Original Article *นิพนธ์ต้นฉบับ*

Ultrasound Evaluation of Biliary Obstruction in Chaoprayayomraj Hospital, Suphan Buri

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Abstract A prospective study on the ability of ultrasound to accurately evaluate the site and cause of biliary obstruction compared with the postoperative diagnoses was carried out. It revealed 90 surgically proven cases entered into this series, in whom the sensitivity, specificity, and accuracy of ultrasound evaluation of the site of biliary obstruction were 98.8 percent, 85.7 percent and 97.8 percent respectively; of the cause of biliary obstruction were 97.6 percent, 85.7 percent and 96.7 percent respectively, respectively, which were relatively high in comparison with multiple previously published series. So this study could support that in Chaoprayayomraj hospital, the screening role of ultrasound in differentiation between obstructive and nonobstructive biliary tract diseases could be extended to gain information of the site and cause of biliary obstruction, of the extension and operability of the tumor, to assess the presence of both ascites and metastatic foci in the liver thus aiding in the staging of neoplastic disease. It also could accurately guide further therapeutic maneuver, which were sufficient to evaluate patients prior to surgery, while cholangiography (PCT and ERCP) and computed tomography (CT) should probably be used only when satisfactory ultrasound examination could not be obtained, in order to avoid the risk of the potentially hazardous complications of the procedures, contrast media administration and radiation; to reduce the high cost and the difficulty in referring the patients. Review of literatures concerning ultrasound evaluation of biliary obstruction were performed. Practical points of making ultrasound evaluation of biliary obstruction were discussed as :- technique of ultrasonographic examination, anatomical relationships of biliary tract, criteria used in ultrasound diagnosis of biliary obstruction, determination and interpretation of its site and cause.

Key words: **ultrasound, biliary obstruction**

Introduction

Ultrasound is an accepted screening procedure to differentiate between obstructive and nonobstructive biliary tract disease[1-7]. Management of the patients with biliary obstruction depends on the anatomic site and cause of the obstruction[8], so previously clinicians usually used cholangiography including percutaneous transhepatic cholangiography (PTC) or endoscopic retrograde cholangiopancreatography (ERCP) as the second investigation after ultrasound to detect the level and exact cause of biliary obstruction[9]. Some clinicians used computed tomography (CT) as the other

combined diagnostic modality. In comparison between ultrasound and CT scanning, both are highly accurate in detecting obstruction [10], but only one of these procedures need to be used for the initial evaluation of biliary obstruction. Being less costly, noninvasive, acceptable to patient, accurate, and safe from the complications of procedure, contrast media administration and radiation[9,11,12], ultrasound should be the investigation of choice and is still highly reliable method. Even some authors have suggested that its screening role can be extended to gain the information of the site and cause of biliary obstruction, the extension and operability of the tumor, to assess the presence of both ascites and metastatic foci in the liver thus aiding in the staging of neoplastic disease, and can accurately guide further therapeutic maneuver [3,7,9,11,13,14]; all of which are sufficient to evaluate patients prior to surgery, while cholangiography (including PTC and ERCP) and CT should probably be used only when satisfactory ultrasound examinations cannot be obtained[9,12,13].

To verify that the ultrasound can be the investigation of choice in the determination of site and cause of biliary obstruction in the vast majority of the patients with obstructive biliary tract disease in Chaoprayayomraj hospital, Suphan Buri, and can give the surgeons sufficient information in surgical planning then the second investigations such as PTC, ERCP, and CT can be sparingly requested, in order to avoid the potentially hazardous complications, to reduce difficulty and the high cost in performing PTC, ERCP and CT. This study has been designed to prospectively evaluate the ability of ultrasound in the determination of the site and cause of biliary obstruction and to compare the accuracy of the ultrasound diagnoses with the postoperative diagnoses in this hospital.

Methodology

From October 2002 to September 2007, 3,745 patients were refered to ultrasound section, dsepartment of radiology, Chaoprayayomraj hospital, Suphan Buri province, for ultrasound evaluation of hepatobiliary system. Realtime ultrasonographic examinations were performed by 1 - 2 radiologist(s). The ultrasonographic technique was scanning throughout the whole liver in the multiple planes as transverse, parasagital, right lateral coronal, right subcostal oblique and right lower intercostal oblique planes for the demonstration of the intrahepatic bile ducts (IHBD). And to demonstrate the proximal common bile duct (PCBD) and distal common bile duct (DCBD) used parasagital scanning and lower transverse scanning at the medial right subcostal region, respectively. Transducer angulation and obliquity depended upon individual anatomical variation. The patient were scanned routinely on supine with or without right anterior oblique position, sometimely on left anterior oblique and/or erect position(s) and occasionally on the trendelenberg position. In the difficult cases who were markedly obesed and/or had much overlying bowel gas in the region of DCBD, rescanning after drinking of about 500 ml of water was attempted on several positions of the patient or by rotation of the patient from left anterior oblique to right anterior oblique position immediately when the duodenum was fully filled by the ingested water.

The 267 patients with evidence of bile ducts dilatation were obtained by using the criteria of IHBD dilatation as visible seperation of the walls of the peripheral third order IHBD (about 2 cm from IHBD bifurcation) and measured more than 4 mm in diameter[15-17](Fig. 1); and/or EHBD dilatation measured more than 5 mm in diameter at common hepatic duct (CHD) and more than 8 mm in diameter at PCBD and DCBD[17,18] (Fig. 2.1, 2.2, 2.3 and Table 1).

Prospective study of ultrasound evaluation of the site and cause of biliary obstruction had been performed by dividing the biliary ductal system into four portions as :-bifurcation of IHBD, CHD, PCBD and DCBD.

The ultrasonographic diagnosis of the cause of

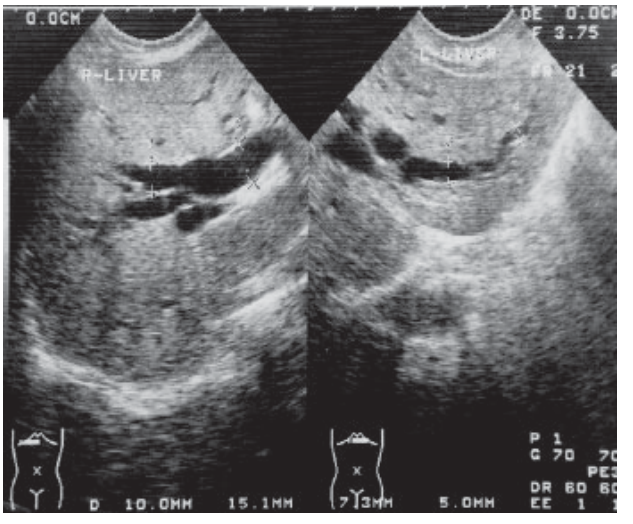

Figure 1 IHBD, dilatation, measured more than 4 mm in diameter

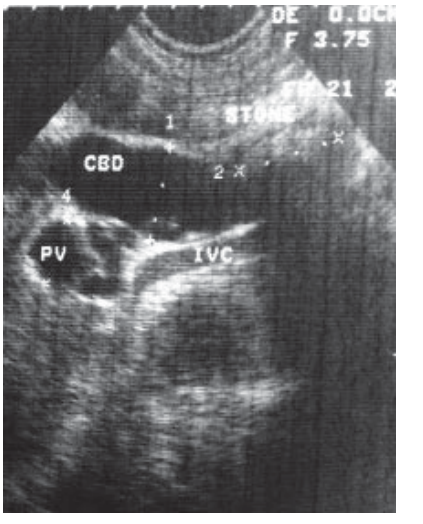

Figure 2.1 Dilated PCBD, about 26 mm in diameter with large stone about 35 mm in size

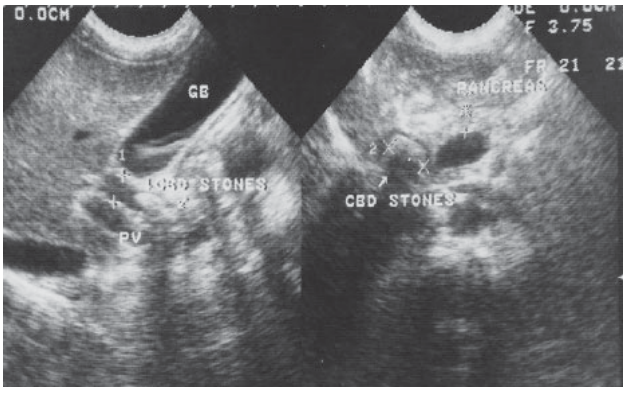

Figure 2.2 Multiple stones in the mildly dilated CBD, measured about 9.8 mm in diameter

Figure 2.3 Dilated CBD, about 10.2 mm in diameter with small DCBD stone

biliary obstruction is choledocholithiasis (or bile duct stone) when an echogenic focus in the lumen of bile duct was demonstrated accompanying acoustic shadowing (Fig. 2.1, 2.2 and 2.3). A mass or mass liked lesion which caused intraluminal obstruction or extrinsic compression of the bile duct was determined as solid or cystic component, benign or malignant nature, and was defined of its size, site, and extension. Local invasion of the mass, regional lymph node involvement, liver metastasis, and ascites which indicated malignant nature of the mass or mass liked lesion were observed. The gall bladder and pancreas were also evaluated, if there were evidences of gall stone, cholecystitis, gall bladder mass, pancreatitis and pancreatic duct dilatation, which could support the diagnosis of the site and cause of biliary obstruction. The films or sonoprinted papers of ultrasonograms and reports of all ultrasonographic findings and diagnoses of all patients had been collected.

Retrospective reviews of the films or sonoprinted papers of ultrasonograms, reports of ultrasound, OPD cards, charts, and the subsequently operative notes of

Table 1 Numerical Criteria for Bile Duct Dilatation in Previous Published Series

	Series	IHBD. size	EHBD. size	Measurement site of EHBD.
1	Cooperberg, et al.[39]	not stated	> 5 mm	CHD
2	Sample, et al.[4]	not stated	6 mm	maximal diameter
3	Honickman, et al.[8]	double tracking	> 6 mm	common duct
4	Dwivedi, et al.[9]	2 mm or more	> 6 mm	CBD
5	Suhas, et al.[34]	not stated	> 7 mm	not stated
6	Behan, et al.[21]	not stated	8 mm	widest point
7	Dewbury, et al.[1]	not stated	8 mm	not stated
8	Goldberg, et al.[12]	5 mms.	8 mm	level of cystic duct
9	Laing, et al.[20]	not stated	> 5, >8 mm	CHD, CBD, respectively
10	Edwin, et al.[17]	4 mm or more	> 8 mm	not stated
11	Goldstein, et al.[11]	2 mm	10 mm	not stated
12	Malini, et al.[37]	4 mm	10 mm	CBD
13	Conrad, et al.[24]	parallel sign	15 mm	not stated
14	Taylor, et al.[2]	2 mm	not stated	not stated
15	Weill, et al.[16]	shot gun sign	= or > PV size	Distal to junction of R and L IHBD

IHBD= Intrahepatic bile ducts, EHBD= Extrahepatic bile duct, CHD= Common hepatic duct, CBD= Common bile duct, PV= Portal vein, R= right, L= left

Table 2 Age, Sex and Distribution of each Cause of Biliary Obstruction Detected by Ultrasound in This Series.

		Age-Year (%)													
Causes of		**< 50**		**50-59**		**60-69**		**70-79**		**> 80**		**Subtotal**		**Total cases**	**Mean**
obstruction	**Sex**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**(Each Cause)**	**age**
1. Stone		0	4	2	4	5	9	5	11	3	4	15	32	**47** (52.2)	67
		(9)		(13)		(30)		(34)		(15)					
2. Mass		2	1	5	6	3	6	4	3	1	1	15	17	**32** (35.6)	62
		(9)		(34)		(28)		(22)		(6)					
3. Pancreatitis		0	0	0	0	0	1	1	0	1	0	2	1	**3** (3.3)	72
4. No organic cause		0	0	1	2	2	0	1	2	0	0	4	4	**8** (8.9)	67
Subtotal		2	5	8	12	10	16	11	16	5	5	**36**	**54**	**90** (100)	Mean age
Total Cases of	**Case**	**7**		**20**		**26**		**27**		**10**		**90**			of Total
Each Age Range	%	**(7.8)**		**(22.2)**		**(28.9)**		**(30)**		**(11.1)**		**(100)**			66

these 267 patients revealed that only 90 surgically proven cases could enter into this series. Ultrasonographic diagnosis of the site and cause of biliary obstruction was compared with the postoperative diagnosis in each case. The sensitivity, specificity, and accuracy of the ultrasound evaluation of the site and cause of biliary obstruction were calculated. Chi-square was used in the statistical analyses.

Results

The mean age of the 90 surgically proven cases was 66 years (range 34-88 years) with female dominance (F:M = 54 cases : 36 cases = 1.5 : 1) , particularly the group of the patients who had stone as the cause of biliary obstruction had more female dominance (F:M = 32 cases : 15 cases = 2.1 : 1). The age and sex distributions of each cause of biliary obstruction detected by ultrasound are shown in Table 2

Determinations of the sites of biliary obstructions are shown in Table 3, and detection of the causes of biliary obstructions are shown in Table 2 and 3.

Of the 47 cases of choledocholithiasis, the stone(s) caused obstruction at DCBD in 45 cases and at PCBD in 2 cases. Single CBD stone was detected in 34 cases; and 2, 3, 4, and multiple stones were found in 9, 2, 1 and 1 cases respectively. Sizes of the all detected CBD stones varied from 2 mm to 35 mm, of the most cases were about 6 - 20 mm in sizes. (Fig.2.1, 2.2 and 2.3)

The mass lesions caused obstructions at IHBD bifurcation in 2 cases (Fig.3), at CHD in 2 cases, at PCBD in 4 cases, and at DCBD in 24 cases All of the mass lesions causing biliary obstruction in this study (32 cases) were solid masses of which the nature were suggestive of malignancy; liked cholangiocarcinoma or carcinoma of CBD (Fig.4) in 12 cases, periampullary carcinoma in 9 cases (Fig.5), carcinoma of pancreatic head in 7 cases (Fig.6), enlarged pancreatic lymph nodes in 2 cases, large gastric carcinoma in 1 case, and suspected cholangiocarcinoma or carcinoma of the gall bladder

Table 3 Comparison of Ultrasound Evaluation of Sites and Causes of Biliary Obstruction with Postoperative Diagnoses in This Series.

Sites of Obstruction	Causes of Obstruction	Postoperative Diagnoses A	B	C	D	E	F	G	H	I	J	Subtotal Cases	Total Cases of each Site
Bifurcation	Mass	0	0	2	0	0	0	0	0	0	0	2	2 (2.2%)
CHD.	Mass	0	0	1	0	0	0	0	1	0	0	2	2 (2.2%)
Proximal CBD.	Stone	2	0	0	0	0	0	0	0	0	0	2	6 (6.7%)
	Mass	0	1^	3	0	0	0	0	0	0	0	4	
Distal CBD.	Stone	42	0	0	0	2	0	0	0	0	1*	45	73 (81.1%)
	Mass	0	13	7	0	0	2	1	0	1	0	24	
	Pancreatitis	0	0	0	3	0	0	0	0	0	0	3	
	Not seen	1!	0	0	0	0	0	0	0	0	0	1	
No obstruc.	No Cause	1#	0	0	0	0	0	0	0	0	6	7	7 (7.8%)
Total cases of each		**46**	**14**	**13**	**3**	**2**	**2**	**1**	**1**	**1**	**7**	**90**	**(cases)**
postoperative Diagnosis		**51**	**16**	**14**	**3.3**	**2.2**	**2.2**	**1.1**	**1.1**	**1.1**	**7.8**	**100**	**(%)**

A = Stone, B = Carcinoma of pancreatic head, C = Cholangiocarcinoma, D = Pancreatitis, E = CBD. Stone with pancreatitis, F = Lymphoma (1) and lymph nodes metatasis from gastric carcinoma (1), G = Carcinoma of Ampulla of Vater, H = Carcinoma of gall bladder invading portal region and CHD., I = large gastric carcinoma at greater curvature of gastric antrum extending to the region of head of pancreas, J = no obstruction.

1^ = Carcinoma of pancreatic head invading distal CBD. and extending up to the proximal CBD.

1* = False positive in site and cause = Ultrasound diagnosis was suggestive of distal CBD. obstruction caused by the distal CBD. stone, but no distal CBD. Stone was detected by operation.

1! = True positive in site but false negative in cause = ultrasound diagnosis was suggestive of distal CBD. obstruction, but its cause could not be seen due to the excessive overlapping bowel gas; and distal CBD. stone causing distal CBD. obstruction was proven by the operation.

1# = False negative in site and cause = Ultrasound diagnosis was suggestive of mild dilatation of CBD. (=10.5 mms.) without visualized cause and probable no obstruction, but sludge liked sand stones impacted in distal CBD. was reported in the operative note.

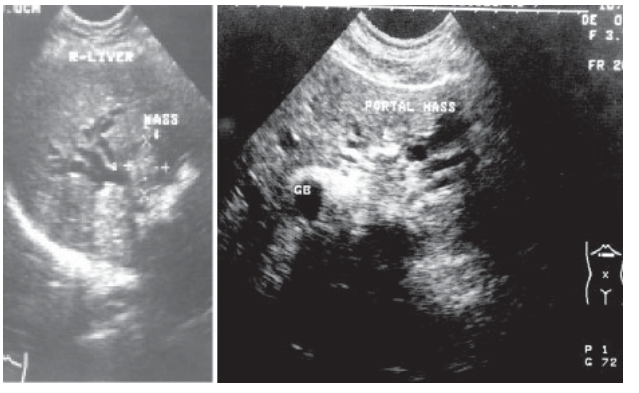

Figure 3 Dilatation of R and L IHBD, with Portal Mass : Cholangiocarcinoma.

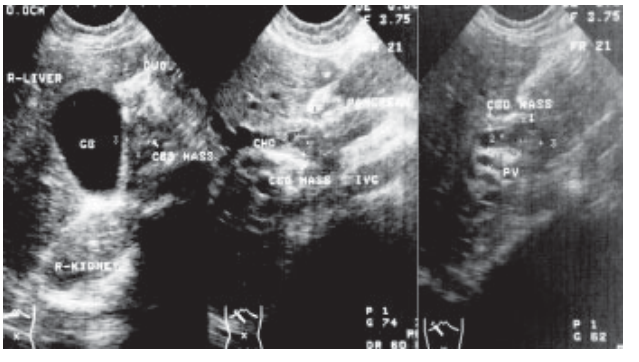

Figure 4 Intraluminal mass in CBD : Cholangiocarcinoma or carcinoma of CBD

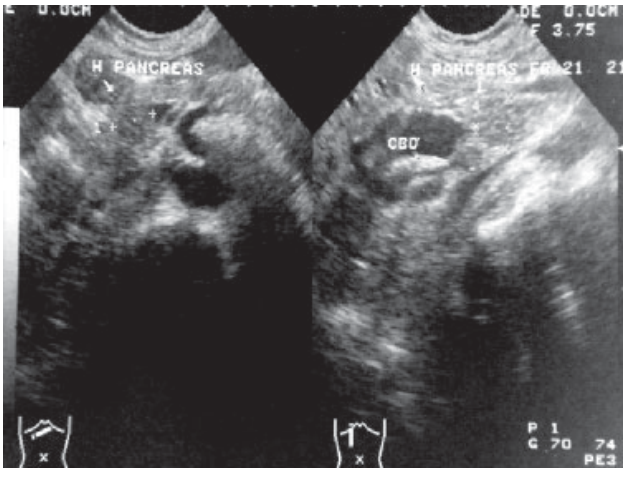

Figure 5 Rat tail liked DCBD : Periampullary carcinoma.

which locally invading to each other in 1 case. Evidence of the accompanying liver metastasis were found in 5 cases, enlarged regional lymph nodes were visualized in 7 cases, and ascites was evident in 3 cases.

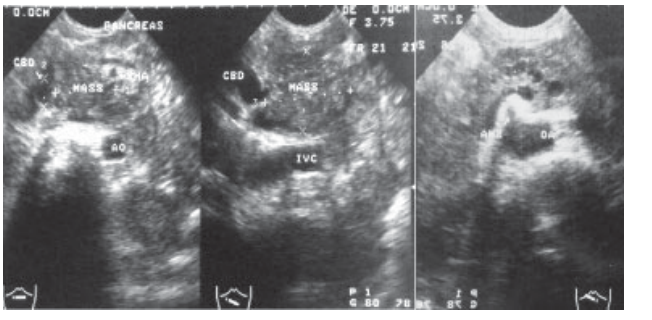

Figure 6 Carcinoma of head of pancreas, with PD dilatation.

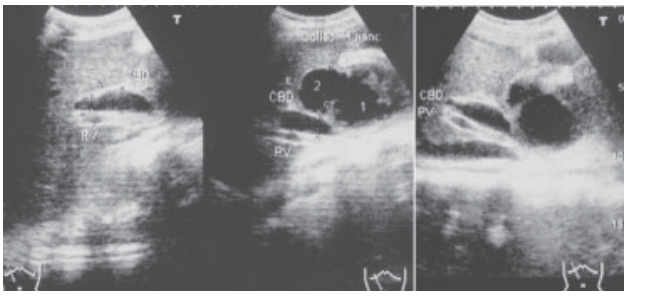

Figure 7 Pancreatitis with pseudocyst, compressing DCBD.

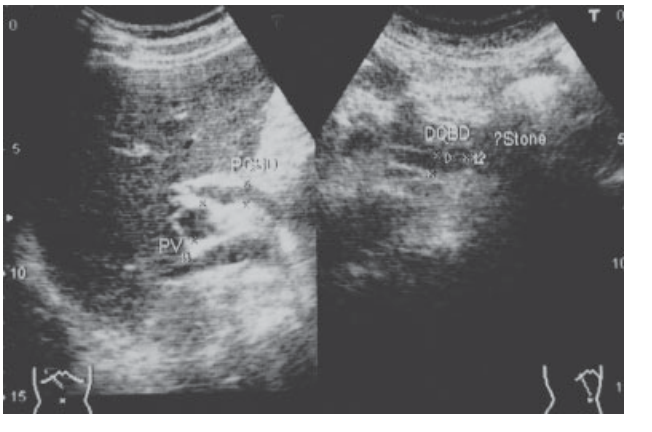

Figure 8 Suspicious tiny DCBD, stone, but no detectable stone during operation.

Dilatations of the pancreatic ducts (Fig. 6) were noted in 17 cases of the patients who had mass lesion at the pancreatic head and DCBD. There were 3 cases of DCBD obstruction due to pancreatitis, one of whom had evidence of multiple loculated fluid collections and then delveloped pseudocyst of the pancreas (Fig. 7).

The postoperative diagnoses of the causes of

biliary obstructions are shown in Table 3 which also demonstrates the comparison of ultrasound evaluation of the site and cause of biliary obstruction with the postoperative diagnoses. Ultrasound diagnoses of the site and cause of biliary obstruction are true positive in 82 and 81 cases, and false negative in 1 and 2 cases, respectively; ultrasound diagnoses of both site and cause are true negative in 6 cases and false positive in 1 case (Fig. 8).

Ability of ultrasound evaluation of the site and cause of biliary obstruction is shown in Table 4. The accuracy rates of ultrasound evaluation of site and cause of biliary obstruction are 97.8 percent and 96.7 percent respectively, in comparison with the postoperative diagnoses.

Discussion

There were difference in the approach to the management of each cause of the obstruction, particularly between the benign causes, as choledocholithiasis (bile duct stone), and the malignant lesion ; differences are still noted in the approach to the management of malignancy between the resectable and the unresectable mass lesion[19]. Correct choices among therapeutic options usually rest upon a precise assessment of site, cause, and extent of diseases[8]. It is therefore, necessary for the radiologist to do more than simply discriminate between obstructive and nonobstructive biliary tract disease; such as using the ultrasound to gain information of the site and the cause of biliary obstruction, of the extent and operability of the tumor, to assess the presence of both ascites and metastatic foci in the liver thus aiding in the staging of neoplastic disease, and can accurately guide further therapeutic maneuvers[3,7,9,11,13,14].

Technique

The success of the ultrasonography besides depending on the quality of the apparatus, it also depends greatly on the expertise of the working radiologist both in the technical performance and in the interpretation of this procedure[11,12]. Ultrasound evaluation of the site and cause of the biliary obstruction need the ability to visualize the biliary tract in its entirety[8], besides knowledge of the anatomic course of biliary tract, the radiologist must have skills for imaging the biliary tract, particularly the entirety of CBD by manipulating the transducer in the proper angulation or obliquity of the scanning planes which may be different in each patient depended upon individual anatomic variation[18]. So multiple planes of scanning must be performed to image the entirety of biliary tract, as prior described in the methodology.

In the difficult cases as the obese patients and/or the patients who had much bowel gas overlying the region of distal CBD and pancreatic head, also the patient who had distal CBD obstruction caused by the impaction of small distal CBD stone or by the small mass lesion at the region of pancreatic head or distal end of CBD; an effort to identify the cause of distal CBD obstruction was time consuming. The rescanning after drinking of about 500 ml of water[20], and using the technique as changing the patient's positions from supine to right anterior oblique (RAO) position[21], to L lateral decubitus position, to erect position, and occasionally to trendelenburg position were attempted. The RAO and the trendelenburg positions of the patients could possibly allow the nonimpacted DCBD stone to migrate cephalically into the ultrasonographically visible portion of CBD[18].

The additional technique which frequently used in this study and could enhance visualization of the DCBD was the rapid rotation of the patient's position from left anterior oblique (LAO) to RAO position immediately when the visualized duodenal C loop was filled by the fluid content or the ingested water.

Anatomical relationships

The main biliary trunks from the right and left lobes of the liver unite to form the CHD at the porta hepatis which means bifurcation of IHBD in this study, the CHD then course caudadly for a distance of approximately 4 cm, where it is joined by the cystic duct, and become the CBD of which surgical anatomy is

divided into 4 portions :- the supraduodenal, retroduodenal, pancreatic, and intraduodenal or intravaterian[22]. However, the EHBD cannot be exactly seperated ultrasonographically into its anatomical subdivisions[23]. In this study, the site of biliary obstruction was attempted to identify in all cases, and localized into 4 subdivisions as bifurcation of IHBD, CHD, PCBD, and DCBD. The PCBD, is the supra-pancreatic portion of CBD, corresponding with the supraduodenal including retroduodenal surgical divisions. In addition, the DCBD represents the intrapancreatic to the ampullary or intraduodenal surgical divisions of CBD, which are hardly visualized by the ultrasound particularly in the patients who were obese and/or had excessive overlying bowel gas.

Criteria of biliary obstruction

The criteria in determination of the biliary obstruction was ultrasound demonstration of dilated bile ducts. Dilatation of IHBD can occur in both IHBD and EHBD obstruction, while dilatation of EHBD with or without IHBD dilatation indicates EHBD obstruction[1,2,12,17,21].

The advent of realtime ultrasound scanners, segments of the normal biliary tree can now be seen regularly in the length not more than 2 cm from the bifurcation of the right and left IHBD or not peripheral to the third order IHBD and their diameters were narrower than the portal vein or portal division[15,16]. Many reports have described the findings of IHBD dilatation as the "parallel channel" sign[24], "double tracking" or "multiple tubes" in the liver[8], "shotgun" sign[16], "double barrel" sign[25], or visible seperation of walls of the peripheral third order IHBD.[15] Many authors used numerical criteria of both IHBD and EHBD dilatation as shown in Table 1 which indicates a lack of agreements on what measurement constitute bile duct dilatation. This study used criteria of biliary obstruction as visible seperation of the walls of the peripheral third order IHBD (about 2 cm from the bifurcation) and/or measured more than 4 mm in diameter, and the CHD diameter measured more than 5 mm. Dilatation of EHBD in this study was determined by the PCBD and/or the widest point of EHBD measured more than 8 mm in diameter, like the previous published series (No. 9, 10 in Table 1) of Laing, et al[20] and Edwin, et al[17], which proved that if the EHBD sonographically measured less than 8 mm and peripheral IHBD was 4 mm or less, then bile duct obstruction was absent ($p < 0.001$).

Determinations of the site and cause of biliary obstruction

In determination of the site of biliary obstruction one must see the point that the dilated bile duct merged into the normal sized or narrow bile duct or terminated at the special point that the lumen of the bile duct was obliterated by the cause of the obstruction as the impacted CBD stone , the mass lesion which fully filled in the lumen or extrinsicly compressed the bile duct, the swelling of the pancreatic head or the stricture of the bile duct[19].

The ultrasound diagnosis of the cause of biliary obstruction was made when the obstructing lesion could be identified. Choledocholithiasis (bile duct stone) was diagnosed when an echogenic focus in the lumen of the bile duct was demonstrated accompanying acoustic shadowing[8]. All of the mass lesions which caused biliary obstruction in this series were suggestive of malignancy because all of them were solid masses, had ill defined and irregular borders, and some had local invasion to adjacent organs, regional lymph node enlargement, evidence of liver metastasis, and a few had ascites. The origins of these malignant masses were suggested belonging to their site and extension.

Biliary obstruction caused by the pancreatitis could be due to coexistent CBD stone[25,26,27] and inflamed enlarged pancreas involving the CBD adjacent to or embedded in the head of pancreas[28,29] compression by the pseudocyst of the pancreas or periductal fibrosis progressed from the periductal inflammatory reaction[30,31,32,33].

No visualized obstructing cause was detected in

6 cases, although the entirety of the CBD was traced, so the ultrasound diagnoses were suggestive of mild dilatation of CBD without biliary obstruction and the subsequent operations proved that no evidence of obstruction were noted, then these cases were determined as true negative cases. Patients who had no biliary obstruction but had mild dilatation of biliary ducts as the CBD measured = 7 - 11 mm were also proved in the previous reports[17,34,35], some of them were presumed that the cause may be the passed CBD stone and/or old age. Additional technique, as eating the fatty meal, was reported and could significantly improve diagnoses in these cases[36]. In the patient who had biliary obstruction, increasing of bile duct diameter was demonstrated after a fatty meal. But in the other hand, the patient who had no biliary obstruction but had dilatation of bile duct, the bile duct diameter returned to normal after eating a fatty meal.

Ability of ultrasound evaluation of the site and cause of biliary obstruction

The sensitivity and specificity in determining the site of biliary obstruction reported by various authors have widely varying results (27-94%)[8,9,13,37]. Similar variability in determining the cause of biliary obstruction, ranging from 23 percent to 81 percent[8,13], has been reported in the literatures. Collections of accuracy rates of ultrasound evaluation of the site and cause of biliary obstruction in previous published series, which are also widely varied, are shown in Table 5 and Table 6, respectively. The sensitivity, specificity, and accuracy of the ultrasound evaluation of the site and cause of biliary obstruction in comparison with postoperative diagnoses in this series which are shown in Table 4, are relatively high, in comparison with the previous published series. This can be because of the effort to identify the obstructing sites and causes in all of the patients. The determination of the result of the comparison between the ultrasound diagnosis and the postoperative diagnosis in each case, particularly of the patient who had mass lesion as the cause of biliary obstruction, was concluded only as the accurate information of gross anatomy of the obstructing site and cause, which were sufficient in decision of surgical management. The conclusions were not strictly compared with the histological diagnosis in some patients, as the cases of periampullary carcinoma and the case of portal mass lesion which involved both gall bladder and CHD, because the ultrasonographic distinctions of them are often difficult[1,9,38].

In this series, all of the cases whose biliary obstructions caused by the mass lesions and the pancreatitis, the ultrasonographic diagnoses were correct. Only the cases whose DCBD obstructions correlated with stones were misinterpreted of the site in 2 cases and of the cause in 3 cases, of which one case had false positive ultrasonographic diagnosis of DCBD stone, this may be resulted from the artifact caused by the adjacent bowel gas or may be due to recent passage of the stone in the period between the ultrasound examination and the subsequent operation or dislodg-

Table 4 Ability of Ultrasound in Evaluation of Sites and Causes of Biliary Obstruction in This Series.

Ultrasound evaluation of	Sensitivity *		Specificity **		Accuracy ***	
	Number	%	Number	%	Number	%
Site of Obstruction	82 / 83	98.8	6 / 7	85.7	88 / 90	97.8
Cause of Obstruction	81 / 83	97.6	6 / 7	85.7	87 / 90	96.7

Sensitivity * = True positive cases / (True positive cases + False negative cases)
Specificity ** = True negative cases / (True negative cases + False positive cases)
Accuracy *** = (True positive cases + True negative cases) / Total studied cases

Table 5 Accuracy of Ultrasound Evaluation of Sites of Biliary Obstruction in the Previous Published Series

	Series	Hospitals	Number*	Accuracy rate
1	Taylor, et al.[2]	Yale University School of Medicine, New Haven	82 / 150	55 %
2	Sample, et al.[4]	University of California, School of Medicine	54 / 66	82 %
3	Honickman, et al.[8]	Harvard Medical school, Boston	17 / 20	85 %
4	Malini, et al.[37]	Texas Medical Center, Houston	19 / 23	85 %
5	Goldberg, et al.[12]	University of California School of Medicine, San F.	21 / 23	91 %
6	Koenigsberg, et al.[13]	Albert Einstein College of Medicine, New York	30 / 32	94 %
7	Dwivedi, et al.[9]	All India Institute of Medical Sciences, New Delhi	42 / 44	96 %

*** = Numbers of patients with correct ultrasound diagnoses of sites of biliary obstruction / total number of patients with proven diagnoses of biliary obstruction.**

Table 6 Accuracy of Ultrasound Evaluation of Causes of Biliary Obstruction in the Previous Published Series

	Series	Hospitals	Number*	Accuracy rate
1	Lapis, et al.[5]	University of North Carolina, School of Medicine	- / 47	< 30 %
2	Zeman, et al.[40]	Yale University School of Medicine, New Haven	5 / 12	41 %
3	Vallon, et al.[14]	Middlesex Hospital, London	27 / 52	51 %
4	Taylor, et al.[2]	Yale University School of Medicine, New Haven	82 / 150	55 %
5	Laing, et al.[20]	San Francisco General Hospital, California	25 / 53	55 %
6	Neiman, et al.[3]	Northwestern University, Chicago	11 / 15	73 %
7	Koenigsberg, et al.[13]	Albert Einstein College of Medicine, New York	26 / 32	81 %
8	Sample, et al.[4]	University of California, School of Medicine	54 / 66	82 %
9	Goldstein, et al.[11]	UCLA School of Medicine, Los Angeles, California	18 / 20	90 %
10	Weinstein, et al.[25]	Allegheny General Hospital, Pittsburgh, Pennsylvania	11 / 12	92 %
11	Behan and Kasam[21]	New York Hospital, New York	51 / 55	93 %
12	Honickman, et al.[8]	Harvard Medical school, Boston	14 / 15	93 %
13	Dwivedi, et al.[9]	All India Institute of Medical Sciences, New Delhi	40 / 42	95 %
14	Malini, et al.[37]	Texas Medical Center, Houston	23 / 23	100 %

*** = Numbers of patients with correct ultrasound diagnoses of causes of biliary obstruction / total number of patients with proven diagnoses of biliary obstruction.**

ing of the stone intraoperatively[8]. And the other two cases of the DCBD stones proven by the operations were misdiagnosed by ultrasound evaluation, this failure of visualization of the DCBD stones could be due to the excessive bowel gas overlapping on the DCBD[18] because of bowel ileus from the accompanying cholecystitis.

Conclusion

This study revealed high accuracy rate of ultrasound evaluation of the sites and the causes of biliary obstructions in Chaoprayayomraj hospital, Suphan Buri province and can support that the ultrasound, besides the investigation of choice in evaluation of biliary obstruction, can be extended to gain the highly

accurate and sufficient information which can guide surgeons to choice of correct therapeutic option and to plan the operative procedure. So cholangiography and CT should probably be used only when satisfactory ultrasound examination cannot be obtained in order to avoid the risk of the potentially hazardous complications from the procedure, contrast media administration and radiation, also to reduce the high cost of the both of patient and hospital.

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บทคัดย่อ **การตรวจอัลตร้าซาวด์ในผู้ป่วยที่มีการอุดตันของระบบทางเดินน้ำด ที่โรงพยาบาลเจ้าพระยายมราช สุพรรณบุรี**

จงดี แจ้งศรีสุข

กลุ่มงานรังสีวิทยา โรงพยาบาลเจ้าพระยายมราช สุพรรณบุรี

วารสารวิชาการสาธารณสุข **2551; 17:SIII593-604.**

การศึกษาวิจัยประยุกต์แบบไปข้างหน้านี้ เพื่อดูความสามารถของการตรวจอัลตร้าซาวด์หาตำแหน่งของการอุดตันของระบบทางเดินน้ำดี และวินิจฉัยโรคที่เป็นสาเหตุของการอุดตัน โดยประเมินความแม่นยำเปรียบเทียบกับการวินิจฉัยหลังผ่าตัด ผลการติดตามและทบทวนปรากฏว่าผู้ป่วยที่นำมาศึกษาได้ มีจำนวน 90 ราย และพบว่า sensitivity, specificity และ accuracy ในการตรวจหาตำแหน่งของการอุดตัน ร้อยละ 98.8, 85.7 และ 97.3 และในการวินิจฉัยสาเหตุของการอุดตัน ร้อยละ 97.6, 85.7 และ 96.7 ตามลำดับ ซึ่งจัดว่าอยู่ในเกณฑ์ที่สูง เมื่อเปรียบเทียบกับรายงานการศึกษาอื่น แสดงว่า การตรวจคัดกรองในการวินิจฉัยแยกโรคของระบบทางเดินน้ำดีที่เกิดจากการอุดตัน กับที่ไม่ได้เกิดจากการอุดตัน ด้วยการตรวจอัลตร้าซาวด์ในโรงพยาบาลเจ้าพระยายมราช สามารถให้ข้อมูลที่ใช้ในการวางแผนการรักษาต่อไปรวมทั้งการประเมินผู้ป่วยก่อนผ่าตัดได้อย่างเพียงพอและมีความแม่นยำสูง ช่วยลดการส่งผู้ป่วยทำการตรวจระบบทางเดินน้ำดีโดยการฉีดสารทึบรังสีเข้าท่อน้ำดี ซึ่งต้องแทงเข็มผ่านตับ (PCT) หรือต้องส่องกล้องผ่านทางลำไส้เล็ก(ERCP) และ/หรือทำการตรวจด้วยเครื่องเอ็กซเรย์คอมพิวเตอร์ได้ ทั้งนี้เพื่อหลีกเลี่ยงความเสี่ยงในการเกิดภาวะแทรกซ้อนที่อาจมีอันตรายอย่างรุนแรง จากวิธีการตรวจเหล่านั้น จากการแพ้สารทึบรังสี และอันตรายจากรังสี รวมทั้งเพื่อช่วยลดค่าใช่จ่ายที่ไม่จำเป็น และลดความลำบากยุ่งยากในการส่งต่อผู้ป่วยด้วย ยกเว้นอาจจะส่งตรวจด้วยวิธีเหล่านั้นเฉพาะผู้ป่วยบางรายที่การตรวจอัลตร้าซาวด์ไม่สามารถให้ข้อมูลที่เพียงพอได้เท่านั้น ในรายงานนี้ยังได้สรุปเทคนิคในการตรวจอัลตร้าซาวด์ หลักเกณฑ์ในการตัดสินว่ามีการอุดตันของระบบทางเดินน้ำดี การตรวจหาตำแหน่งของการอุดตัน และการวินิจฉัยโรคที่เป็นสาเหตุของการอุดตันในเชิงปฏิบัติจากการวิจัยครั้งนี้ และเปรียบเทียบกับรายงานอื่นๆ

คำสำคัญ: **การตรวจอัลตร้าซาวด์, การอุดตันของระบบทางเดินนำดี**