Original Article

Evaluating Role Of Ultrasound And Mrcp In Diagnosing Causative Factors Of Obstructive Jaundice

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Abstract

Though Ultrasonography and CT are noninvasive, they have their own disadvantages as well. Ultrasound is not effective in accurately diagnosing the site of obstruction in many cases. Computed Tomography has an increased risk of radiation as well as decreased sensitivity or detecting stones. Intravenous cholangiography has its own limitations as in one third to one fourth of the cases there is no complete opacification of the biliary tract and increased number of cases show contrast reaction as well. “ERCP and PTC are not simple procedures and require technical experience and contrast media. To add to the difficulties also several complications from the procedure may arise.”

“Other imaging techniques used in the diagnosis of biliary tree and pancreatic duct are Ultrasonography, Computed Tomography, IV cholangiography and Endoscopic Retrograde Cholangiopancreatography (ERCP) and Percutaneous Transhepatic Cholangiography (PTC). For patients with suspected ductal pathology there are advantages and disadvantages which are unique to the specific technology.”

Introduction

Obstructive jaundice, a common clinical problem which has been documented as one of the leading causes of increased mortality and morbidity. “Proper clinical data like history, physical examination, and laboratory tests can differentiate between extrahepatic & intrahepatic obstruction in 90% of patients, imaging modalities are essential in diagnosing the cause and site of obstruction. The main aim of any imaging procedure in obstructive jaundice is to confirm the presence of obstruction, its location, extent, probable cause, and attempt to obtain a map of the biliary tree (normal anatomy or any variants if present) that will help the surgeon or the interventionist to determine the best approach to each case individually.”

Aim and Research Objectives

To evaluate the diagnostic accuracy of Magnetic Resonance Cholangiopancreatography (MRCP) in diagnosis of the level andcause of obstruction in patients with obstructive Jaundice.

Review of Literature

Anatomy

A broad understanding of normal and radiological anatomy is essential for easy diagnosis of various pathologies affecting biliary tract leading to obstructive jaundice in turn[1].

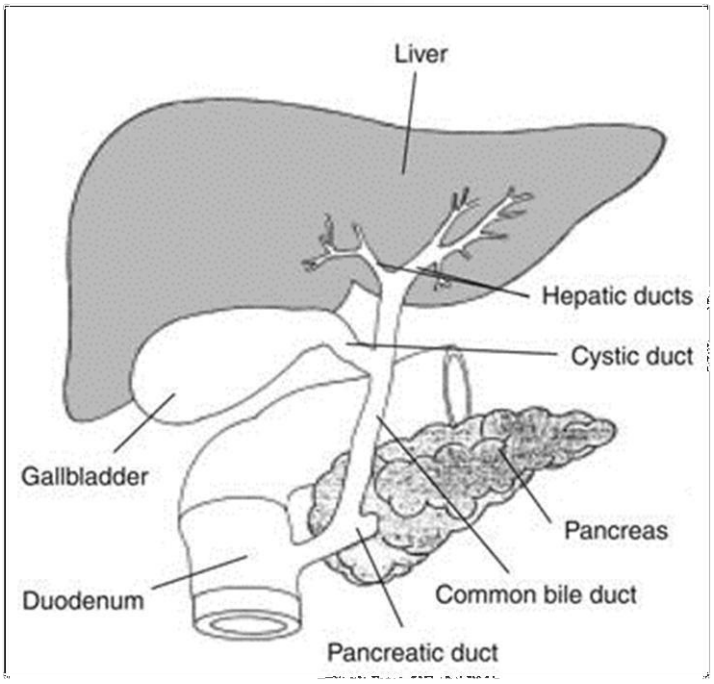

Figure 1: Normal anatomy of biliary tract.

Intra hepatic bile ducts:

They are seen throughout liver [2] and show linear water density. Towards hilum they unite to form right & hepatic ducts which have a constant location which is anterior to main portal vein bifurcation[3]. "The right hepatic duct has two main branches – posterior (dorso-caudal) drains segment VI andVII and anterior (ventro-cranial) which drains V and VIII. The left hepatic ductis formed by segmental tributaries draining segment II-IV. Bile duct draining caudate lobe joint either left or right hepatic duct. Normally the peripheral part of biliary ducts are not visualised on MR imaging."

Common hepatic duct:

At the right end of porta hepatis, the right and left hepatic duct unite to form common hepatic duct (about ± 1cm below the edge of liver). On imaging modalities it is seen as round or elliptical structure just right of portal vein. Thenormal measurement is between 3 to 6 cm in short axis diameter.

Gall Bladder:

It is a pear shaped hollow viscus, contained in fossa which is at the inferior surface of right hepatic lobe. It usually measure 7- 10 cm in length, 3-5 cm in width, wall thickness being less than 3 mm and has a capacity of 30 – 50 ml.It has four parts - fundus (part palpable in vivo), infundibulum or Hartmann's pouch (located at free edge of lesser omentum with a bulge towards cystic duct), body and neck. From upper and left wall cystic duct arises. Normal bile shows uniform bright T2W signal intensity and on T1W images bile shows variable signal intensity depending on its concentration.[1,3]

Cystic duct:

The cystic duct has serpengious course. The Cystic duct also has undulating contour due to valves of Heister. Normally it is seen as small tubular fluid containing structure between gall bladder and bile duct on T2W and MRCP. [1,3]

Common bile duct:

It is the portion between papilla and cystic duct. It is usually 7.5 cm in length and 6 cm in diameter, which increases 1mm per decade thereafter. Normally it courses through pancreatic parenchyma, in a groove in posterior aspect of pancreatic head. The distal part of this ampulla is constricted, which opens into descending duodenum on summit of major duodenal papilla. [1.3]

Pancreatic duct:

The duct is commonly arranged in either "sigmoid configuration" ("ascending – horizontal – ascending") or "pistol" configuration ("ascending – horizontal – horizontal"). "As a rule, only a small anterior part of pancreatic head is drained by accessory pancreatic duct (of Santorini) and enters duodenum at small accessory papilla. It communicates with main pancreatic duct in pancreatic head." [1,3]

Fluid gives bright signal on these sequences because of its long T2 relaxation time. Hence hepatobiliary tree including pancreatic duct will appear bright within background of low signal intensity liver and other structures.

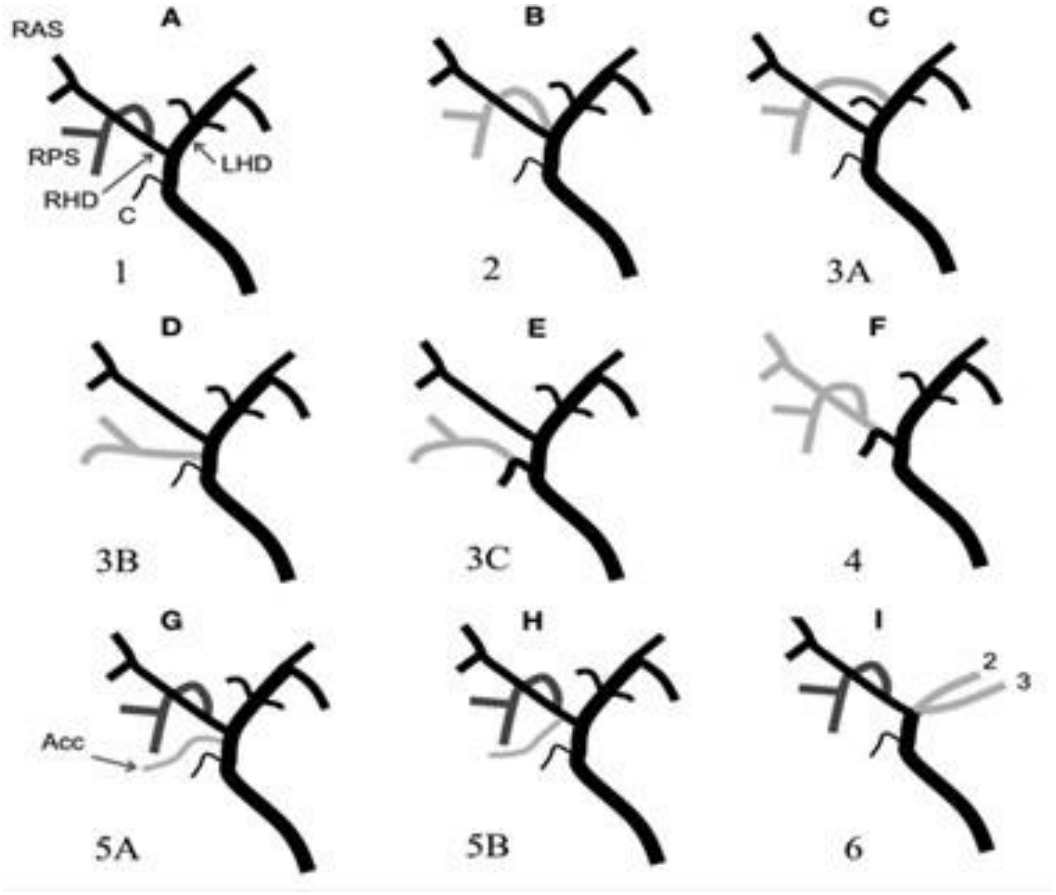

Figure 2: Schematic diagram of right hepatic duct (RHD) anatomy variants. Shows typical anatomy which is found in 58% of population, Type 1- is Conventional branching (A). Type 2 is -Triple confluence: right posterior segmental (RPS) duct (gray line) (B). Types 3 is (A, B, C) - RPS anomalous drainage into left hepatic duct (LHD), common hepatic duct (CHD) and cystic duct respectively (C, D, E). "Type 4- is Right hepaticduct (RHD) draining into cystic duct (F). Types 5 are (A, B) – Right accessory duct drains into CHD or RHD (G, H). Type 6 is:- Segments II and III draining individually into RHD or CHD(I)".

Embryology:

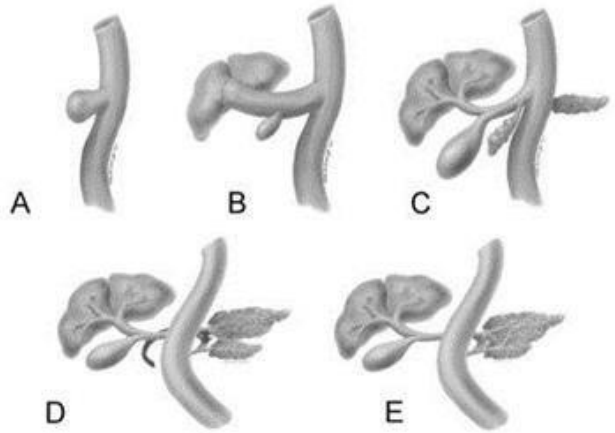

Figure 3: Schematic representation showing development of hepatic bud(arrow)from foregut and subsequent formation of hepatobiliary and pancreatic system.

Caroli's disease:

Also known as communicating cavernous ectasia of intrahepatic bile duct. It is segmental, saccular, destructive inflammation and dilatation of the intrahepatic bile ducts. Bile duct stones, ascending cholangitis, liver abscesses and renal cystic disease are often associated with it. CENTRAL DOT SIGN-Cystic areas communicating with the bile ducts are pathagnomonic of carolis disease. This sign consists of cystic dilatation of IHBDs with a small focus or 'DOT' of increased density lying within dilated duct. 'DOT' represents portal radicle which enhances on post contrast [1,3].

Cholecystolithiasis:

Most commonly seen in female in age group of 20-40 years. Three types are as follows:

a) Pigment stone – 20%
b) Cholesterol stone 80%
c) Mixed stone

On USG it seen as a hyperechoic lesion with post echoic shadow. "Sometimes these calculi may not give shadow or may be obscured by gas in abdomen. On CT calcified stones are hyperdense, cholesterol stones are hypodense, whereas stones isodense to bile are undetectable by CT."

On MR stones show hypointense signal on T1 and T2 weighted images. "The cross sectional T2 weighted images are more sensitive than T1 weighted images. Older stones on dehydration leads to internal shrinkage and due to nitrogen gas filling ("crow-foot" or "Mercedes-Benz" sign) a hypointense central core is seen." [3,4].

Choledocholithiasis:

"Passage of gallstone in CBD is seen in 10 to 15% of patients with cholelithiasis. Most of bile duct calculi are cholesterol or mixed stones formed in Gall bladder. Primary stones arising de novo in the ducts are pigment stones formed in patients with, 1. Chronic haemolytic disease. 2. Hepatobiliary parasitism. 3. Congenital anomalies of the bile ducts. 4. Dilated stricture or sclerosed ducts." The appearance of the stones in USG may

differ. Majority of the stones are highly echogenic with a post acoustic shadow. Small soft calculi may not shadow. On CT it appears as radio dense filling defect, with appreciation of "TARGET SIGN". "Secondary signs on CT include sudden termination of CBD, rim of increased density around a lower density and associated inflammation of CBD wall shows thickening and enhancement on post contrast images. On MRCP it appears as a hypointense structuresurrounded by hyper intense bile".[3,4,7,8]

Carcinoma Head of the pancreas:

Incomplete or complete obstruction of the duct can be due to carcinoma of thehead of the pancreas. Risk factors are smoking and alcohol consumption. It is commonly seen in sixth to eighth decade. "Majority of them are adenocarcinoma. USG may show an ill-defined, homogenous or inhomogeneous hypoechoic mass lesion. CECT shows mass effect, changes of morphologic contour, density changes, enhancement pattern, duct changes, and some secondary changes. On MR it is invariably hypointense on T1 weighted images and variable on T2 weighted images due to the desmoplastic reaction". [3,4].

Peri-ampullary carcinoma:

The Ampulla of Vater is embedded within the wall of the duodenum and the duodenal papilla is within the lumen. The adenocarcinoma can arise from boththe ampulla or the papilla of duodenum and produce biliary obstruction. The tumour is seen in CT or MRCP as a mass in the distal end of the CBD or in duodenal lumen. Although the bile ducts are dilated, the pancreatic duct is usually not dilated because of the accessory pancreatic duct.

Carcinoma of Gall bladder:

It is one the most common malignant neoplasm of the biliary tract. The peak incidence is in sixth and seventh decades. It is 3 to 5 times more common in women than in men. The tumour is adenocarcinoma in 80% to 90% of cases.

USG may show a polypoidal mass lesion or diffuse malignant wall thickening. "CECT clearly shows invasion of adjacent structures. On MR images mass replacing gallbladder, with focal, asymmetric wall thickening, and mass showshypo intensityon T1 and moderately hyperintense on T2".[3,4]

Bloom et al (1984) have analyzed "the role of USG in the detection, characterization and staging of cholangiocarcinoma and have concluded that in well trained hands, with high resolution equipments it is possible to detect and characterize this rare tumour using USG as sensitively as with other radiological modalities"[9].

Hyun Ju Lee et al (2002) have analyzed "14 patients with obstructive jaundice using 3D USG. The level of obstruction was correctly depicted in all patients, and a dilated common bile duct, common hepatic duct, gallbladder, and main intrahepatic ducts were well visualized on minimum transparent mode images. The findings on minimum transparent mode images were well correlated with those on cholangiography; however, the perspective of the whole biliary tree on minimum transparent mode images was inferior to that on cholangiographyin all cases"[10].

"Though USG is a very effective modality in the screening of obstructivejaundice its specificity seems to be low in many studies. CT as a modality of choice for obstructive jaundice was investigated by several researchers. In a study conducted by Cesar et al (1981) in evaluating the site of obstruction with CT the results were accurate and comparable to that of direct cholangiography"[11].

Another study was conducted by Reiman H. Threasa et al (1987) to analyze "biliary obstruction proximal to the pancreatic segment with CT. They concluded that CT is the most valuable as a non-invasive means of narrating surgical or radiologic drainage procedure in patients with biliary obstruction"[12].

"The initial results with MR Cholangiopancreatography studies were achieved with gradient echo sequences by

using a steady-state free precession techniques"[13]. Subsequently, MR Cholangiopancreatography studies were performed with fast or turbo spin echo pulse sequence (FSE). "These sequences were not only slow and required longer scan time for adequate spatial resolution but were also prone to motion induced artefacts and signal loss. The latest imaging techniques for MRCP are Rapid Acquisition with relaxation Enhancement (RARE) and Half-Fourier Acquisition Single-Shot Turbo-Spin-Echo (HASTE)[14]. Using RARE and HASTE sequences, image acquisition is possible within a few seconds, allowing MRCP to be performed comfortably during a single breath hold thus markedly reducing the motion artefacts and improving the quality of images."

"After the introduction of MRCP several studies were performed to compare the efficacy of MRCP with various other radiological modalities. The results and the conclusions of these studies are enumerated below."

Barish et al (1995) in their study of 30 patients with suspected pancreatico biliary diseases compared the efficacy of MRCP with ERCP. They concluded that MRCP is a sensitive and specific as invasive techniques and should be the technique of choice, when invasive techniques are incomplete, unsuccessful or technically difficult[15].

Liberpoulos et al (1997) in their study of 166 patients with various proved biliary diseases compared the efficacy of MRCP findings with ERCP findings.

They concluded that MRCP shows a comparable sensitivity and specificity to ERCP in assessing diseases of the biliary system[16].

Robinson et al (1997) in their study of 24 patients with obstructive jaundice using MRCP concluded that there is a role for MRCP as a second line investigation following ultrasound scanning in patients with obstructive jaundice[17].

Tomoaki I Chikawa et al (1997) in their study of pancreatic "ductal adenocarcinoma preoperative assessment with helical CT versus dynamic MR imaging, concluded that dynamic MR imaging more diagnostic than helical CT in the preoperative detection and evaluation of local tumour extension"[18].

Larena et al in their study showed that "MRCP was a promising alternative to ERCP in evaluation of pancreatic duct especially in ill patients, patients with complete occlusion of the pancreatic duct, overweight debilitated and noncooperative patients"[19].

J.C. Varghese et al (1999) in their study of "191 patients compared MRCP and sonography with ERCP. They proved MRCP was highly accurate (87%) similar to that of ERCP in diagnosis of choledocholithiasis and it is far superiorto sonography. They concluded that MRCP has a potential to replace ERCP"[20].

Norton et al (1999) conducted MRCP technique in 22 young patients with suspected biliary disease. They concluded that unlike ERCP and PTC, which cannot be performed in children without general anaesthesia, MRCP rarely required anaesthesia. MRCP enables visualization of the entire liver and biliary system, whereas ERCP cannot image proximal to a biliary obstruction and PTC cannot opacity ducts distal to an obstruction. ERCP cannot be performed in postoperative setting of biliary enteric anastomosis[21].

Takyushi Masui et al (1999) in their study of 89 patients using SSFSE MRCP concluded that while single thick-slice MRCP only provided information about the biliary tree pathologies. Multiprotection Volume Reconstruction MRCP provided additional information about solid tissue components in and around the pancreas and showed their precise location[22].

Hiroshi Kondo et al (2001) in their retrospective study of "43 patients with biliary calculi to compared observer performance for the diagnosis of choledocholithiasis using the cholangiography with volume rendered maximum intensity projection and thick section half Fourier rapid acquisition with relaxation enhancement

sequences. They concluded that observer performance with volume rendered MR cholangiography was better than that with MIP and thick section MR cholangiography for diagnosis of choledocholithiasis. Volume rendering may be an efficient technique for the reconstruction of MR cholangiography"[23].

Jorge E. Lopera (2001) determined the usefulness of MR cholangiography in defining the extent of biliary ductal involvement in 29 patients with malignant hilar and perihilar biliary obstruction and also evaluated the accuracy of MRCP to plan percutaneous interventions in these patients.

"All patients underwent PTC and 27out of 29 patients also underwent biliary drainage and/or stent placement within 7days after MRCP. They concluded that high accuracy of MRCP for defining extent of ductal involvement in patients with malignant hilar and peri-hilar obstruction allows adequate planning or percutaneous intervention in a majority of patients."

MRCP uses "heavily T2 weighted sequences to take advantage of the inherent contrast effect of bile. Overlap between high signals from the pancreaticobiliary system and from the gastrointestinal tract (GIT) (stomach, duodenum and proximal intestine), is a recognized limitation of MRCP and may mimic pathology. Several studies have shown that the administration of anegative oral contrast material, before performing a MRCP will improve image quality and provide good visualization of the bile and pancreatic ducts without superimposed high signal from the GIT."

This study aims to compare the commonly availablemodalities in the Indian set up and prove the efficacy of the individual modalities.

Material and Methods

Detail Research Plan

The study was done in the department of Radio Diagnosis, "KRISHNA INSTITUTE OF MEDICAL SCIENCES & HOSPITAL. All the patients were referred to the department of Radio diagnosis with the clinical suspicion of obstructive jaundice and elevated serum bilirubin levels. Ultrasonography followed by MRCP were done for all the patients. Two radiologists reviewed the images separately and evaluated the cause and site of obstruction in patients. The accuracy of both modalities was analyzed statistically and correlation was done with the surgical findings or histopathological reports."

Study Population:

All the patients with obstructive jaundice who were referred for USG and were prospectively evaluated by MRCP.

Type of Study:

Observational.

Study Design:

Prospective observational longitudinal study.

Total Study Period:

24 months

Study Area:

Department of Radiodiagnosis, KRISHNA INSTITUTE OF MEDICAL SCIENCES & HOSPITAL

Sample Size:

Rationale for sample size calculation: (Diagnostic accuracy of MRCP as compared to Ultrasound/CT in patients with obstructive jaundice; J Clin Diagn Res. 2014 Mar; 8(3); 103-107. Published online 2014 Mar. doi: 10.7860/JCDR/2014/8149.4120).

	USG – DA (%)	MRCP- DA(%)
Benign Conditions	88	98
Malignant Conditions	88	98

N=$\underline{(p1q1+p2q2)\ X\ \{Z\ (1-a/2)\ +\ Z\ (1-b)\}}(p1-p2)^2$
i.e.: 95% confidence and 80 % power.
Calculating from above formula and taking into account the prevalence of study in our institute for past 5 years:
Sample Size – 25.

Method of Data Collection:

All participating patients were made aware of the study and informed consent to participate in the study was taken from them. Recruitment for the study was done in the USG Room, based on the inclusion and exclusion criteria during the study period.

"Ultrasound was performed on GE {LOGIQ p-5 Ver R-4.0} and Siemens Acuson Juniper machine using a 3.5 MHz curvilinear transducer. **MRCP** was performed on Siemens 1.5 Tesla MRI Scanner. All images were obtained withbreath holding and parameters were individualized".

Sonographic Technique:

First routine intercostal view was done for liver and intrahepatic biliary duct were examined. Then subcostal oblique view, with transducer pointing towards right shoulder was done, sweeping from shoulder to umbilicus to assess porta hepatis. Ninety degree to this was done to see long axis view of CHD & CBD. Distal ducts were difficult to assess and depended on various aspects, but the most favorable view for seeing the distal CBD was through epigastrium.

Assessment of imaging findings as malignant or benign cause ofobstructive jaundice is based on the given scale of confidence.

(i) **Definitely Benign: "** Biliary duct dilatation with a visible calculi in the ductwith no associated mass or stricture."
(ii) **Probably Benign: "**Cystic dilatation of bile passage. Pancreatico-biliary duct dilatation considered benign (i.e. Sign of chronic pancreatitis)."
(iii) **Inconclusive**: "Not confidently labelled as benign or malignant".
(iv) **Probably Malignant: "**Isoenhancing to hypoenhancing mass with indirect signs of neoplasm such as duct dilatation with ductal cut-off adjacent to the mass or atrophic distal parenchyma or pancreato-biliary dilatation considered malignant without sign of a mass or lesion in pancreatic head without duct dilatation."
(v) **Definitely Malignant**: "Mass in the pancreatic head with duct dilatation. Isolated CBD dilatation with an abrupt narrowing located cranial to the level of mass lesion".

Inclusion Criteria:

- Symptoms of obstructive jaundice were to be seen in All patients with clinical symptoms suggestive of obstructive jaundice.
- All patients with Total Bilirubin more than 5mg/dl.

Exclusion Criteria:

- MRI incompatibility (metal implants, dental filling, pacemakers etc...)

"Claustrophobia"			
"Critically ill patients on life support Patients not giving consent."			
"Patient Satisfies all Inclusion Criteria":	Yes	|	No
"No Exclusion Criteria applies to the Patient":	Yes	|	No
"Patient is eligible for Inclusion in the Study"	Yes	|	No

Study Technique:

The study was commenced after Institutional Ethics Committee approvalwas finalized.
Then patient selection was done as per inclusion and exclusion criteria.Written informed consent were collected from the selected patients.

After a brief initial history and examination, the details were seen from thepatient's OPD Card or Bed Head Ticket (if the patient is admitted).

- Interview of the patients and record analysis.
- After that, they were carefully evaluated by high frequency ultrasound, colour Doppler and power Doppler as required. Tracking of patient was done via phone call.

Data Analysis:

"Data was compiled in MS excel sheet and then analyzed using online statistical calculator.
Statistical Analysis was performed with help of Epi Info (TM) 7.2.2.2 EPI INFOis a trademark of the Centers for Disease Control and Prevention (CDC)."

"Using this software, basic cross-tabulation, inferences and associations were performed. Chi-square test was used to test the association of different study variables with the study groups. Z-test (Standard Normal Deviate) was used to test the significant difference between two proportions. t-test was usedto compare the means. $p < 0.05$ was considered to be statistically significant."

Ethical Issues:

a) "Protocol of the study was sent to the Institutional Ethics Committee and hard copy along with soft copy submitted to KRISHNA INSTITUTE OF MEDICAL SCIENCES DEEMED UNIVERSITY for approval."

b) Study will be solely be used for academic purposes only.

Observations and Results

Statistical Analysis:

Statistical Analysis was performed with help of Epi Info (TM) 7.2.2.2 EPI INFOis a trademark of the Centers for Disease Control and Prevention (CDC).

"Using this software, basic cross-tabulation, inferences and associations were performed. Chi-square test was used to test the association of different study variables. Z-test (Standard Normal Deviate) was used to test the

significant difference between two proportions. t-test was used to compare the means. Diagnostic accuracy, sensitivity, specificity, positive predictive value and negative predictive value were calculated to compare the findings of different diagnostic tools. $p<0.05$ was considered to be statistically significant. The mean age (mean ± s.d.) of the patients was 59.52±11.22 years withrange 39 – 86years and the median age was 60 years."

"Most of the patients (52.6%) were in the age group between 50 – 69 years which was significantly higher than other age group ($Z=4.21$; $p<0.001$). Thus, in this study obstructive jaundice was mostly prevalent in the age group between 50 – 69 years."

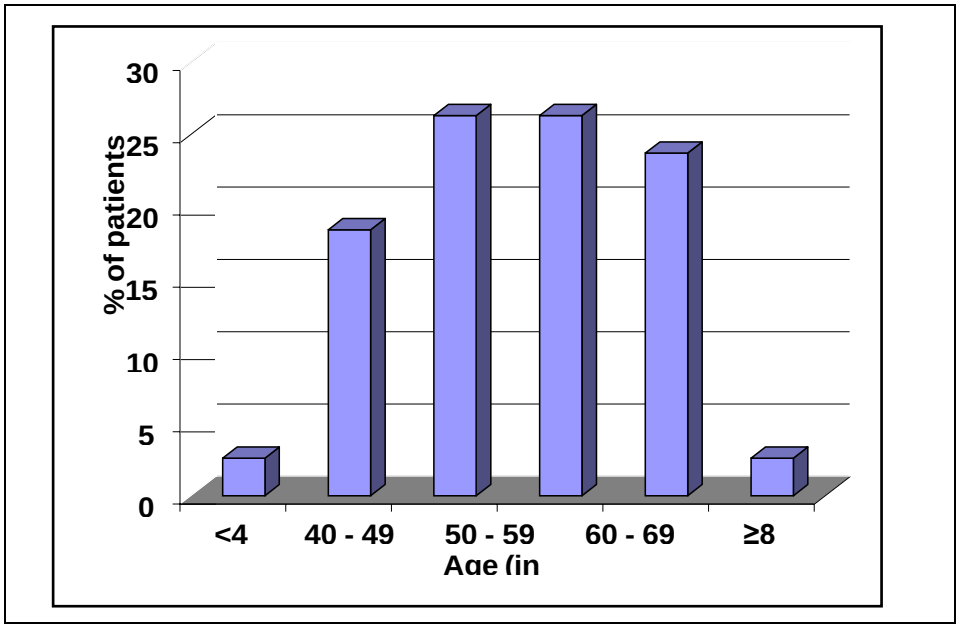

Figure 4: Distribution of age of the patients

Table-1: Distribution of gender of the patients

Gender	Number	%
Male	24	63.2%
Female	14	36.8%
Total	38	100.0%
Male: Female	1.7:1.0	

T-test showed that "there was no significant difference between mean age of males and that of females ($t_{36}=1.06$;$p>0.05$). However, the mean age of the females was lower than that of males. So females were higher risk of having obstructive jaundice at a younger age than males."

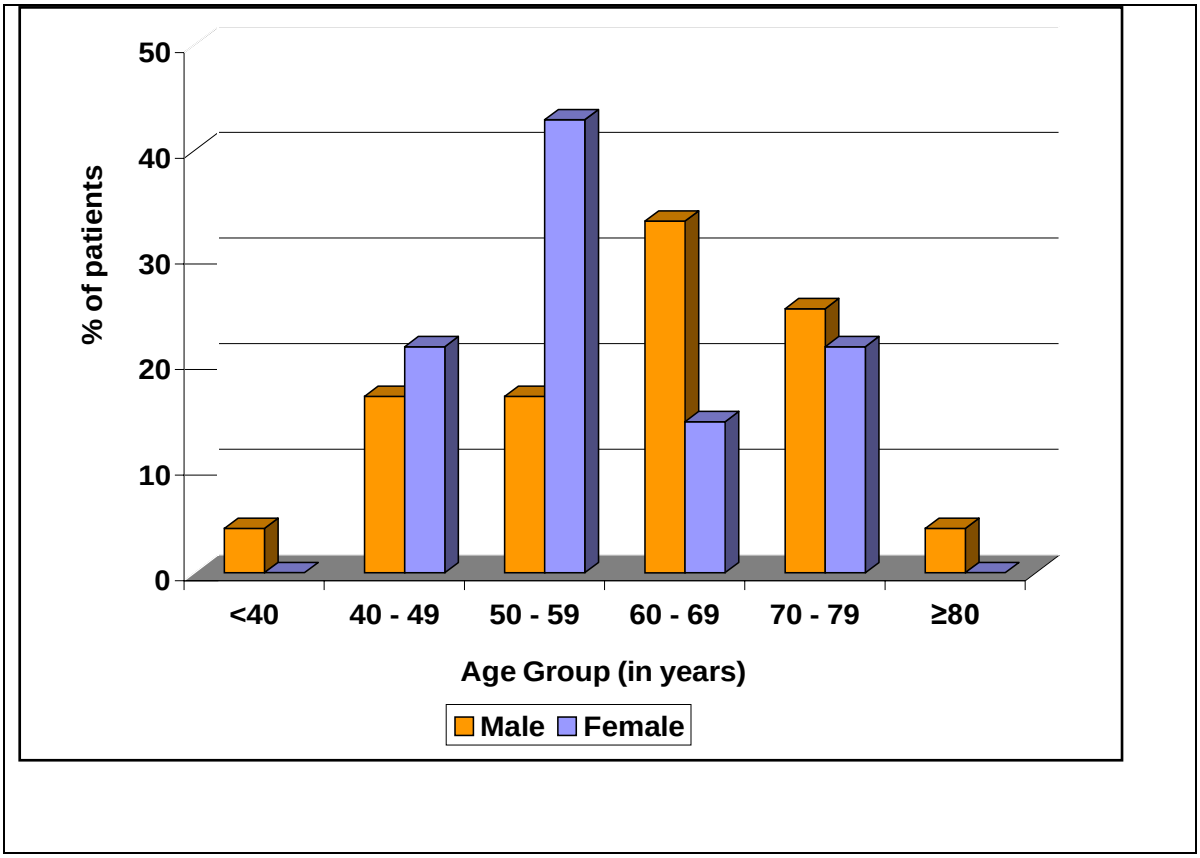

Figure 5: Distribution of age and gender of the patients

Parameters related to jaundice:

Table-2: Distribution of type of obstructive jaundice of the patients

Type of obstructive jaundice	Number	%
"Benign"	23.00	60.5%
"Malignant"	15.00	39.5%
Total	38.00	100.0%

Table-3: Distribution of USG Findingsof the patients

Obstructive jaundice as perUSG Findings	Number	%
"Present"	30.00	78.9%
"Absent"	8.00	21.1%
Grand Total	38.00	100.0%

Table-4: Distribution of MRCP Findings of the patients

Obstructive jaundice as per MRCPFindings	Number	%

"Present"	34.00	89.5%
"Absent"	4.00	10.5%
Total	38.00	100.0%

"Most of the level of obstruction was only at suprapancreatic level (39.4%) followed by only at periampullary region (36.8%) which were significantly higher than that of other level of obstruction (Z=3.37;p<0.001)."

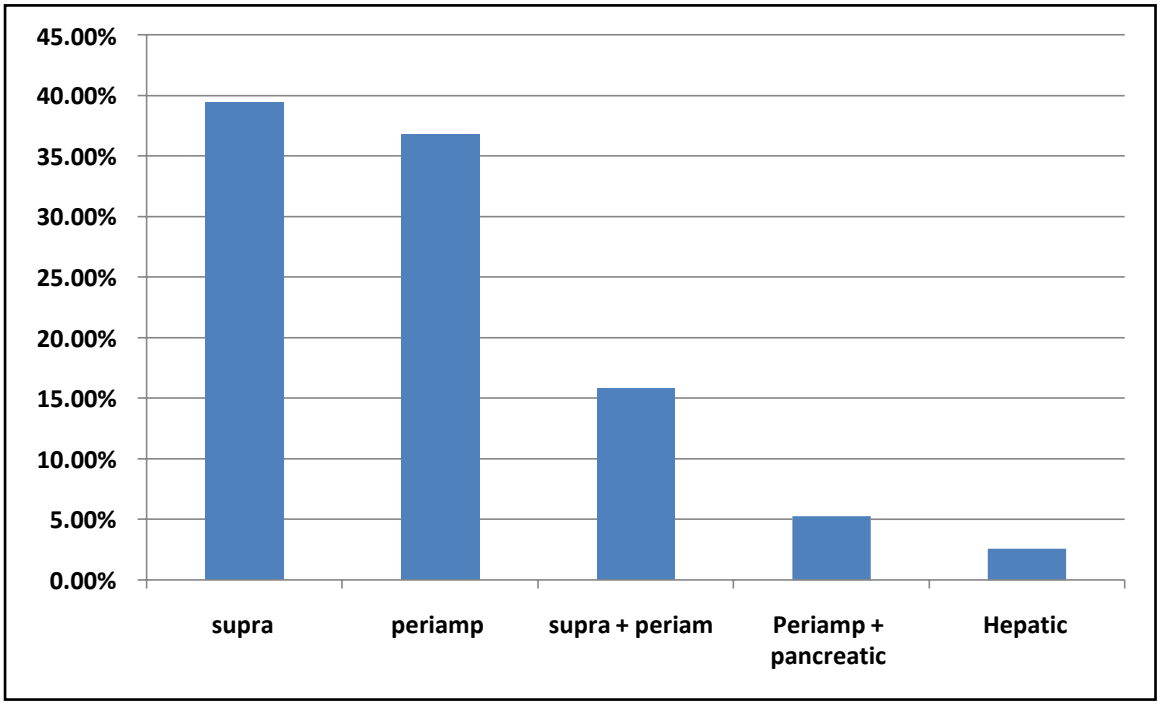

Figure 6: Distribution of level of obstruction of the patients

In 76.3% of the cases CBD were dilated which was significantly higher thanthat of not dilated cases (23.7%) (Z=7.43;p<0.001).

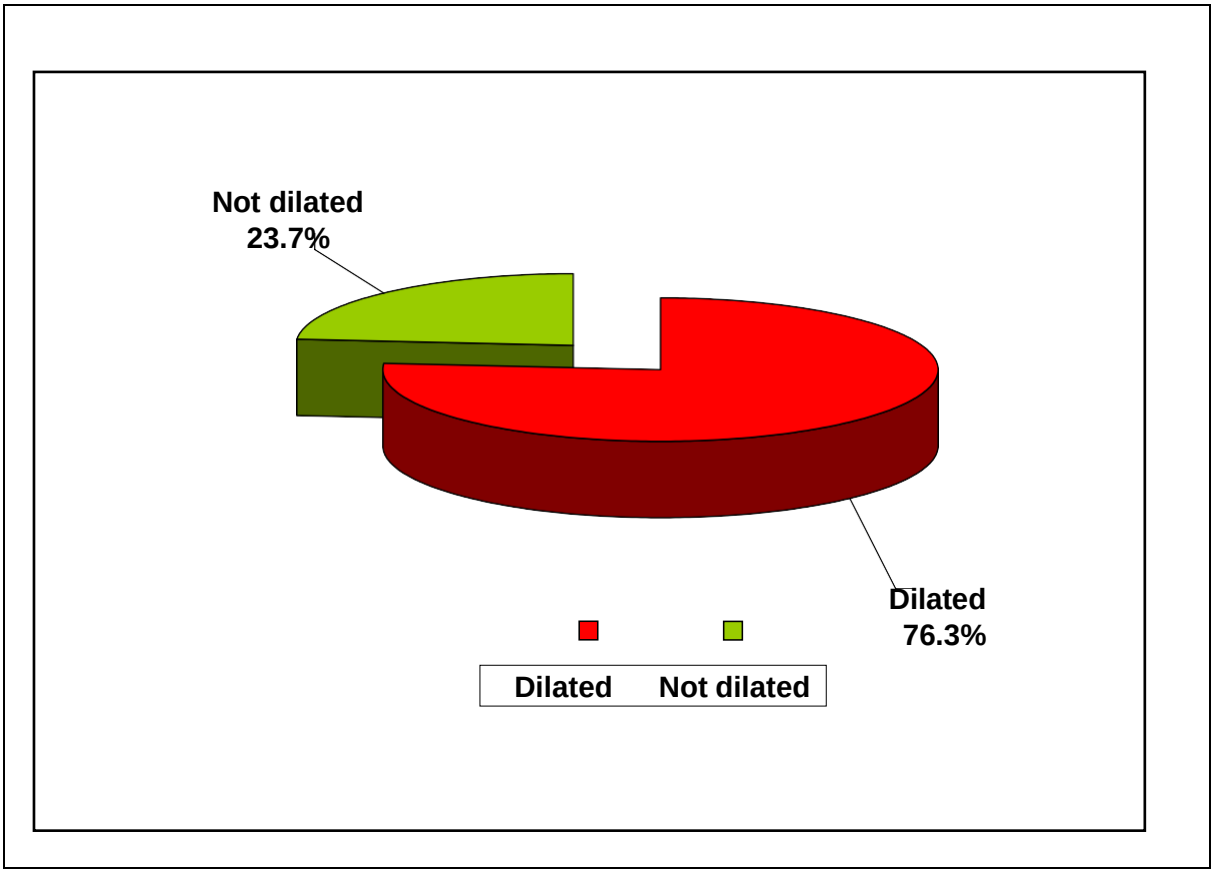

Figure 7: Distribution of status of CBD of the patients

Table-5: Distribution of MPD status of the patients

MPD status	Number	%
Dilated	11	28.9%
Not dilated	27	71.1%
Total	38	100.0%

In 71.1% of the cases CBD were not dilated which was significantly higher than that of dilated cases (28.9%) (Z=5.96;p<0.0001).

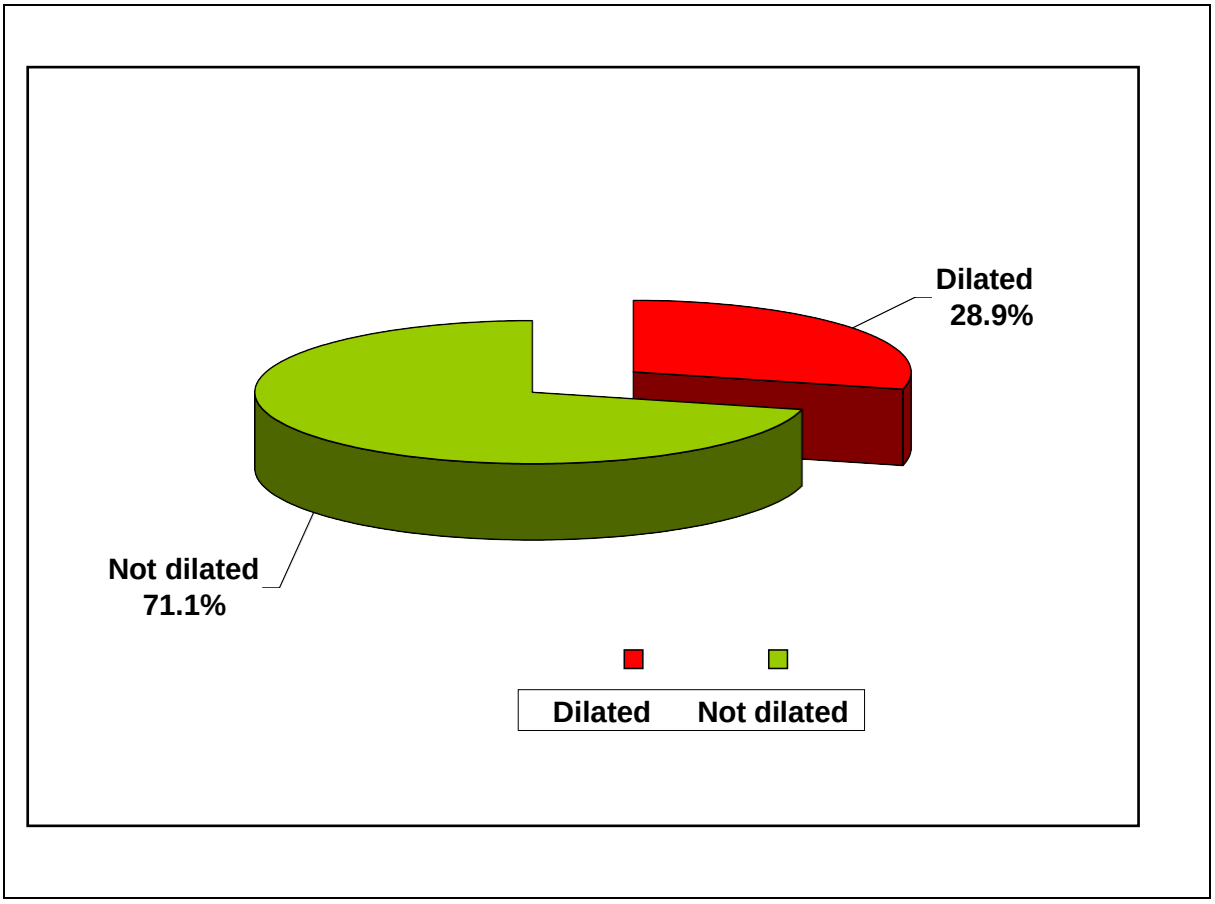

Figure 8: Distribution of MPD status of the patients

In 63.2% of the pancreas was normal which was significantly higher (Z=5.63;p<0.001). However, out of 14 abnormal pancreases most of the patients had atrophied pancreas (23.7%) which was significantly higher (Z=3.06;p<0.001).

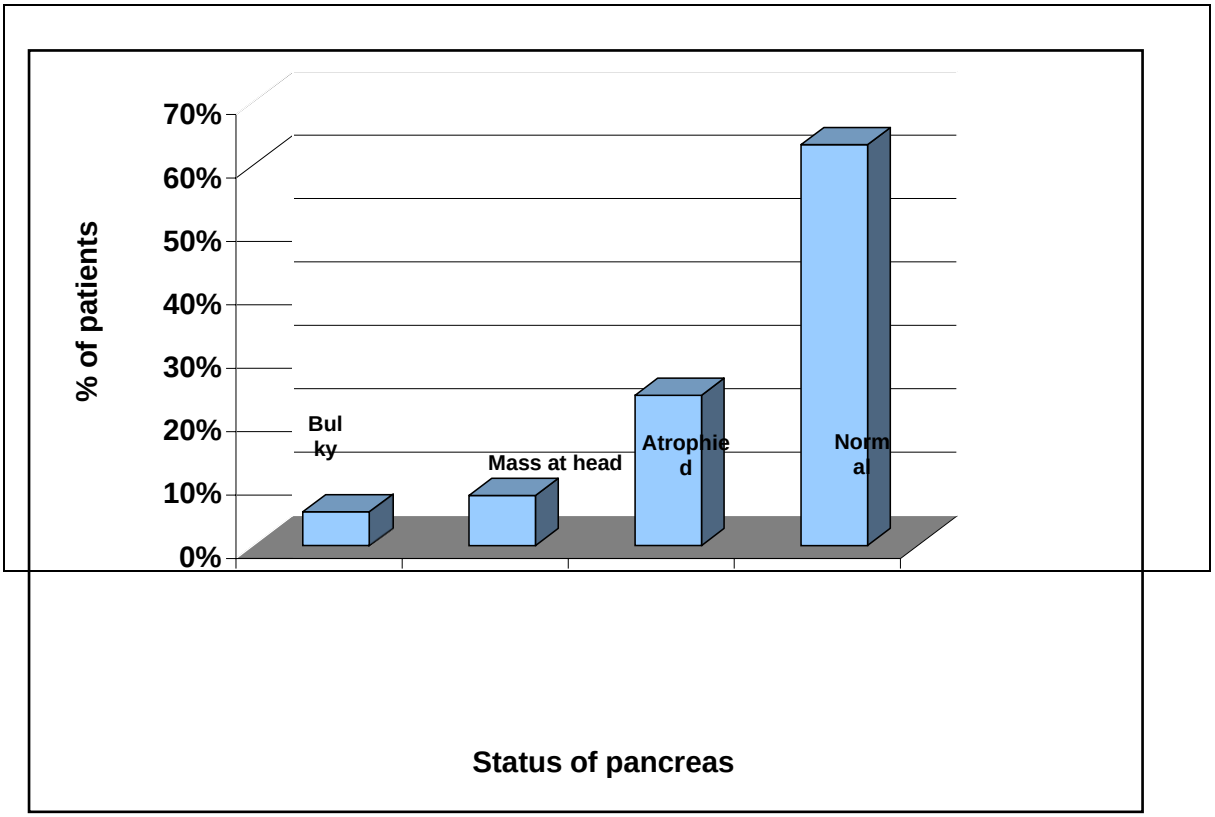

Figure 09: Distribution of status of pancreas of the patients

Table-6: Distribution of FNAC/HPE/ERCP findings of the patients

Findings of FNAC/HPE/ERCP	Number	%
"Benign"	21.00	55.3%
"Malignant"	17.00	44.7%
Total	38.00	100.0%

For common bile duct calculi and cholangiocarcinoma, though the proportionsof males were higher than that of females, there were no significant differences between the proportion of males and females (p>0.05).

Table-7: Comparison of USG and MRCP findings of the patients

USG Finding	MRCP Findings		TOTAL
	Correctly diagnosed	Not correctly diagnosed	
Correctly diagnosed	30	0	30
Row %	100.0	0.0	100.0
Col %	88.2	0.0	78.9
Not correctly diagnosed	4	4	8
Row %	50.0	50.0	100.0
Col %	11.8	100.0	21.1
TOTAL	34	4	38
Row %	89.5	10.5	100.0
Col %	100.0	100.0	100.0

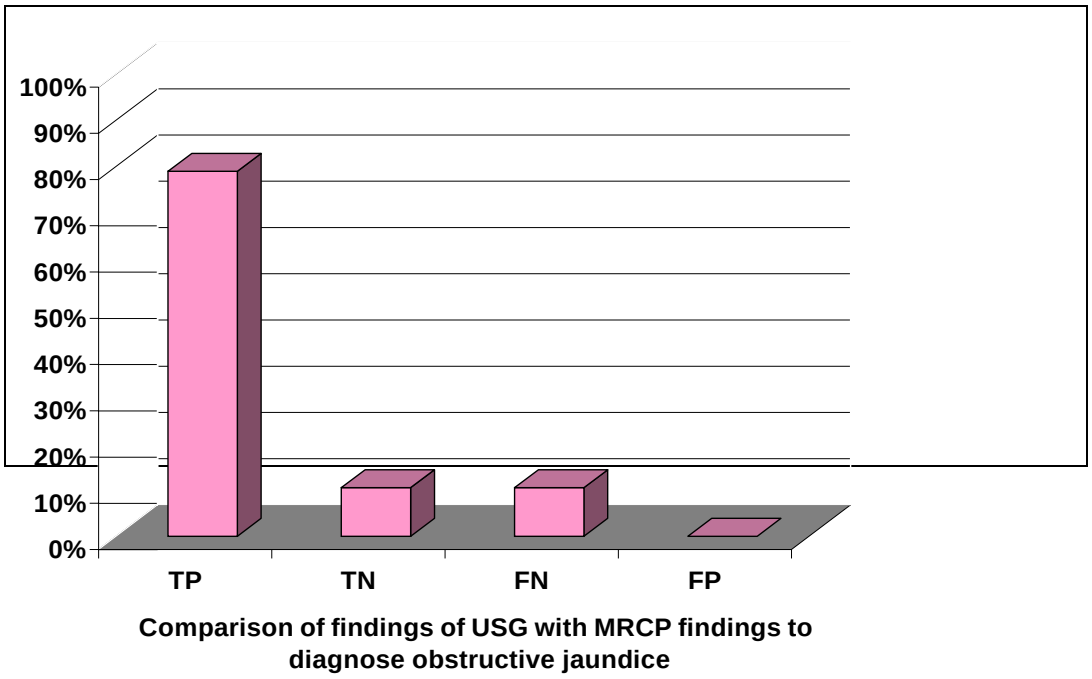

Figure 10: "Comparison of findings of USG with MRCP findings todiagnose obstructive jaundice"

Table-8: "Association between findings of MRCP and HP findings todiagnose obstructive jaundice"

MRCP Finding	**HP findings**		**TOTAL**
	Benign	**Malignant**	
Correctly diagnosed	19	14	33
Row %	57.6	42.4	100.0
Col %	90.5	82.4	86.4
Not correctly diagnosed	2	3	5
Row %	40.0	60.0	100.0
Col %	9.5	17.6	13.6
TOTAL	21	17	38
Row %	55.3	44.7	100.0
Col %	100.0	100.0	100.0
MRCP Finding	**HP findings**		TOTAL
	Benign	**Malignant**	
Correctly diagnosed	19	14	33
Row %	57.6	42.4	100.0
Col %	90.5	82.4	86.4
Not correctly diagnosed	2	3	5
Row %	40.0	60.0	100.0
Col %	9.5	17.6	13.6
TOTAL	21	17	38
Row %	55.3	44.7	100.0
Col %	100.0	100.0	100.0

"Out of the 21 benign cases as per HP findings 19(90.5%) were found to beobstructive by MRCP. Out of the 17 malignant cases as per HP findings 14(82.4%) were found to beobstructive by MRCP."

Table-9: Comparison of USG and MRCP findings with respect to HP findings

MRCP Finding	HP findings	
	Benign	**Malignant**
Obstructive by USG	18(85.7%)	12(70.6%)
Obstructive by MRCP	19(90.5%)	15(88.2%)
Z and p-values	Z =1.11;p=0.26	Z =2.97;p=0.003
Non-obstructive by USG	3(14.3%)	5(29.4%)
Non-obstructive by MRCP	2(9.5%)	2(11.8%)
Z and p-values	Z =0.87;p=0.38	Z =2.92;p=0.004

For the above table it revealed that for benign cases though the proportion of obstructive cases by MRCP (90.5%) was higher than that of USG (85.7%) butthere was significant between them (Z=1.11;p=0.26). Thus both USG and MRCP were more or less equally effective to find the obstructive cases.

However, for malignant cases though the proportion of obstructive cases by MRCP (88.2%) was significantly higher than that of USG (70.6%).Thus MRCPwas significantly better than USG to find the obstructive cases.

Table-10: "Association between findings of USG & MRCP and HP findings to diagnose obstructive jaundice"

USG and MRCP Finding	HP findings		TOTAL
	Benign	**Malignant**	
Obstructive	21	2	23
Row %	91.3	8.7	100.0
Col %	100.0	11.8	60.5
Non-obstructive	0	15	15
Row %	0.0	100.0	100.0
Col %	0.0	88.2	39.5
TOTAL	21	17	38
Row %	55.3	44.7	100.0
Col %	100.0	100.0	100.0

Out of the 21 benign cases as per HP findings 21 (100.0%) were found to beobstructive by USG & MRCP.

Table-11: Comparison of findings of USG and MRCP with HP findings todiagnose obstructive jaundice

Comparison	Number	%
TP	15	39.5%
TN	21	55.3%
FN	2	5.3%
FP	0	0.0%
Total	38	100.0%

TP= "correctly diagnosed malignant cases".TN= "correctly diagnosed benign cases".
FN= "incorrectly diagnosed as benign" FP= "incorrectly diagnosed as malignant".
Diagnostic Accuracy = "(TP+TN) / TOTAL CASES X 100 = 94.74% Sensitivity = TP/ (TP+FN) x 100 = 88.24%"
Specificity = "TN/ (TN+FP) x 100 = 100.0%"
Positive Predictive Value = "TP/(TP+FP) x 100 =100.0% Negative Predictive Value = TN/(TN+FN) x 100 = 91.3%"

Discussion

In the current study thirty-eight patients presenting with obstructive jaundice clinically were studied. "Most of these patients presented with symptoms of jaundice and abdominal pain. Jaundice was the most common presentation followed by passage of white stools and complains of pruritis. All these patients had total bilirubin

of more than 5mg/dl."

Among these patients, "76.3% patients had dilated common bile duct which was significantly higher than that of not dilated cases, 23.7 %. 68.4% of the IHBR statuses were dilated which was significantly higher than that of not dilated cases (31.6%). USG however, had a poor sensitivity in diagnosing the malignant lesions. 1(5.8%) case, which had choledocolithiasis with gall bladder sludge was stated as benign but later was confirmed to have cholangiocarcinoma insuprapancreatic CBD as well."

"There were 5 (29.5%) cases USG could not find the cause of obstructive jaundice and it turned out to malignant pathologies. In 11(64.7%) cases ultrasound was successful in diagnosing the malignant pathology. Out of the 17 malignant cases as per HP findings 14 (82.4%) were found tobe malignant by MRI. Among rest of the cases, in 2(11.8%) cases of cholangiocarcinoma causing obstruction at periampullary region could not be diagnosed and in 1(5.8%) case the cause of obstruction was given as benign by MRI."

"Out of the 21 benign cases as per HP findings 18 (85.7%) were found to be benign by USG. Whereas in 3(14.3%) cases USG could not detect the pathology and it turned out to be benign pathology, among which one was the case of CBD calculus in periampullary region and two cases were diagnosed to have papillary stenosis."

"MRCP was able to detect pancreatic carcinoma with a sensitivity of approximate 86%-97%" in studies conducted by Faria et al, Tamm et al [24].

Their appearance on USG is dependent on the pattern of carcinoma. Polypoidal intraluminal masses are recognized from nonneoplastic pathologies by immobility of masses, larger in size(>1cm) and Having prominent internal vascularity.

In the present study there were no cases of choledocalcyts, or parasitic infestations, or klatskin tumor, mirrizi syndrome etc.

Future Scope:

With the advent of MRI guided interventions it can be soon possible in the coming times to use MRCP for diagnostic as well as therapeutic applications for various pathologies of biliary tract and pancreas.

Conclusion

"Assessment of obstructive jaundice and its cause, site and area of involvement of the lesion, MRCP proves to be better imaging modality over other modalities like ultrasound. It also has added advantage of being non invasive procedure with no ionization radiation. However, few drawbacks associated with MRCP are its availability and cost. Small sample size and the disease spectrum in the patients during the stipulated time for the study were the limitation of the study."

IMAGES

Illustration number 1:

T2 haste cor thin slab shows a hypointense filling defect with hyperintensebile around it.

Illustration number 2:

T2 haste cor showing multiple filling defect in GB.

Illustration number 3:

T2 haste cor thin slab section shows irregular, thickened GB wall deficient atplaces invading liver. On HPE it was proven to GB carcinoma.

T2 haste cor thin slab shows abrupt cut-off of CBD and pancreatic duct, givingit "double duct" sign. Also well defined hypointense lesion is seen just adjacent to abrupt cut-off. Liver showed multiple hyperintense metastasis.

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