, such as in-patients for Lithotripsy.[3,4] Oral cholecystography detected stones in 65% of patients, whereas ultrasound (US) detected stones in 93% of patients with cholelithiasis.[5] On the other hand, state of the art CT is now widely available and scanners are fast, reliable and provide high quality images.[6] They are capable of better visualization of gall stone composition than plain radiography[7,8] and are more accurate than OCG in detecting the presence of calcium.[9] Moreover, they are helpful in obese patients, or those with excessive bowel gas[10] and can resolve atypical

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gallbladder (GB) calculi which are either adherent or within the GB wall. Furthermore, if US showed a false positive double arc shadow sign or suspicious stones with GB wall calcification (porcelain GB), CT may be needed to determine the etiology.[11] Modern US equipment and careful scanning techniques allow approximately 75% of common bile duct (CBD) stones to be shown, but it is limited in visualizing stones in the absence of CD dilatation.[7,8-11] Thin slice CT, alternatively, may be helpful to show a calculus in the lower common bile duct however, it is generally impossible to detect biliary stones in a patient with a normal caliber duct, unless there is significant calcification in the stone.[8-11] Moreover, it can give additional information concerning the biliary tree and surrounding structures.[8-12]

Methods. Ultrasound followed by CT was performed on 33 patients during one year, 20 of whom were females and 13 males, with a mean age of 40 (27-88 years). The details of the clinical findings are shown in (Table 1). In addition to US and CT, some patients also had percutaneous transhepatic cholangiography (PTC), ERCP and 30 under-went surgery, (Table 2). Ultrasound was carried out on high resolution Real Time Scanner (Platinum Philips) with 3.5 MHz transducer. Conventional views of the upper abdomen were carried out and the GB was studied in the sagittal and axial axes with the patient lying supine. Views were also obtained with the patient turned to the left and sometimes in the upright position when required. Computerized tomography was performed on a Tomoscan CXQ Philips Third Generation Scanner and with 5mm contiguous thick axial slices and in some 3 and 10mm for CD and liver imaging. No oral or IV contrast medium was given when GB stones were suspected. An intravenous bolus of 50ml of Omnipaque (300mg/ml) was injected in 14 patients for better visualization of the GB, CD wall and to enhance demonstration of faintly calcified stones as well as other associated pathology.

Results. Out of the 33 patients who were screened, suspected having GB or CBD stones on the US, only 28 had been confirmed to have stones on the CT abdomen. Illustrations of this are shown in Table 2. The discrepancies between the findings of US upper abdomen and the CT in 6 different identified groups. In group 1 (6 patients): Gall bladder debri presented as small non-shadowing echogenicities (6 points). One proved to have only biliary sludge; another had limy bile, and the rest had calcified GB stones (Figure 1). Group 2 (2 patients): Focal wall thickening versus stone impaction; gallstones were confirmed in 2 patients (Figure 2). Group 3 (3 patients): Thick calcified GB wall. Gallstones were found in 2 patients by CT that were missed on the US (Figure 3) and the 3rd patient had ampullary carcinoma shown by PTC. Group 4 (4 patients) non visualized GB seen as false double arc shadow sign on the US seen in 4 patients, in 2 patients stones were found in a contracted GB, the 3rd patient had sclerosing cholangitis and a normal GB proved by PTC and the 4th had no GB at opeation (Figure 4). Group 5 (9 patients): Suspected GB neck stones (9 patients): (Figure 5) CT failed to show stones in one patient (False negative) who had thick walled GB on US (Radiolucent stones were shown by ERCP). Finally, one patient had a mucocele and sludge masking a GB neck stone on US but was seen on CT and surgery. Group 6 (9 patients): Common duct stones presented in 9 patients (Figure 6) and in another 4 who had gallstones as well. In one patient, stones were diagnosed but none were found at ERCP and surgery (False positive) and in the other 4 patients, no stones were seen on CT. In 30 patients the findings were verified from the post operative notes while the rest were treated medically.

Discussion. Gallstones, gallbladder wall thickening, common bile duct dilatation and duct stones are all recognizable at CT. Ultrasound is the

Table 1 - Summary of the clinical findings in 33 patients.

Clinical Findings	n
Right hypochondrial pain	22
Right hypochondrial pain and jaundice	7
Painless jaundice	1
Lower abdominal pain and jaundiced	1
Biliary colic	1
GB enlargement (mucocele)	1

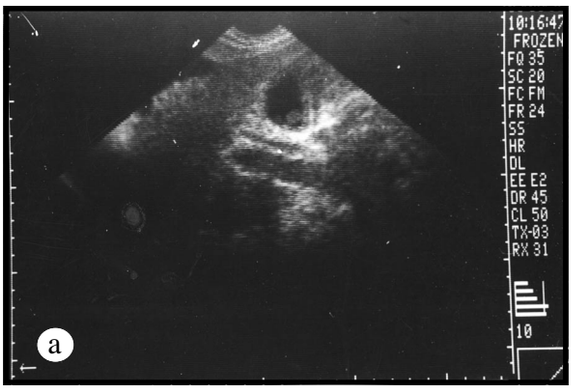
n=number, GB=gallbladder

Table 2 - CT abdomen findings in 33 patients with possible GS on US.

Pathology	n %
Stones	28 (85)
Positive GB	4
Impacted GB	2
Calcified wall GB	2
Contracted GB	2
Neck GB	8
Neck GB + Mucocele	1
CD stones	9
No stones	5 (15)

CT=computerized tomography, GS=gallstones, US=ultrasound, n=number, GB=gallbladder, CD=common duct

Note: Figures 1-3 show the discrepancy between the upper abdomen US (a) Compared to the upper abdomen CT (b) In the same patients (see text).



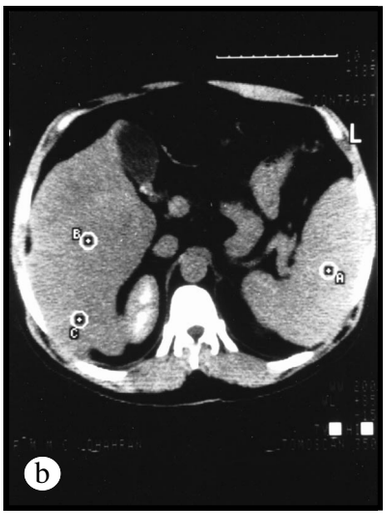
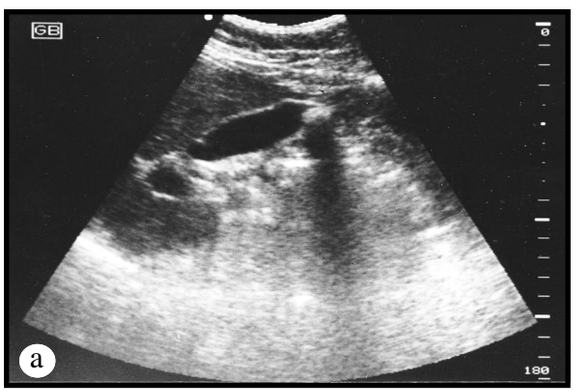


Figure 1 - (a) Upper abdomen ultrasound (Sagital section), showing some debri resting on the dependant gallbladder wall. **(b)** Computerized tomography upper abdomen, shows calcified stones at the gallbladder outlet.



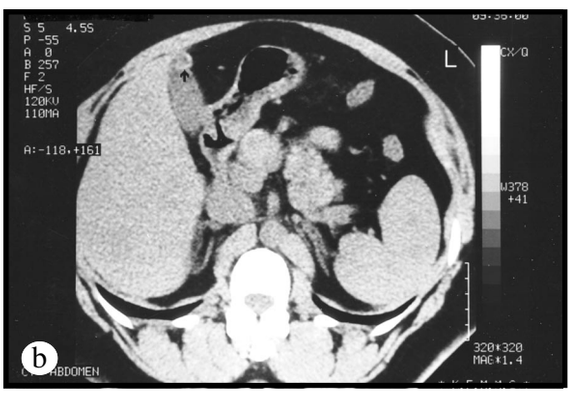


Figure 2 - (a) Upper abdomen ultrasound (Sagital section), focal wall thickening. **(b)** Computerized tomography upper abdomen, ring shaped calcified stone at the gallbladder fundus.

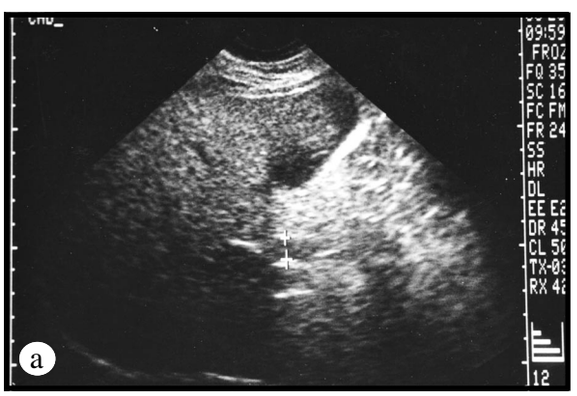


Figure 3 - (a) Ultrasound upper abdomen (Sagital section), echogenic calcified gallbladder wall (no stones). **(b)** Computerized tomography upper abdomen, 2 calcified stones floating adjacent to a calcified gallbladder wall.

Note: Figures 4-6 show the discrepancy between the upper abdomen US (a) Compared to the upper abdomen CT (b) In the same patients (see text).

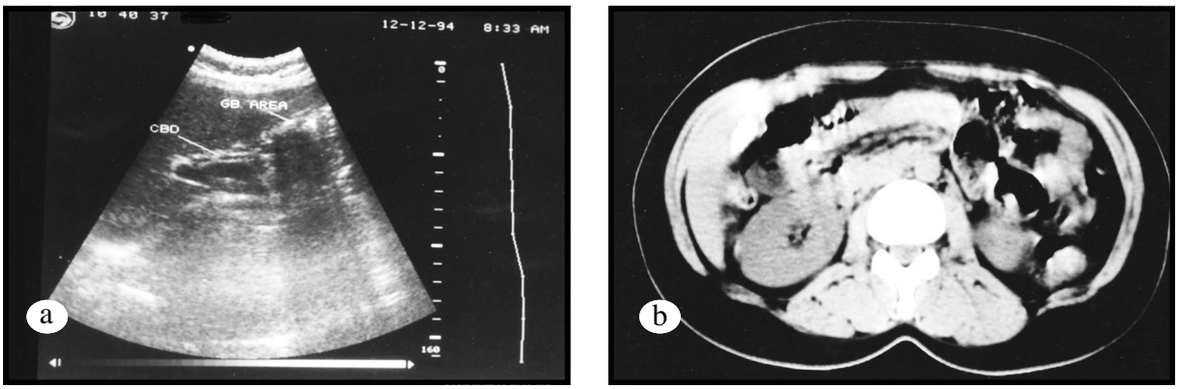


Figure 4 - **(a)** Ultrasound upper abdomen (Sagital section), showing double arc shadow sign at gallbladder bed. **(b)** Computerized tomography upper abdomen, confirms calcified stones in a contracted gallbladder.

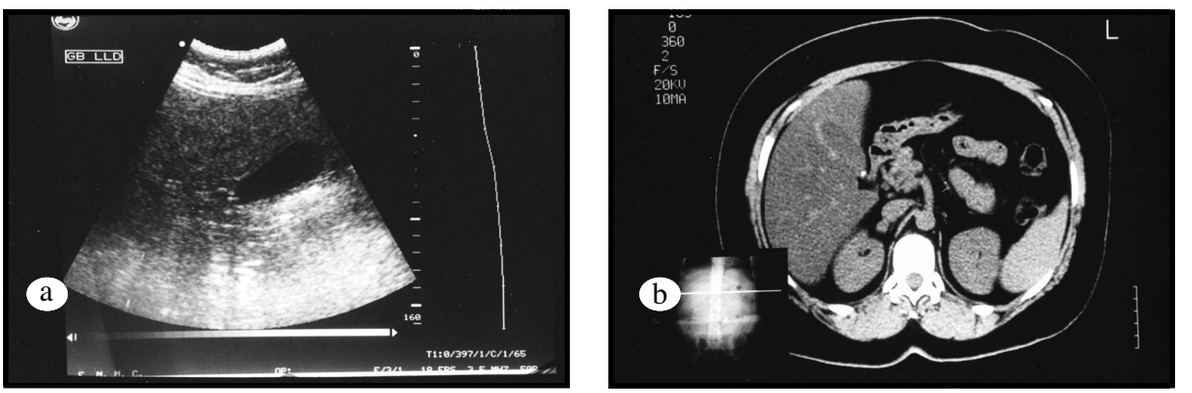


Figure 5 - **(a)** Ultrasound upper abdomen (Sagital section), suspicious tiny echogenicity at the gallbladder neck. **(b)** Computerized tomography upper abdomen (level of superior mesenteric artery) small calcified stone neck of gallbladder.

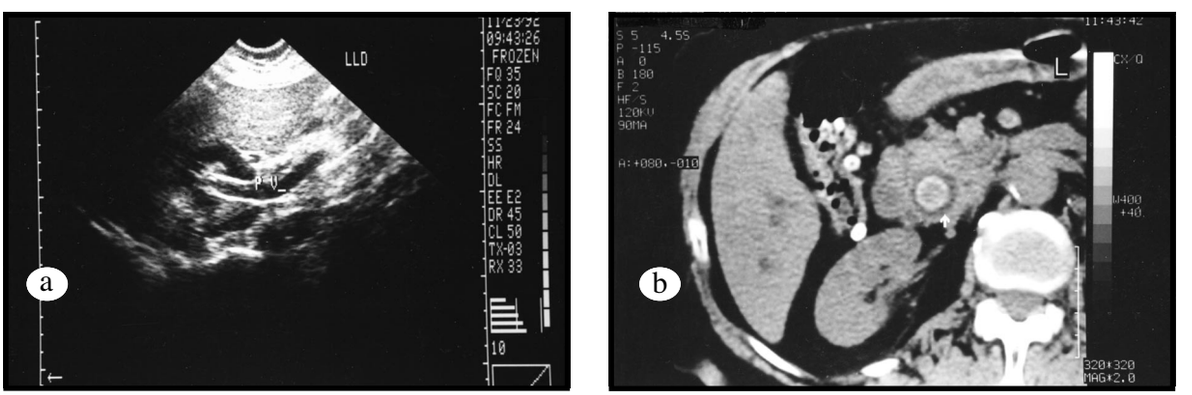


Figure 6 - **(a)** Upper abdomen ultrasound level of portar hepatis (Sagital section) dilated common hepatic duct. **(b)** Computerized tomography upper abdomen (level of pancreatic head), calcified stone in a dilated distal common bile duct.

best all purpose method of investigation as it is the cheapest, simplest and best test for showing gallstones, GB disease and also an excellent test for confirming or excluding bile duct dilatation.[13] The overall diagnostic accuracy of US in gallstones is 90-95%, while for extra hepatic duct stones it has an accuracy of 20-50%[8-12] and up to 75%.[9] Oral cholecystography has been largely abandoned as a diagnostic test.[10] It is used in screening patients for entry into non-surgical treatment of GB disease and is considered complementary to US in determining sizing fragments.[2] Gallstones usually absorb and reflect the US beam and produce a highly reflective echo originating from the surface of the stone with a prominent posterior acoustic shadow. Non-shadowing echo densities correlate with stones in only 50% of cases,[11] computerized tomography may be required in special circumstances to ensure the definitive diagnosis of cholelithiasis.[12] Cholesterol stones are usually uncalcified but if calcium is present it often occurs as a ring like structure in the stones, 80% in one series.[7] In pigment stones the calcium is usually centrally located. Mixed stones are the most frequent and are often multiple and faceted. On rare occasions, sludge balls or tumefactive biliary sludge can appear as mobile non-shadowing masses within the GB lumen.[11] Computerized tomography scanning may give some clues as to the likely composition of stones.[6,8] Atypical stones may occur and are either adherent to or within the gall bladder wall and can mimic focal air, junctional folds, calcification within the GB wall or cholesterol polyps cholesterolosis.[11] Computerized tomography may be required if US is equivocal as a complementary test.[11,12] A false positive diagnosis of cholelithiasis (4%)[1] can also be made by US if the GB is physiologically contracted, filled with echoic sludge or if the gastric antrum/duodenum contains material that mimics the appearance of a GB filled with stones and if the GB is absent or agenetic,[17] (such as false double arc shadow sign). In these situations, technitium, iminodiacetic acid or CT may be carried out to prove whether GB is normal or pathological.[11] CT successfully detected calcified gallstones group 1 and all abnormalities related to the GB wall including impacted wall stones, group 2, wall calcification and masked stones, group 3. It also helped to verify the non-visualized GB and helped to resolve the false double arc shadow sign, group 4, in 2 patient. Gall bladder wall thickening may or may not be associated with primary GB disease while focal GB wall thickening strongly suggests primary GB disease (most likely cholilithiasis in 80-90% of cases.)[8,11] The wall affected by chronic inflammatory disease may undergo calcification which is presumably a healing phenomenon such as cases of porcelain GB shown on the plain radiographs[13,14] Computerized tomography shows GB wall thickening and calcification and can detect associated gallstones as well, group 4. The GB neck continues with the body at the right end of the porta hepatis, it is a further difficult area for US. As a result of edema and gas from adjacent bowel, stones maybe obscured as the gallbladder neck is short and tortuous. Confusion could also occur from the heistral valve (False negative diagnosis) by US is 3%.[11] In one out of 9 patients, a stone was missed by CT (False negative) but was found at ERCP and surgery, probably due to the low opacity of the stone (Ø calcium content) and the associated thick wall. The extra biliary ducts are difficult to visualize throughout its length by US, and the distal common bile duct in particular may be obscured by bowel contents and gas.[8] Choledocholithiasis may be detected in a normal-size bile duct but calculi are more readily seen in a dilated system.[11,12] Thin slice CT successfully visualized calcified stones in the normal and dilated CD.[8,10] In our patients, CT visualized all dilated ducts which had stones, and in one a stone was found in a normal CD. Moreover, in one patient with CD stones shown on CT, none were found at surgery (False positive). Computerized tomography has a sensitivity of 76% and a specificity of 98% in cholidocholithiasis. Some advocate 2 screening tests to predict cholidocolithiasis prior to surgery including CD size and serum gamma-glutamyl transferase level,[14,15] others recommend MRCP (magnetic resonance cholangio pancreatography) and EUS (Endoscopic Ultrasound). Both of these modalities are of high sensitivity and specificity 100%/97% and 85%/97%, the previous being independent of stone size and CD dilatation.[16]

Computerized tomography is widely available and proved reliable for the investigation of hepatobiliary disorders, we found it an effective adjunct to US in the diagnosis of atypical gallstones GB wall pathology and to determine stones in non visualized GB. If biliary obstruction is suspected CT is mandatory for demonstration of stones or other causes, however eventually ERCP may be needed prior to surgery to avoid false positive diagnosis. Magnetic resonance cholangio pancreatography has begun to supplant ERCP in the detection of stones and is now used in many patients prior to cholecystectomy as well as in patients where there is some risk in an ERCP.

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