

COMPARISON OF ACCURACY OF ULTRASONOGRAPHY AND ORAL CHOLECYSTOGRAPHY IN THE DIAGNOSIS OF CHOLELITHIASIS.

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SYNOPSIS

To compare the accuracy of ultrasonography and oral cholecystography in the diagnosis of cholelithiasis, 91 patients with right hypochondrial pain were studied prospectively and had both ultrasonic and oral cholecystographic examinations. Of the 23 patients with gallstones demonstrated on ultrasonography, 15 were confirmed on oral cholecystograms. Of the 68 cases with normal ultrasonic findings, 63 had normal oral cholecystograms as well. The accuracy of ultrasonography was found to be 95%, sensitivity was 94% and specificity was 95%. There was no advantage in the use of fatty meal in the ultrasonic diagnosis of cholelithiasis. Ultrasonography, as a diagnostic tool, is thus comparable to oral cholecystography. Its advantages and its usefulness as an initial screening procedure in the evaluation of gall bladder disease are discussed.

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INTRODUCTION

Oral cholecystography has for many years played the primary role in evaluation of gall bladder disease. Its diagnostic accuracy has been reported to be up to 98% (1). However with the advent of ultrasonography, the role of oral cholecystography as the main investigative procedure has been supplanted. It has been suggested by Hessler et al (2) that a sonographic re-examination 24 hours after a fatty meal could be performed in diagnostically indeterminate cases, in order to improve the accuracy of ultrasonography in evaluating cholelithiasis.

The purpose of the present study was (1) to compare, prospectively, the accuracy of diagnosis of cholelithiasis by ultrasonography to that of oral cholecystography in our hospital practice, and (2) to investigate the effect of a fatty meal on the diagnostic yield of ultrasonography in cholelithiasis by re-examining the gall bladder 45 minutes after a fatty meal.

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METHOD

All patients referred to the Departments of Diagnostic Radiology at Tan Tock Seng and Toa Payoh Hospitals during the period from January to June 1986, for right hypochondrial pain, with or without clinical evidence of acute cholecystitis and with or without abnormal liver function were screened for the present study. Patients who had jaundice or dilated common hepatic ducts (i.e. more than 10-mm diameter) were excluded from the study because their oral cholecystograms were expected to be diagnostically non-contributory. All the patients who were selected were given ultrasonographic and oral cholecystographic examinations within a week of each other.

Ultrasonic Imaging was done in the transverse, sagittal, oblique and lateral decubitus planes which would optimally demonstrate the gall bladder. Real-time sector scanning with a 3.5-MHz transducer was carried out on either the Technicare EDP 1200 or Picker Digital Sector View. The Criteria used for the ultrasonographic diagnosis of cholelithiasis were:

- (1) the gall bladder was well visualised in at least two projections;
- (2) the intraluminal density was well demonstrated; and
- (3) the density cast an acoustic shadow or it moved with a change in posture.

A standard fatty meal was ingested for the physiological stimulation of the gall bladder. It consisted of 50 mls of Bull's Diet (Table 1), followed by 10 mls of water. The ultrasonographic examination was repeated 45 minutes after the fatty meal.

For the **Oral Cholecystogram**, the patient was asked to consume non-fatty light meals the day before the examination. Two Dulcolax tablets were to be taken before bedtime. On

the day of the examination, 3 gm of a contrast agent, Biloptin, was given orally. A second dose was given if the gall bladder failed to opacify. This was followed by the consumption of similar fatty meal (Bull's Diet: see Table 1). On the basis of their cholecystographic findings, the patients were placed in three categories:

- Positive — opacification of the gall bladder with gallstones seen
- Negative (Normal) — opacification of the gall bladder with no gallstones seen
- Non-Functioning — no opacification of the gall bladder even after a second dose of contrast media

The ultrasonographic and oral cholecystographic examinations were carried out and reported independently. The ultrasonographic diagnosis of cholelithiasis was then compared to that of oral cholecystography and its sensitivity, specificity and accuracy assessed. The patients' medical records were subsequently reviewed after at least one month following the ultrasonographic and oral cholecystographic examinations, and their clinical course noted.

RESULTS

A total of 91 patients were studied, consisting of 55 women and 36 men, giving a sex ratio of 1.5 : 1. The sex ratio of cholelithiasis proven by oral cholecystography was 7:1. The ages of our patients ranged from 19 to 78 years, with a mean of 48. 81% of those with cholelithiasis demonstrated on oral cholecystogram were between 40 to 59 years of age. History of right hypochondrial pain ranged from 1 day to 20 years.

The results of both the ultrasonographic and oral cholecystographic examinations are shown in Table 2. Out of the 68 patients whose ultrasonography did not reveal any gallstones, 63 had confirmatory oral cholecystographic findings and 4 had non-functioning gall bladders. The remaining patient was thought to have either a small gallstone or polyp but no confirmation was possible as she was subsequently well and discharged from follow-up.

Conversely, out of the 23 patients with cholelithiasis who were diagnosed by ultrasonography, 15 were confirmed by oral cholecystograms. 5 patients had non-functioning gall bladders while the remaining three cases were negative for gallstones.

Surgical confirmation could not be obtained in all the cases. Out of the 15 patients with cholelithiasis which were diagnosed by ultrasonography and oral cholecystogram, only 5 underwent surgery when the diagnosis was confirmed. 3 patients refused surgery while 6 were lost to follow-up. One patient was later found to have diverticular disease of the colon as well. No surgery was offered as her symptoms were thought to be bowel-related.

By comparing the ultrasonographic with the oral cholecystographic results, the present study has shown that ultrasonography is a sensitive, specific and accurate method for diagnosing cholelithiasis. Three indices — sensitivity, specificity and accuracy — which are defined in Table 3, are used. The sensitivity was found to be 94%; the specificity 95% and the accuracy 95%.

After a fatty meal, 69 patients showed no evidence of gallstones on ultrasonography (Table 4) although before a fatty meal, 68 patients were shown to have ultrasonically normal gall bladders. Thus only 1 out of 91 cases showed a disparity between the ultrasonographic diagnosis before and after the fatty meal. But this patient was found to have

Table 1

Constituents	Quantity
Arachis Oil BP	200.0 ml
Acacia Powder BP	50.0 gm
Dextrose Anhydrous EP	16.0 gm
Essence of Raspberry	1.5 ml
Chloroform Water Conc. (40X)	5.0 ml
Water to	400.0 ml
Constitution of Bull's (Fatty Meal)	

Table 2

	Positive for Gall Stones	Normal	Non-Functioning	TOTAL
Positive for Gall Stones	15 (True Positive)	3 (False Positive)	5	23
Negative for Gall Stones	1 (False Negative)	63 (True Negative)	4	68
TOTAL	16	66	9	91
CORRELATION OF ULTRASONOGRAPHIC (U/S) AND ORAL CHOLECYSTOGRAPHIC (OCG) FINDINGS				

Table 3

SENSITIVITY = $\frac{\text{True Positive}}{\text{True Positive} + \text{False Negative}} = 94\%$
SPECIFICITY = $\frac{\text{True Negative}}{\text{True Negative} + \text{False Positive}} = 95\%$
ACCURACY = $\frac{\text{True Positive} + \text{True Negative}}{\text{Total Diagnostic Cases}} = 95\%$
DEFINITIONS OF SENSITIVITY, SPECIFICITY AND ACCURACY

Table 4

Ultrasonic Examination	Before Fatty Meal	After Fatty Meal
Positive for Gall Stones	23	22
Negative for Gall Stones	68	69
COMPARISON OF ULTRASONOGRAPHIC DISGNOSIS OF CHOLELITHIASIS BEFORE AND AFTER FATTY MEAL		

gallstones on oral cholecystography and we attribute this disparity to observer's error. However, out of the 23 patients diagnosed to have gallstones on ultrasonography, only 22 had similar findings after a fatty meal.

DISCUSSION

The usefulness of oral cholecystography, despite its premier role in the investigation of gall bladder disease, had lately been questioned because of its limitations. The radiation dose, inherent inconvenience, dependence on liver function and inaccuracy are now more obvious with the application of ultrasonography(3) to the diagnosis of cholelithiasis. With increasing technical sophistication and improving expertise, the diagnostic yield and accuracy of ultrasonography now rivals those of oral cholecystography. Several comparative studies between the two methods of investigation in the detection of cholelithiasis have been reported (3-10). Most of these showed comparable, if not slightly higher, accuracy of ultrasonography to oral cholecystography although Krook et al(3), however believes that a 'technically excellent and meticulously performed' oral cholecystogram is slightly superior in sensitivity and specificity to real-time ultrasonography. It was with these points in mind that the present study was undertaken to provide data on the Singapore experience.

Our study revealed our ultrasonographic sensitivity and specificity to be 94% and 95% respectively, with an accuracy of 95%. These figures are comparable to those of other studies. On the other hand, oral cholecystography failed to be diagnostic in 10% (9/91) of the cases because of non-functioning gall bladders. We believe then, that ultrasonography is currently the investigation of choice in suspected cholelithiasis. It is quick and accurate, non-invasive, requires minimal preparation, avoids radiation and side-effects of contrast media, is independent of liver function and gastro-intestinal upset and does not require repeated visits for follow-up radiographs. It can also be employed on acutely-ill patients. This is of particular value in Surgical Departments where emergency cholecystectomies are performed on confirmation of cholelithiasis in cases of acute cholecystitis. Another important advantage of ultrasonography is that it allows multi-organ imaging. Patients with suspected gall bladder disease could be symptomatic from diseases of the liver, pancreas, right kidney, or even bowel, as well (Fig 5).

The earlier reluctance in utilizing ultrasonography as a primary screening procedure was mainly due to its technical limitations and high operator-dependence. The introduction of real-time high resolution instrumentation and increasing operator experience has allowed examinations to be conducted expeditiously. Strict criteria for the diagnosis of gallstones, as listed previously, have now been generally ac-

cepted. The presence of acoustic shadowing was in fact reported to be 100% accurate(8). A definite diagnosis was also obtained if mobility of an echodense, intraluminal lesion was demonstrated. Stones of 3 or more than 3-mm calibre were said to be detectable (2) and Cooperberg et al (7) even claimed to have demonstrated 1-mm stones.

Our study showed that ultrasonography is comparable to oral cholecystography in the diagnosis of cholelithiasis. A fatty meal however, does not increase the diagnostic yield of ultrasonography in cholelithiasis. Mindful of the numerous advantages of ultrasonography, we believe that it should be the initial screening procedure in the evaluation of gall bladder disease. We recommend oral cholecystography only when no definitive diagnosis can be arrived at, or when the patient's symptoms persist in the presence of a normal ultrasonogram (Fig 1).

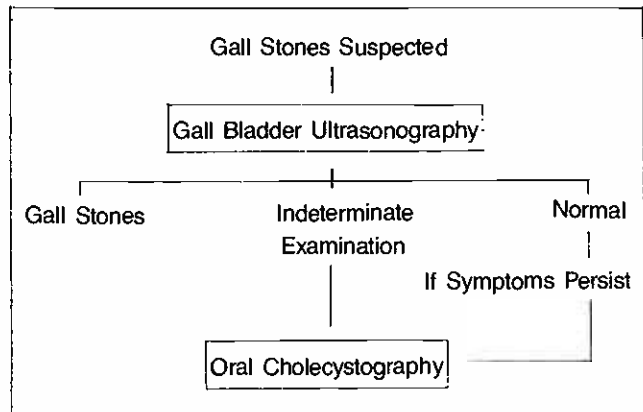


Fig. 1 — SCHEME FOR EVALUATION OF GALL BLADDER

Table 5 — ADVANTAGES OF ULTRASONOGRAPHY

- quick and accurate
- non-invasive
- requires minimal preparation
- avoids radiation and side-effects of contrast media
- independent of liver function and gastro-intestinal upset
- does not require repeated visits for follow-up radiographs
- acutely ill patients can be examined
- multi-organ imaging possible

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