Ultrasound and jaundice

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SUMMARY We have examined 26 consecutive jaundiced patients referred to the ultrasound clinic. A differentiation between extrahepatic and other causes of jaundice was possible in 23 of the 24 patients satisfactorily examined. The use of ultrasonic techniques in the jaundiced patient offers a high degree of accuracy to the clinician, and little or no discomfort to the patient.

The ability to differentiate between extrahepatic biliary obstruction and other causes of jaundice is important to the clinician. Extrahepatic obstruction is often amenable to surgically curative or palliative procedures, while an exploratory laparotomy may be hazardous in a patient with hepatitis or cirrhosis (Strack *et al.*, 1971).

Various biochemical parameters have been used to distinguish between obstructive and non-obstructive jaundice. In particular an alkaline phosphatase level of over 30 King Armstrong units is said strongly to suggest biliary obstruction (Sherlock, 1975a). Recently a computer has been used to help in the differential diagnosis of jaundice (Stern *et al.*, 1973). Endoscopic retrograde cannulation of the ampulla of Vater has been used to determine the patency of the biliary system with good results in expert hands (Blumgart *et al.*, 1972).

None of these methods is completely reliable and all of them cause some discomfort to the patient. We wish to report our experience with our first 26 jaundiced patients.

Methods

PATIENTS

Twenty-six consecutive patients with jaundice were seen at the clinic. The patients were, in general, referred because the clinician could not decide whether extrahepatic obstruction was or was not present. In three cases, while clinically extrahepatic obstruction seemed likely, the surgical team wished to know whether stones were present or not.

The patients were referred by physicians or surgeons at University College Hospital, the

Whittington Hospital, or the Hospital for Tropical Diseases.

Patients were all seen in an unfasted state, having had a fat-containing meal up to three hours previously.

TECHNIQUES

The patients were scanned using the Nuclear Enterprises 4102 Disonograph without grey-scale or the Unirad (Denver, Colorado) grey-scale scanner.

The abdomen was covered in a layer of arachis oil and scanned using parasagittal sector sweeps, 1 cm apart, under the ribs in the epigastrium and right hypochondrium (Figs. 1 and 2). Transverse scans from the xiphisternum downwards were also performed, generally at 2 cm intervals.

Occasionally the patient lay on the left side and the abdomen was scanned below the ribs on the right in a coronal plane to obtain views of the common bile duct.

Scans were reported by the clinician and physicist, who were both present throughout the procedure.

The reports stated (1) the size of the gall-bladder in three planes at right angles to each other; (2) the state of the bile ducts—whether distended or normal; (3) whether stones were seen.

Finally, a conclusion was drawn as to whether extrahepatic obstruction was or was not present.

Results

Of the 26 patients with jaundice, follow-up was possible in all of them: 18 of the 26 patients seen were scanned with a conventional B-scanner and eight were scanned with a grey-scale machine. In two patients, satisfactory scanning was not possible for technical reasons—that is, gas in the bowel or machine problems. It was possible to differentiate

correctly between extrahepatic obstruction and other causes of jaundice in 23 of the remaining 24 (Table 1).

Altogether extrahepatic jaundice was correctly diagnosed in nine of 10 patients, and other non-surgical causes of jaundice were correctly diagnosed in all 14 patients. The size of the gall-bladder was an important factor in helping to differentiate between extrahepatic obstruction and other causes of jaundice in our non-fasted patients. In one patient, however, no. 11 on Table 1, a normal size gall-bladder and common bile duct were seen, but distended intrahepatic radicles were noted. At laparotomy she was found to have a small carcinoma of the gall-bladder, blocking cystic and common hepatic ducts.

Stones were noted in five patients, although correctly diagnosed as causing obstruction in only three of the five. In all of our obstructed patients,

the gall-bladder volume was computed as more than 60 ml. In only one of our patients without gall-bladder obstruction was the gall-bladder volume greater than 60 ml. Gall-bladder volumes were computed by assuming that its shape was like that of a cylinder. Dilated common bile ducts and extrahepatic biliary ducts were found in most of our obstructed patients. Dilated intrahepatic biliary vessels were also frequently detectable (Fig. 3).

Clinical diagnosis of all obstructed patients was made at laparotomy. Diagnosis of our other patients was made in some cases by liver biopsy. In two cases, the jaundice resolved and was assumed by the clinicians in charge of the cases to be due to acute hepatitis.

Table 2 gives a summary of disease states seen in the 24 patients scanned.

Fig. 1 Parasagittal scan of patient no. 10, showing the gall-bladder (GB), spiral valve (SV) of the cystic duct, and dilated common bile-duct (CBD). The skin (S) and liver (L) are also shown.

Fig. 2 Parasagittal scan from patient no. 14, showing a large stone (GS) in the gall-bladder (GB). Note the shadow (S) cast by the stone.

Table 1 *Methods of diagnosis*

No.	Ultrasound diagnosis	Clinical diagnosis	Clinical diagnosis based on
1	a. Extrahepatic obstruction b. Mass in head of pancreas	Carcinoma of head of pancreas	Laparotomy
2	No obstruction	Hepatitis	Liver biopsy
3	No obstruction	Multiple secondaries	Necropsy
4	No obstruction	Cholestatic hepatitis	Liver biopsy Transhepatic cholangiography
5	a. Extrahepatic obstruction b. One calculus seen in gall-bladder No stones seen in duct system	Carcinoma of head of pancreas. One calculus found in gall-bladder	Laparotomy
6	No obstruction	Cirrhosis	a. Liver biopsy b. Antibodies
7	No obstruction	Acute hepatitis	Liver biopsy
8	No obstruction	Acute hepatitis	Clinical course
9	a. Extrahepatic obstruction b. Stones present. Irregular outline of gall-bladder	Multiple stones in gall-bladder and common bile duct	Laparotomy
10	a. Extrahepatic obstruction b. No stones seen	Carcinoma of head of pancreas	Laparotomy
11	Dilated intrahepatic ducts but gall-bladder not enlarged	Carcinoma of gall-bladder	Laparotomy
12	No obstruction	Acute hepatitis	Clinical course
13	No obstruction	Acute hepatitis	Liver biopsy
14	No obstruction but two stones seen in gall-bladder	Probable hepatoma and two gall-stones	Patient died without necropsy Alpha foetoprotein +ve. Gall-stones seen on plain X-ray of abdomen
15	No obstruction	Cirrhosis	Liver biopsy
16	No obstruction	Cirrhosis	Isotope scan. Known heavy alcohol intake
17	No obstruction	Carcinoma of head of pancreas	Laparotomy
18	No obstruction	Multiple secondaries	Necropsy
19	No obstruction	Cirrhosis	Liver biopsy
20	Extrahepatic obstruction. Stone seen	Stones in common bile duct	Laparotomy
21	Extrahepatic obstruction	Carcinoma of head of pancreas	Laparotomy
22	No obstruction	Hepatitis	Liver biopsy
23	a. Extraheptic obstruction b. Stone in common bile duct and stone in gall-bladder	Stones in common bile duct and gall-bladder	Laparotomy
24	Extrahepatic obstruction. No stone seen	Carcinoma in head of pancreas	Laparotomy

Table 2 *Summary of causes of jaundice*

Cause	No.
Carcinoma of pancreas	6
Gall-stones	3
Carcinoma of gall-bladder	1
Hepatitis	7
Cirrhosis	4
Hepatic tumours	3
Total	24

Discussion

This series demonstrates the value of ultrasound in the differentiation of jaundiced patients into surgical and non-surgical categories. Although we would not claim that ultrasound can provide a complete diagnosis in the jaundiced patient, it is a helpful diagnostic tool. It has the great advantage to the patient of being free from side-effects and completely non-invasive. It, therefore, represents a distinct advance over other diagnostic methods—for

example, ERCP—which is unpleasant for the patient and has complications (Kasugai *et al.*, 1972), transhepatic cholangiography which has definite morbidity (George *et al.*, 1965), and liver biopsy which may also be dangerous to the jaundiced patient (Sherlock, 1975b).

We are convinced that it is more rational to scan patients in an unfasted state. In the fasted state the gall-bladder may be distended and may be hard to distinguish from an obstructed gall-bladder. Although we appreciate that there may be sound reasons for examining the gall-bladder in a distended, fasted state in radiological procedures, we suggest that ultrasonic evaluation of the jaundiced patient is simplified by the patient being unfasted.

Although we were able on most occasions to demonstrate the biliary ducts, this was not possible in all patients. It is important to appreciate that the visualisation of a gall stone in the gall-bladder may be an incidental finding, as in two of our patients, and may not be related to the cause of jaundice. We were able to visualise a pancreatic mass in only two of our six patients with proven carcinoma of the

Fig. 3 Showing gall-bladder (GB) with centimetre caliper across, hemidiaphragm (HD), kidney (K), and dilated intrahepatic ducts.

pancreas. Some authors have suggested that visualisation of the pancreas and pancreatic tumours is possible in most cases (Otto *et al.*, 1973), but this is not so in our hands, or in those of Taylor and his colleagues at the Royal Marsden Hospital (Taylor *et al.*, 1974).

Two machines were available to us—one with grey-scale attachments. There was little doubt that grey-scale gave us a clearer indication of organ texture, but we remain unconvinced of its advantage in situations where one is looking for clear-cut ultrasonic boundaries such as those that exist in the biliary system.

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