Grey-scale ultrasonography in cholestatic jaundice

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SUMMARY Grey-scale ultrasonography was performed without access to detailed clinical information in a prospective study of 55 jaundiced patients. Forty-one were eventually proved to have an extrahepatic obstructive cause, and 14 had intrahepatic 'medical' disease. Satisfactory ultrasound images were obtained in 54 patients, and the bile duct calibre was correctly reported in 53 (96%). All 14 medical cases were correctly identified. Two patients with gallstones (one with a normal sized duct) were incorrectly classified as medical. A specific and correct disease diagnosis was given in five of the 14 medical cases (one metastases, four cirrhosis), and in 23 of the 41 obstructive cases (12/14 pancreatic cancer, 5/15 gallstones), 5/5 bile duct compression, 1/3 bile duct cancer). Ultrasonography is safe, cheap, and acceptable to patients. It should be the first imaging investigation in jaundiced patients, providing remarkable diagnostic accuracy and important guidance for further management.

Some patients with cholestatic jaundice pose difficult diagnostic problems (Cotton and Stern, 1977); the primary concern is to separate those with an extrahepatic condition who may require surgery from others with intrahepatic disease who must be protected from it. Both unnecessary surgery and unnecessary delay in treatment can be dangerous and expensive.

Biochemical studies and isotope scans (whether static or dynamic) are rarely conclusive. Percutaneous transhepatic cholangiography (PTC) (Redeker *et al.*, 1975) and endoscopic retrograde cholangiopancreatography (ERCP) (Cotton, 1977) can usually provide a precise distinction and diagnosis, but both are invasive and potentially hazardous. Ultrasound scanning of the liver was reported to be of value in 1967 by McCarthy *et al.*, and the recent grey-scale modification has greatly increased sensitivity. We have assessed the accuracy and clinical value of grey-scale ultrasonography in the differential diagnosis of patients with cholestatic jaundice.

Methods

Between January and November 1977, 55 jaundiced patients were referred to the Gastrointestinal Unit because of uncertainty regarding the possibility of extrahepatic biliary obstruction. On the basis of a personal clinical assessment and standard

biochemical investigations, the physician recorded whether he believed the cause of jaundice to be 'medical' (intrahepatic) or obstructive (extrahepatic) and whether his assessment was definite or probable; a specific disease diagnosis was sometimes also offered. Grey-scale ultrasonography (GSU) was then performed by a single operator (WRL) using a Nuclear Enterprises diasonograph NE 4102 with NE 4104 grey-scale modification. The patients were allowed nothing orally for six hours before examination and were occasionally given simple bowel preparation. Patients were scanned in the longitudinal and transverse planes, first supine and then in the left lateral decubitus position and its variants. The scans were reported without access to detailed clinical information, and stated (1) whether the intrahepatic biliary radicles were dilated, the level of any obstruction, and (2) the precise nature of the disease process. Conclusions were again graded as definite or probable.

The final diagnosis in the 55 patients and the further methods employed are shown in Table 1. PTC was only used before percutaneous biliary drainage (Takada *et al.*, 1976).

Results

The clinical assessment was correct in distinguishing medical from obstructive jaundice in only 38 of the 55 patients (Table 2); 'definite' ratings were given to only nine of the 38 correct assessments, but to none of those 17 which proved to be incorrect.

Table 1 *Final diagnosis and diagnostic methods*

	Totals	Surgery (+ histology)	ERCP	PTC	Liver biopsy	Follow-up only
Intrahepatic disease	14	1 (1)	1		7	5
Extrahepatic obstruction						
Gallstones	15	10	7			
Cancer of pancreas or papilla	14	14 (9)	9	3		
Cancer of bile duct	3	3 (2)	3	1		
Sclerosing cholangitis	4	2 (1)	3	0		
Bile duct compression	5	3 (3)	5			
Totals	41	32 (15)	27	4		
Grand totals	55	33 (16)	28	4	7	5

Table 2 *Accuracy of clinical assessment of type of jaundice*

Clinical diagnosis	Final diagnosis		Total
	Medical	Obstructive	
Medical			
Definite	2	0	13
Probable	8	13	
Obstructive			
Definite	0	7	28
Probable	4	21	
Total	14	41	55

Grey-scale ultrasonography (GSU) provided adequate images in all except one patient with excessive bowel gas. Overall, GSU assessment of bile duct calibre was correct in 53 cases (96%), and made the correct distinction between 'medical' and obstructive causes of jaundice in 52 cases (94%) (Table 3). Normal calibre bile ducts were seen in all 14 patients with intrahepatic disease and GSU provided a correct disease diagnosis in five of them (multiple metastases, one, hepatic cirrhosis, four). In the remaining nine patients the intrahepatic appearances were normal or non-specific.

Table 3 *Overall results of GSU in cholestatic jaundice*

Final diagnosis	Totals	Grey-scale ultrasonography	
		Bile duct calibre correctly assessed	Specific diagnosis
			Definite Probable
Intrahepatic disease	14	14	5 0
Extrahepatic obstruction			
Gallstones	15*	13	5 7
Cancer of pancreas or papilla	14	14	12 0
Cancer of bile duct	3	3	1 2
Sclerosing cholangitis	4	4	0 4
Bile duct compression	5	5	5 0
Totals	41	39	23 13
Grand totals	55	53 (96%)	28 13

*One ultrasound scan technically unsatisfactory.

Biliary dilatation was seen in all 14 patients with cancer of the pancreatic head or papilla of Vater; abnormalities of the pancreatic head were seen in all patients, with detail sufficient to distinguish carcinoma from pancreatitis in 12.

Of the 14 patients with jaundice due to gallstones in which GSU provided good images, only six had bile duct dilatation. GSU showed this (and stones) in five, but was reported normal in the other who had a single stone in a slightly dilated duct. Gallbladder stones were seen in two of them, the remainder having previously undergone cholecystectomy. Seven other patients were shown by GSU to have gallstones (gallbladder stones alone in five, gallbladder and bile duct stones in two), but with normal sized ducts. In one patient no dilatation or stones were seen, and the patient was incorrectly classified as having 'medical' jaundice. ERCP subsequently showed a stone in a normal sized bile duct.

Sclerosing cholangitis or cholangiocarcinoma was present in seven patients; GSU showed intrahepatic duct dilatation and abnormalities of the extrahepatic tree in all cases, but could provide a confident diagnosis in only one. Five patients had extrahepatic bile duct compression, caused by lymph nodes (two), large metastases (one), pancreatic pseudocyst (one), choledochal cyst (one). GSU views were sufficient to determine the site and nature of the lesion in all five cases.

Discussion

Our clinical accuracy of around 70% in differentiating between medical and obstructive causes of jaundice is lower than that reported elsewhere (Martin *et al.*, 1960; Schenker *et al.*, 1962), but reflects the preponderance of problem cases in this series; many patients had been referred by other specialists. GSU made this distinction in 94%, and provided a confident and correct disease diagnosis in 51%. Very similar figures (97% and 54.7%, respectively) have recently been reported by Taylor and Rozenfeld (1977). Vicary *et al.* (1977) were

able to distinguish medical and surgical causes of jaundice in 23 of 26 patients, but could suggest a diagnosis only in four cases. These authors reported difficulty in visualising the pancreas, where we believe ultrasonography also has a crucial diagnostic role (*Lancet*, 1977; Lees *et al.*, 1978). In all three jaundice series, GSU errors occurred only in patients with gallstones. The technique is very accurate in detecting calculi in the gallbladder, but those in the bile duct are more difficult to see, and they may cause jaundice without biliary dilatation. Thus the patient with jaundice due to a duct stone may be falsely labelled as 'medical' by GSU if there are no accompanying stones in the gallbladder (which is unusual) or if cholecystectomy has already been performed; in such a case the GSU picture may also be confused by postoperative scarring. Patients with postoperative biliary strictures also do not necessarily show duct dilatation. Conversely, gallbladder stones may occasionally be incidental in patients with jaundice, and their demonstration by GSU misleading.

Ultrasonography is relatively simple, non-invasive, safe, and cheap. The rare examination which is spoiled by excessive gas can be repeated. Results depend on the experience of the examiner, but can be very accurate. Where does GSU lead clinically and how does it influence the use of preoperative cholangiography? Both endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic cholangiography (PTC) can provide definitive information in around 90% of jaundiced patients, and their relative merits have been well rehearsed (Cotton and Stern, 1977; Cotton, 1977; Elias, 1976). ERCP is more complex and less pleasant for the patient, but is more effective when ducts are not dilated, and can give crucial information about the duodenum, papilla, and pancreas. Complications occur, but can be prevented (Cotton, 1977). PTC provides a cholangiogram in almost 100% of patients with dilated ducts, but there is a significant risk of bile leakage even using a fine needle (Juler *et al.*, 1977).

When GSU shows gallbladder stones in a jaundiced patient with consistent clinical features, surgery can be performed directly without cholangiography; it is in these patients with infected bile that both ERCP and PTC can provoke cholangitis and septicaemia. In patients who have previously undergone biliary surgery, GSU may be helpful in showing pancreatic or hepatic lesions, but cholangiography is necessary to demonstrate unequivocally the presence or absence of a duct stone or stricture. Since the ducts are usually not dilated, ERCP is the preferred technique especially as any duct stones may be removed at the same time

by endoscopic diathermy sphincterotomy (Safrany, 1977). When GSU shows extrahepatic biliary abnormalities which may be due to sclerosing cholangitis or cholangiocarcinoma, both PTC and ERCP are applicable; however ERCP also allows a tissue diagnosis using a cytology brush passed up the bile duct. ERCP can also provide histological proof of cancer of the papilla of Vater or pancreatic head by brushing cytology or forceps biopsy. But, neither PTC nor ERCP can give an accurate indication of the size and operability of any tumour. These data can be provided by detailed angiography, and the relative roles of GSU and computed tomography have yet to be established (Husband *et al.*, 1977). Computed tomography can also complement GSU in documenting mass lesions causing bile duct compression.

Grey-scale ultrasonography is a major diagnostic advance in jaundiced patients. It should be the first imaging investigation after a plain abdominal radiograph. In many patients the results will be definitive and alone sufficient for confident medical or surgical management. In the remainder, it indicates the appropriate next step, usually ERCP or PTC. There is no longer any need for delay, which can be demoralising, dangerous, and expensive in investigating jaundiced patients.

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