Case Report

Comprehensive evaluation of MRCP versus ultra sonography in biliary obstruction

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Abstract

Background: Biliary disorders are one of the common problems routinely seen in clinical practice. Ultrasound (USG) is an initial investigation and Magnetic resonance cholangiopancreatography (MRCP) is a relatively new technique, which has gained popularity because of its excellent diagnostic capabilities in the evaluation of biliary obstruction. **Aims:** The aim of our study was to know the cause and grade of obstruction in case of clinically suspected biliary obstruction and to evaluate and correlate the accuracy between MRCP and Ultra sonography. **Material and Methods:** This prospective cross sectional comparative study was conducted in the department of Radiology, Government medical college and Rajindra hospital, Patiala. 50 patients with suspected biliary obstruction with clinical and laboratory features suggestive of obstructive jaundice who were referred for USG, followed by MRCP were studied. **Results:** Most common disorder observed was choledocholithiasis 16 (32%), followed by carcinoma gall bladder with 7 (14%) cases, periampullary carcinoma with 6 (12%) cases, cholangiocarcinoma and benign stricture with 5 (10%) cases each, carcinoma head of pancreas with 4 (8%) cases, postoperative stricture with 3 (6%) cases and choledochal cyst and cholangitis with 2 (4%) cases each. The overall sensitivity, specificity, positive predictive value and diagnostic accuracy of MRCP in diagnosing biliary obstructive disease was 98%, 100%, 100% and 100%respectively as compared to 60%, 100%, 100%and 97% of USG. **Conclusion:** Ultrasound is considered the primary screening investigation modality of choice However, owing to its low sensitivity in most of the benign stenosis and distal common bile duct disease, where the clinical and laboratory suspicion is strong, MRCP is highly accurate, non-invasive, sensitive, non-ionizing and superior diagnostic modality in establishing diagnosis of obstructive biliary pathologies.

Key words: Biliary obstruction, Ultrasound, Magnetic resonance cholangiopancreatography.

Introduction

Obstructive jaundice is a common clinical problem. In a suspected case of biliary obstruction with clinical and laboratory findings suggestive of obstructive jaundice, the main aim of radiologist is to confirm the presence of obstruction, its location, extent, probable cause and it should also attempt to obtain a map of the biliary tree that will help the surgeon or the interventionist to determine the best approach to each individual case. Suspected biliary tract disease is diagnosed by a variety of imaging modalities including Ultrasonography (USG), Computed tomography (CT) and Magnetic resonance cholangiopancreatography (MRCP). There are advantages and disadvantages that are unique to the specific technology. Currently the non-invasive diagnosis of bile duct obstruction mainly relies on USG and CT.

Ultrasonography is being used as the initial screening procedure due to its many advantages like its ready availability, cost effectiveness and no requirement of contrast material and lack of ionizing radiation. Its major limitation in the visualization of distal common bile duct and pancreas, due to obscuration by overlying bowel gas in 30-50 % of cases and obesity can degrade the image quality[1,2]. Biliary strictures are not directly visualized on CT. IV cholangiography has its own limitations as in 30-40 % of the cases there is incomplete opacification of the biliary passage and increased contrast reaction [3,4]. For these reasons

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cholangiographic modalities like PTC and ERCP are required. However, ERCP is a very operator dependent and invasive procedure and it is associated with 1-7% related morbidity and 0.2%-1% mortality [5].PTC has the same diagnostic and therapeutic role as ERCP but is more invasive and risky. Incidence of sepsis is around 1-4%[6].

In view of limitation of US and CT and invasiveness of PTC, IVC and ERCP there is need for an imaging modality which is non-invasive and provides high resolution projection images of the biliary and pancreatic duct.

Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive, non-ionizing imaging modality and is unaffected by bowel gas shadow as in ultrasound and provides good visualization of the hepato- biliary system [7].

With the development of higher magnetic field strength and newer pulse sequences, MRCP with its inherent high contrastresolution, complete mapping of the ductal system, non-invasiveness, non-requirement of contrast media , rapidity, multi planar capability and virtually artifact free display of anatomy and pathology in biliary obstruction patients is proving to be examination of choice in patients with biliary diseases[8]. Several recent studies have demonstrated that MRCP is able to accurately identify common bile duct stones with sensitivity of 81-100 %.MRCP lacks the major complication rate of approximately 3% associated with ERCP such as sepsis, bleeding, bile leak and death [9].

The diagnostic accuracy of MRCP suggests that, it has the potential to replace the more invasive procedures like diagnostic ERCP, which should be used only in cases where intervention is being contemplated.

Materials and Methods

Place of study: The study was conducted in the Department of Radio diagnosis, Government Medical College, Patiala.
Type of study: Hospital based cross sectional comparative study**.**

Sample size: The sample size was estimated to 50 patients, which was calculated by taking in to account 80% of the average of suspected biliary obstruction cases from june,2015- june2017, hospitalized in Government medical college and Rajindra hospital, Patiala.

Sampling methods: 50 cases of suspected biliary obstruction with clinical and laboratory features suggestive of obstructive jaundice who were referred for USG and MRCP to Department of Radiology, Government medical college and Rajindra Hospital, Patiala had been enrolled in the study following the inclusion and exclusion criteria. The age and sex of the patient were no criterion for selection of cases.

Sample collection: During the study period, informed written consent was obtained from the study subjects who were willing to participate in the study on voluntary basis. A complete clinical history of study subjects followed by general physical examination and detailed abdominal examination with examination of other systems along with routine investigations were done. Initially USG was done followed by MRCP.

Inclusion criteria: Patients with suspected biliary obstruction with clinical and laboratory features suggestive of obstructive jaundice who were referred for USG and MRCP to Department of Radiology, Government medical college and Rajindra hospital, Patiala.

Exclusion criteria: Patients having cardiac pacemakers and electromagnetic implants

Statistical methods: The data collected was tabulated and statistically analyzed. Data analysis was done using rates, ratios and percentages. Statistical methods included Chi square test, Fischer Exact test, sensitivity, specificity, positive and diagnostic accuracy.

Study equipment

1. Ultrasound machine (Philips Envisor)
2. MRCP by 1.5 Tesla Siemens MRI machine

USG was performed with Philips Envisor machine. An appropriate transducer frequency ranging from 2.5 to 5 MHz had been used, depending on the body habitus. Both curvilinear and linear probes were used in the study. Sagittal, transverse and sub costal oblique views were taken and images of the biliary tree were recorded for later review.

Protocol for MRCP:T2 BLADE FAT SAT TRANS, T2 HASTE TRANSVERSE,T2 TRUFI CORONAL,T2 HASTE CORONAL,T2 SPACE CORONAL,T1 AXIAL,3D MRCP, Coronal T2 and Axial T2 Thin slices (whenever indicated).

MRCP was performed by 1.5 Tesla Siemens MRI machine with heavily T2-weighted sequences by using fast spin echo or single shot fast spin echo software and both a thick-collimation (single-section) and thin collimation (multi section) technique with a torso phased array coil. Imaging time was usually 4-6 minutes. Single-shot fast spin-echo is a newer and more rapid MRCP sequence that was performed in a single breath hold, thereby significantly reducing motion artifacts and increasing image quality. However, there was also a decrease in signal, albeit not as great as the decrease in noise. We preferred to have the patient fasting for 3 hours before the study because, in our experience, small amounts of fluid was always present in the duodenum, thus providing a landmark for the ampulla and reducing fluid signal from the stomach.

MRCP and USG scans were analyzed separately in a blinded fashion without knowledge of the results of other examinations, or of clinical findings. Final diagnosis was established with per operative or histopathological correlation.

Results

This prospective study was done in the Department of Radio diagnosis, Rajindra Hospital Patiala. Maximum number of cases, 14 (28%) were in age group of 51-60 years, followed by 13 (26%) in age group 41-50 years, 8 (16%) in age group 31- 40 years, 7 (14%) in age group >60 years, 6 (12%) in age group 21-30 years and 1 (2%)each in age group 0-10 and 11-20 years. Youngest patient in present study was 8 years old and oldest was 67 years old. Majority of patients were females 27 (54%) and 23 (46%) were males. Male to female ratio being 1:1.7. Out of 50 cases of biliary obstruction, 96% cases presented with jaundice, 90% cases presented with pain abdomen, 58% with vomiting, 50% with anorexia, 39% with weight loss, 32% with pruritus and 30% with fever.

Table-1: Distribution of cases according to final diagnosis and their comparative evaluation of USG and MRCP

Cause of Obstruction	Final diagnosis (histopathology/ intraop)	USG	MRCP	$\chi 2$	p-value
Choledocholithiasis	16 (32%)	10 (63%)	16 (100%)	7.385	0.006*
Carcinoma gallbladder	7 (14%)	6 (86%)	7 (100%)	1.077	0.299NS
Periampullary carcinoma	6 (12%)	3 (50%)	5 (83%)	1.500	0.220NS
Cholangiocarcinoma	5 (10%)	3 (60%)	5 (100%)	2.500	0.113NS
Benign stricture	5 (10%)	1 (20%)	5 (100%)	6.667	0.009*
Carcinoma head of pancreas	4 (8%)	3 (75%)	4 (100%)	1.143	0.285NS
Post-operative stricture	3 (6%)	1 (33%)	3 (100%)	3.000	0.083NS
Choledochal cyst	2 (4%)	2 (100%)	2 (100%)	0.000	1.000NS
Cholangitis	2 (4%)	1 (50%)	2 (100%)	1.333	0.248NS
Total	50 (100%)	30	49	21.760	0.000*

* Significant, NS - Not significant

Table-2: Location of calculi in 16 cases of choledocholithiasis

Location		USG (n=16)	MRCP (n=16)	X2	p-value
No. of cases diagnosed correctly		10 (63%)	16 (100%)	7.385	0.006*
Right hepatic duct		0	1 (6%)	1.032	0.309NS
Left hepatic duct		0	0	-	-
Common hepatic duct		2 (13%)	2 (13%)	0.000	1.000NS
Common bile duct (n=13)	Proximal	6 (38%)	6 (38%)	0.000	1.000NS
	Middle	2 (12%)	2 (12%)	0.000	1.000NS
	Distal	0	5 (31%)	5.926	0.014*
Sensitivity		63%	100%		
Specificity		100%	100%		

Out of 50 cases of biliary obstruction, choledocholithiasis was the most common cause with 16 (32%) cases followed by carcinoma gall bladder with 7 (14%) cases, periampullary carcinoma with 6 (12%) cases, cholangiocarcinoma and benign strictures with 5 (10%) cases each, carcinoma head of pancreas with 4 (8%) cases, post-operative stricture with 3 (6%)

cases, choledochal cyst and cholangitis with 2 (4%) cases each. P value was statistically significant in detecting choledocholithiasis & benign stricture.

CBD was the most common site of choledocholithiasis comprising of 13 cases (81%). 2 cases (13%) were present in the common hepatic duct and one (6%) in right hepatic duct. Out of 13 cases (81%) with stones in CBD, in 5 cases (31%) calculi were present in the distal CBD which was obscured by overlying bowel gases therefore could not be diagnosed on USG and one case (6%) with calculi in right hepatic duct was also not visualized on USG. In cases of choledocholithiasis, p value was 0.006 which was statistically significant in our study. Also, for diagnosing distal CBD stones, p value was 0.014 which was statistically significant in our study.

Table-3: Distribution of cases on the basis of level of dilatation of biliary tree

Level	USG (n=50)	MRCP (n=50)	X2	p-value
IHBR	45 (90%)	50 (100%)	5.263	0.021*
Common hepatic duct	45 (90%)	50 (100%)	5.263	0.021*
Proximal CBD	45 (90%)	50 (100%)	5.263	0.021*
Distal CBD	25 (50%)	43 (86%)	14.890	0.0001*

IHBR dilatation was noted in 45 cases (90%) on USG and 100% cases on MRCP. Common hepatic duct dilatation and proximal CBD dilatation was seen in 45 cases (90%) each on USG and 100% each on MRCP. Distal CBD dilatation was seen in 25 cases (50%) on USG and 43 cases (86%) on MRCP. For detection of dilatation at different levels, p value was statistically significant.

Table-4: Diagnostic performance of USG and MRCP for different causes of biliary obstruction

Cause of obstruction	Sensitivity		Specificity		Positive predictive value		Diagnostic accuracy	
	USG	MRCP	USG	MRCP	USG	MRCP	USG	MRCP
Choledocholithiasis	63%	100%	100%	100%	100%	100%	88%	100%
Carcinoma gallbladder	86%	100%	100%	100%	100%	100%	98%	100%
Periampullary carcinoma	50%	83%	100%	100%	100%	100%	94%	98%
Cholangiocarcinoma	60%	100%	100%	100%	100%	100%	96%	100%
Benign stricture	20%	100%	100%	100%	100%	100%	92%	100%
Carcinoma head of pancreas	75%	100%	100%	100%	100%	100%	98%	100%
Post-operative stricture	33%	100%	100%	100%	100%	100%	96%	100%
Choledochal cyst	100%	100%	100%	100%	100%	100%	100%	100%
Cholangitis	50%	100%	100%	100%	100%	100%	98%	100%

Sensitivity of USG was 100% in diagnosing choledochal cyst, 86% in carcinoma gall bladder, 75% in carcinoma head of pancreas, 63% in choledocholithiasis, 60% in cholangiocarcinoma, 50% each in periampullary carcinoma and cholangitis, 33% in postoperative stricture and 20% in benign stricture whereas sensitivity of MRCP was 100% in diagnosing all the cases of biliary obstruction except periampullary carcinoma in which it was 83%.

Specificity and positive predictive value of USG as well as MRCP was 100% since there were no false positive cases.

Diagnostic accuracy of USG was 100% in diagnosing choledochal cyst, 98% in carcinoma gall bladder, carcinoma head of pancreas and cholangitis, 96 % in postoperative stricture and cholangiocarcinoma, 94% in periampullary carcinoma and 92% in benign stricture and 88% in choledocholithiasis whereas diagnostic accuracy of MRCP was also 100% in diagnosing all the cases of biliary obstruction except periampullary carcinoma in which it was 98%.

Table-5: Comparison of overall diagnostic performance of USG and MRCP for benign and malignant causes of biliary obstruction

	USG (n=50)			**MRCP (n=50)**		
	Benign (n=28)	**Malignant (n=22)**	**Overall for diff.causes**	**Benign (n=28)**	**Malignant (n=22)**	**Overall for diff.causes**
No. of cases diagnosed correctly	15 (30%)	15 (30%)	30 (60%)	28 (56%)	21 (42%)	49 (98%)
Sensitivity	53%	68%	60%	100%	95%	98%
Specificity	100%	100%	100%	100%	100%	100%
Positive predictive value	100%	100%	100%	100%	100%	100%
Diagnostic accuracy	91%	96%	93%	100%	100%	100%

In 28 (56%) of benign cases, the sensitivity, specificity, positive predictive value and diagnostic accuracy of USG was 53%, 100%, 100% and 91% respectively and of MRCP was 100% each.

In 22 (44%) of malignant cases, the sensitivity, specificity, positive predictive value and diagnostic accuracy of USG was 68%, 100%,100% and 96% respectively and of MRCP was 95%, 100%, 100% and 100% respectively.

Table-6: Comparison of USG and MRCP in assessment of biliary obstructive lesions/diseases and few ancillary findings

Etiology & few other ancillary finings	**USG & MRCP diagnosis**	**USG > Informative**	**MRCP > Informative**	**USG & MRCP Indeterminate**
Choledocholithiasis	16	-	6	-
Carcinoma gallbladder	7	-	1	-
Periampullary carcinoma	6	-	1	1
Cholangiocarcinoma	5	-	2	-
Benign stricture	5	-	4	-
Carcinoma head of pancreas	4	-	1	-
Post- operative stricutres	3	-	2	-
Choledochal cyst	2	-	-	-
Cholangitis	2	-		
Renal cyst	2	-	2	-
Biliary hamartoma	2	-	1	1
Peripancreatic lymph nodes	4	-	1	-
Ascites	4	1	-	-

MRCP was more informative in 6 cases of choledocholithiasis, 4 cases of benign stricture, 2 cases each of cholangiocarcinoma and postoperative stricture, 1case each of carcinoma gall bladder, periampullary carcinoma and carcinoma head of pancreas.

MRCP gave additional findings of renal cyst in 2 cases, biliary hamartoma in 1 case and peripancreatic lymph nodes in 1 case whereas USG gave additional finding of ascites in 4 cases. USG and MRCP both were indeterminate in 1 case each of periampullary carcinoma and biliary hamartoma.

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Fig-1a: Ultrasonography abdomen showing dilated common bile duct (CBD) & intrahepatic biliary radicles and echogenic focus (cal) giving acoustic shadowing indicative of calculus.

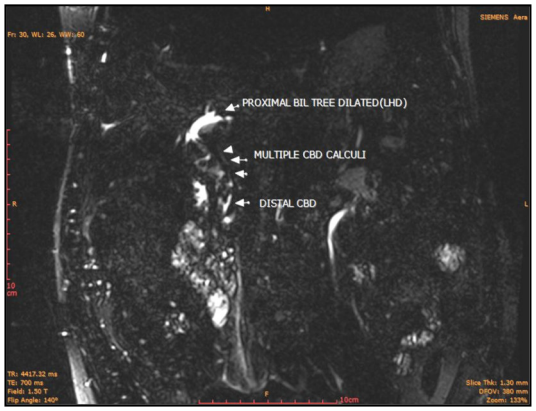

Fig 1b: MRCP T2 SPACE coronal sequence showing multiple filling defects in common bile duct indicative of multiple calculi in a case of choledocholithiasis

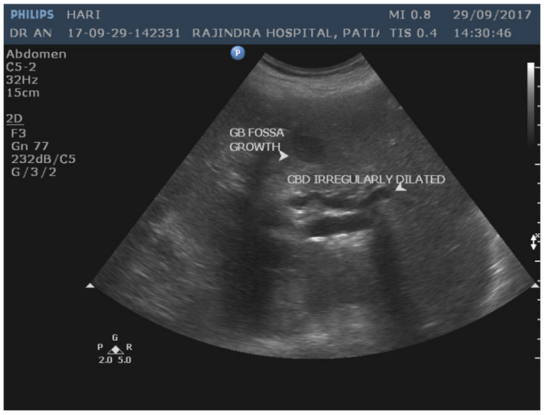

Fig 2a : Ultrasonography abdomen showing echogenic lesion in gall bladder fossa region. It is extending to involve common bile duct and causing proximal dilatation of the same.

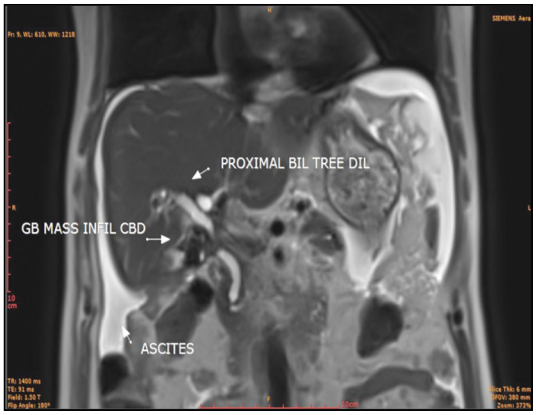

Fig 2b: MRCP T2 HASTE coronal sequence in a case of carcinoma gallbladder showing an ill defined hypointense mass in gall bladder fossa region which is infiltrating into the common bile duct.Proximaldilataion of the biliary tree also seen.

Fig 3a: Ultrasonography showing a fusiform dilatation of common bile duct.

Fig 3b: MRCP T2 SPACE coronal sequence showing fusiform dilatation of common bile duct and distal common hepatic duct in a case of Type1 choledochal cyst.

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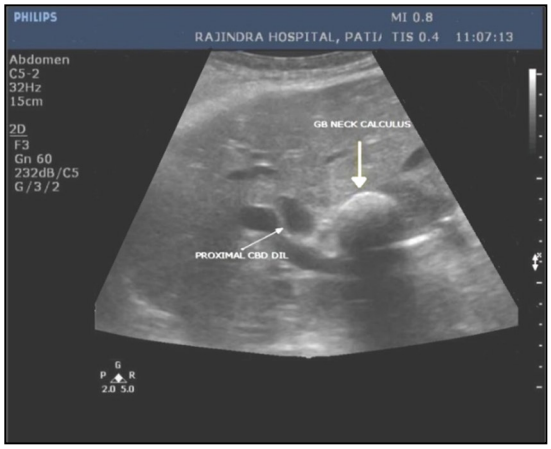

Fig 4a: Ultrasonography abdomen showing an echogenic mass with distal acoustic shadow in the cystic duct region/neck of the gall bladder. Proximal dilatation of common bile duct present.

Fig 4b: MRCP T2 SPACE coronal sequence showing calculus in the neck of gall bladder causing extrinsic compression of common bile duct in a case of Mirizzi Syndrome.

Discussion

Diagnosing patients with suspected biliary pathologies in their early stage is most important in patient care and management. Knowledge of the advantages and disadvantages of each technique are needed to determine the appropriate work up of patients with these pathologies. The purpose of the study was to evaluate and correlate the accuracy between MRCP and Ultrasonography in diagnosing suspected cases of biliary obstruction.

In the present study maximum number of patients (28%) were seen in age group of 51-60 years which was similar with the results of study by Kushwah et al[10] andUpadhyaya et al[9].Female preponderance was seen in present study (54%) which was similar with the results of studies done by Ferrari et al[11] (53%), Upadhyaya et al[9](53%), Kushwah et al[10] (60%) and Siva et al[12] (66%).

A diverse spectrum of underlying causes can be the cause of obstructive jaundice. The variations in the frequency of various etiologies had been attributed to differences in methodology, time period and duration of study, geographical area, racial and genetic differences. In the present study most common cause of biliary obstruction was choledocholithiasis (32%) which was similar to the study conducted by Siva et al[12] (32%), Upadhyaya et al[9] (31%) and Singh et al[13] (30%) whereas cholangiocarcinoma was the most common cause in studies by Kushwah et al[10] seen in 28% cases and Kurian et al[14] seen in 20% cases.The second most common cause in our study was carcinoma gall bladder (14%) which was similar to the studies conducted by Upadhyaya et al[9]seen in 19% patients and by Kushwah et al[10] (2015) seen in 20% patients whereas the second most common cause was periampullary carcinoma (10%) in a study by Singh et al[13], choledochal cyst (24%) in a study Siva et al[12] and choledocholithiasis in a study by Kurian et al[14] .

Jaundice was the most common clinical presentation which was seen in 96% cases which was similar to study by Kushwah et al[10] (92%) and Schwartz et al[15](68%).

Benign stricture was seen in 10% cases in the present study which was similar to the study by Hurter et al[16] seen in 9.6% cases whereas 6% and 4 % each cases were seen in studies by Upadhyaya et al[9] , Bhatt et al[17] and Shadan et al[18] .

In the present study, carcinoma gallbladder was the most common malignant pathology seen in 14% cases which was comparable to the study by Upadhyaya et al[9] where it was seen in 19% cases and being the least common etiology in a study by Bhatt et al[17] seen in 2% cases whereas carcinoma head of pancreas was the most common malignant etiology in a study by Schwartz et al[15] seen in 37.5% cases . Cholangiocarcinoma was seen in 10% cases comparable to 9% cases seen in a study by Upadhyaya et al[9] and 12 % cases in a study by Bhatt et al[17] and in contrast to 21.8% in a study by Schwartz et al[15]. Carcinoma head of pancreas was the least common cause seen in 8% cases comparable to 9% cases seen in Upadhyaya et al[9].

In the present study, the sensitivity of USG in diagnosing benign conditions was 53% and malignant conditions is 68% which is in contrast to studies done by Singh et al[13], Kushwah et al[10] and Kurian et al[14], which can be due to involvement of both benign and malignant cases in the present study. The sensitivity of MRCP in diagnosing benign conditions in the present study was 100% which is similar to study done by Singh et al[13] and the sensitivity in diagnosing malignant conditions is 95% which is comparable to studies by Singh et al[13] (95.83%), Kushwah et al[10] (97%) and Raguram[19] (81.25%).

In the present study, the specificity of USG in diagnosing benign conditions was 100% each which is similar to study by Kushwah et al[10] and for diagnosing malignant conditions was also 100% which is comparable to studies by Singh et al[13] (96.15%) and Kurian et al[14] (94.4%). The specificity of MRCP for diagnosing benign and malignant conditions was also 100% which is comparable to studies by Singh A et al[13] (95.83% and 100%) and Kushwah et al[10] (97% and 93.7%). The specificity in the present study was 100% because there were no false positive cases.

In the present, the diagnostic accuracy of USG was 91% in diagnosing benign conditions which is comparable to study by Kushwah et al[10] (94%) and in diagnosing malignant conditions was 96% which is comparable to studies by Kushwah et al[10] (86%) and Singh et al[13] (88%). The diagnostic accuracy of MRCP for both conditions was 100% which is comparable to studies by Singh et al[13] (2014), Kushwah et al[10] (2015) and Raguram[19].

The sensitivity of USG in diagnosing choledocholithiasis in the present study was 63% which is comparable to a study by Bhargava et al[20](25-58%). 6 false negative cases on USG were due to hindering of distal CBD evaluation by bowel gas shadow and obese body habitus. The sensitivity of MRCP was 100% which is similar to a study by Singh et al[13]. The specificity of USG and MRCP was 100% which is similar to study by Kushwah et al[10], because there were no false positive cases in the present study. The diagnostic accuracy of USG and MRCP was 88%, respectively which is comparable to a study by Kurian et al[14](80% and 100%).

The sensitivity of USG in diagnosing carcinoma gall bladder in the present study was 86% which is comparable to a study by Kushwah et al[10] (100%). The sensitivity of MRCP, specificity of USG and MRCP was 100% each which is comparable to a study by Kushwah et al[10].

The sensitivity of USG in diagnosing periampullary carcinoma in the present study was 50% because pancreatic head and peripancreatic region were poorly visualized on ultrasonography due to bowel gas shadows, which is similar to a study by Singh et al[68] (2014) (57.14%).

The sensitivity of USG in diagnosing cholangiocarcinoma in the present study was 60% which is comparable to a study by Singh et al[13](66.67%) and the specificity of USG and MRCP was 100% which is similar to a study by Singh et al[13].

The sensitivity of USG in diagnosing benign stricture in the present study was 20% and specificity is 100%. The high specificity was attributable to the capability of USG to detect true negatives in benign stenosis, thus showing the cause of the obstruction by calculi or malignant stenosis. The low sensitivity figures are to be related to intrinsic limitations of the methodology, which, though showing the indirect signs of stenosis, did not allow optimal visualization of the distal CBD and the periampullary region, which is where benign stenosis are often localized. Low sensitivity is also noted in other studies by Singh et al[13] and Al-Obaidi et al[21]. The sensitivity and diagnostic accuracy of MRCP was 100% in the present study which was similar to studies by Singh et al[13]and Kurian et al[14].

The sensitivity of USG in diagnosing carcinoma head of pancreas in the present study was 75% which is also low in a study by Kushwah et al[10] (66.6%) because of obscuration of head of pancreas by bowel gas shadows. The sensitivity and diagnostic accuracy of MRCP is 100%.

The sensitivity of USG in diagnosing postoperative stricture in the present study was 33% because out of 3, two cases were present in the distal CBD which could not be detected by USG whereas the sensitivity of MRCP was 100% which is similar to Kushwah et al[10].

The sensitivity of USG in diagnosing choledochal cyst in the present study was 50% because out of 2, only one case could be diagnosed but the sensitivity of MRCP was 100% which is similar to a study by Kurian et al[14].

The overall sensitivity of USG in the present study was 60% which was comparable to a study by Shadan et

al[18] (61.3%) and Bhargava et al[20](67%). The sensitivity of MRCP was 98% in the present study which is comparable to studies by Varghese et al[22] (97%), Romagnuolo et al[23] (97%), Shadan et al[18] (97.77%) and Kurian et al[14] (97.14%).

The overall specificity of USG and MRCP in the present study was 100% which is comparable to a study by Shadan et al[18] (83.33% and 100%).

The overall diagnostic accuracy of USG and MRCP was 93% and 100% respectively and as compared to 75% and 100% in a study by Bhargava et al[20].

Conclusion

Although USG is considered the initial screening modality in the diagnostic imaging of obstructive biliary disease, however, owing to its low sensitivity in most of the benign stenosis and distal CBD disease, MRCP is highly accurate and superior diagnostic modality in establishing diagnosis of obstructive biliary pathologies. MRCP is a non-invasive, sensitive, non-ionizing imaging modality for evaluation of biliary anatomy and pathology and provides valuable information of therapeutic and prognostic significance. MRCP is able to detect exact location and cause of biliary obstruction and can visualise the status of the biliary apparatus proximal to the complete stricture, which is not feasible on ERCP.

There is now enough evidence to suggest that based on the efficacy of MRCP, it can be considered as the gold standard for evaluation of the biliarysystem.

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