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"Comparative Study Of Diagnostic Accuracy Between Sonography And 3 Tesla Mrcp In Diagnosing Suspected Cases Of Obstructive Jaundice Presenting To A Tertiary Care Hospital In Coastal Karnataka"

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Abstract:
Background*:*
In clinically suspected cases of obstructive jaundice, the fundamental purpose of any imaging modality is to confirm the presence of obstruction. Extent, probable cause of obstruction of the biliary tree will help the surgeon to determine the treatment plan for each individual case.
Materials and Methods*:*
This was a cross-sectional study conducted in the Department of Radio diagnosis in Yenepoya medical college, Deralakatte, Mangalore from November 2017 to October 2019.
A total number of 30 patients who were suspected to have obstructive jaundice was included in this study. A composite assessment of the patient's history, findings on physical examination, laboratory investigations-conventional biochemical liver function tests like total serum bilirubin, serum alkaline phosphatase, AST, ALT levels, serum albumin and globulin were noted and then subjected the patients initially to ultrasonography examination and then 3Tesla MRCP. All parameters were obtained by one operator. Informed consent was taken.
Ultrasonography and MRI scans were analysed separately. All examinations were analysed by experienced eminent radiologists. Then classification of imaging findings as benign or malignant cause of obstructive jaundice were done. Diagnosis was correlated with histopathology if any.
Results*:*
The gender distribution showed that males were the majority 53 % (16 nos.) and females were less than half of the total patients 47 % (14 nos.).The mean age of the study population is 50.3 ± 14.4 years, in that females were having higher mean age of 52.3 ± 9.3 years when compared to 48.5 ±17.8 years for males. The age and gender wise distribution showed, males were higher in the age group 31 to 40 years (25 %), and females were highest in the age group 41 to 50 and 51 to 60 years (35.7 % each).
Pain abdomen was seen in most of the patients (93.3%), followed by vomiting in 20 patients (66.7%) and jaundice in 18 (60%). All three complaints were presented in 13 patients (43.3%). The direct bilirubin levels were normal in 7 patients (23.3%), followed by 9 patients each with elevated levels from 0.4 to 2 and 2.1 to 10 mg/dL.5 patients had >10mg/dl (16.7%). The mean levels are 4.6 ± 6 mg/dL.
By ultrasonographic investigation, 20 patients had intrahepatic biliary radical dilatation. Common hepatic duct was dilated in 17 patients, thickened with irregular abrupt ending in 1 patient. Cystic duct was dilated in 2 patients and normal in rest. Common bile duct was dilated in 11 patients, with thickened wall in 1 patient and non-visualization of the duct in 4 patients due to excessive bowel gas. Pancreatic duct was dilated in 6 patients By MRCP investigation, 20 patients had intrahepatic biliary radical dilation. The Common hepatic duct was dilated in 17 patients and normal in 12, the wall was thickened in one patient. The Cystic duct was normal in majority (25 nos.) and dilated in 4. The Common bile duct was dilated in 8, wall thickened in 1 patient, had smooth narrowing in 6, regular abrupt ending in one patient and irregular abrupt ending in one patient. The pancreatic duct was dilated in 6 patients and normal in rest of the patients. Ultrasonographic evaluation was done to see for calculi in the hepatobiliary pancreatic system. The Cystic duct calculus was present in one, absent in 28 patients and the duct could not be visualized in one patient. The Common bile duct calculus was visualised in 2 patients, absent in 17 and not visualized in 11 patients. The gall bladder calculus was present in 14 and absent in 14 patients. Contracted gall bladder was seen in one patient. The pancreatic duct calculus was seen in 3 patients.MRCP evaluation was done to see for calculi in the hepatobiliary pancreatic system. Cystic duct calculus was present in three and absent in 26 patients. The Common bile duct calculus was visualised in 11 patients and absent in 19. The gall bladder calculus was present in 16 and absent in 14 patients. In one patient, gall bladder was seen to be contracted. The pancreatic duct calculus was seen in 4 patients.In 14 patient local effects and metastases were not seen .Gall bladder wall thickening with pericholecystic fluid were

seen in 6 patients, Organ invasion was observed in 5 patients and complications of pancreatitis was recorded in 2 patients. The diagnosis on USG showed majority (23 Nos.) were benign lesion, malignant in 2 patients and inconclusive in 5. The diagnosis on MRCP showed majority (23 Nos.) were benign lesion, and malignant in 7 patients. There were 5 inconclusive results in USG, and those were excluded. The sensitivity of the USG to detect malignant cases is 25% and the specificity to rule out malignancy is 95.2%. The positive predictive value is 50% and negative predictive value of USG is 86.9%.There was 1 inconclusive result in MRCP, and that was excluded. The sensitivity of the MRCP to detect malignant cases is 57.4% and the specificity to rule out malignancy is 90.9 %. The positive predictive value is 66.6% and negative predictive value of USG is 86.9%.

Conclusion:

In conclusion, ultrasonography is an excellent modality as a screening tool in evaluating biliary obstruction, but MRCP is superior to ultrasonography in identifying the cause of biliary obstruction in addition to diagnosing biliary dilatation.

Key Words: *Suspected cases of obstructive jaundice, ultrasonography, 3T MRCP*

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I. Introduction

The biliary tract refers to the liver, gallbladder and bile ducts and how they work together to produce, store and secrete bile. Bile is secreted by the liver in small channels that join to form the common hepatic duct. Between meals, the secreted bile is stored in the gallbladder, where 80 to 90% of the water and electrolytes can be absorbed, leaving bile acids and cholesterol. During a meal, the smooth muscles of the wall of the gallbladder contract, causing the secretion of bile in the duodenum to eliminate waste stored in the bile and contribute to the absorption of fat and edible oils by solubilizing

them with bile acids.

Jaundice is caused by hyper bilirubinaemia that may be in conjugated or unconjugated form. Medical jaundice is when bilirubin level exceeds 34-35 μmol / L or 2-3 mg / dL.[1,2] Jaundice can be divided into two categories: obstructive (surgical) and non-obstructive (medical) jaundice.[3] Post hepatic jaundice is a type of jaundice whose cause lies in the biliary part of the hepatobiliary system. The main cause of post hepatic jaundice is extra hepatic biliary obstruction. Therefore, it is also known as obstructive jaundice.[1] Obstructive jaundice has high morbidity and mortality and is therefore a difficult condition for the surgeons.[3] In clinically suspected cases of obstructive jaundice, the fundamental purpose of any imaging modality is to confirm the presence of obstruction. Extent, probable cause of obstruction of the biliary tree will help the surgeon to determine the treatment plan for each individual case.[4,5]

Magnetic resonance cholangiopancreatography (MRCP) was introduced around two decades back. With time the technique has evolved, T2 weighted images of the biliary tree were traditionally obtained through use of balanced gradient-echo steady state free precession sequences and now fast spin-echo (FSE) pulse sequences with long echo times are used, which have higher signal to noise and contrast to noise ratio and lower sensitivity to motion and susceptibility artefacts. Rapid acquisition with rapid enhancement, fast recovery FSE and the half-Fourier acquisition single-shot turbo spin echo(HASTE) sequences are the modified sequences which have been developed.[6]

The present study was undertaken to find out the sensitivity and specificity in early diagnosis of suspected cases of obstructive jaundice and to understand the cause and level of obstruction in clinically suspected cases of biliary obstruction.

II. Material And Methods

This prospective cross sectional study was carried out on patients of Department of Radio-diagnosis at Yenepoya medical college, Mangalore, Karnataka, Indiafrom November 2017 to October 2019.
A total 30 adult subjects (both male and females) of aged ≥ 18 years were for in this study.
Study Design: Hospital based cross sectional study

Study Location: This was a tertiary care teaching hospital based study done in Department ofRadio-diagnosis, at Yenepoya medical college, Mangalore, Karnataka, India

Study Duration: November 2017 to October 2019.
Sample size: 30 patients.
Sample size calculation: Convenient sampling.

Subjects & selection method: This study was conducted on 30 suspected cases of obstructive jaundice patients presenting to the department of Radio-diagnosis of Yenepoya medical college and hospital Mangalore who met the inclusion and exclusion criteria. The study period was for 24 months from November 2017 to October 2019.

Inclusion criteria:

- All patients above the age of 18 years who were referred to Radiology Department with clinical suspicion of biliary obstruction and/ altered LFT who will be subjected to USG and 3T MRCP were included in the study.
- Cases where USG showed abnormality with/without LFT abnormality.
- Cases which showed no abnormality on USG with altered LFT.

Exclusion criteria:

- Patients, who underwent surgical intervention/post ERCP for biliary obstruction, already diagnosed cases of obstructive jaundice.
- Patients with history of contrast reactions.
- Patients with elevated renal parameters.
- Contraindications for MRI.
- Uncooperative patients.
- Patients with non- obstructive jaundice.
- Terminally ill patients
- In situations where HPE diagnosis can be made without increased expenditure of 3T MRCP.

Procedure methodology

A total number of **30** patients who were suspected to have obstructive jaundice was included in this study . A composite assessment of the patient's history, findings on physical examination, laboratory investigations- conventional biochemical liver function tests like total serum bilirubin, serum alkaline phosphatase, AST, ALT levels, serum albumin and globulin were noted and then subjected the patients initially to ultrasonography examination and then 3Tesla MRCP. All parameters were obtained by one operator. Informed consent was taken. Patients who underwent surgical interventions and other interventional procedures for biliary obstruction were excluded from the study.

Sonographic examination was done in all patients with Voluson E8, using 2-5MHz transducer. Images were recorded on single emulsion film. Careful scanning of the entire course &caliber of the duct system whenever possible helps to trace the extent of the duct dilatation & to localize the level of obstruction. The upper limit of normal for the diameter of the common bile duct on the sonogram was taken as 8 mm.

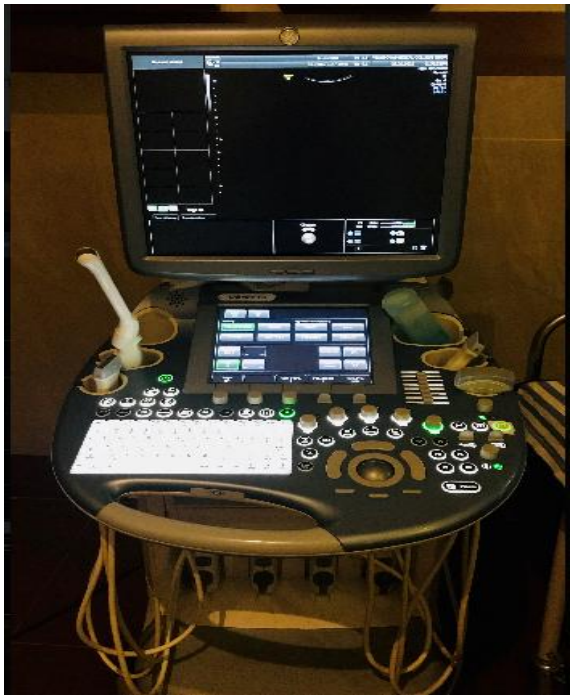

Fig 1: GE Voluson E8 Ultrasound machine

After the Ultrasound examination, all the 30 patients underwent MRCP examination. The examination was done using GE Signa Pioneer 3 Tesla MRI machine. The patient was placed on the MR table in supine position with arms placed above the head and explained to stay still and avoid movements. All images were obtained with breath holding.

Fig 2: GE Signa Pioneer 3 Tesla MRI machine

The ultrasound and MRCP findings then was compared with the surgical and histopathological diagnosis if any.

Protocol for MRCP: Axial T1, Axial T2 FS, T2 Axial, Coronal FIESTA, Axial, Coronal and sagittal T2 SSFSE, Axial diffusion, T1 post contrast and 3D projection images were the sequences studied.
The following parameters were studied for Ultrasound and MRI with 3 Tesla MRCP;

- Level of obstruction (four Anatomical Segments)
- Hepatic/ Suprapancreatic/ Pancreatic/Ampullary
- Presence of bile duct calculi
- Non visualized/Definitely visualized.
- Status of CBD
- Smooth tapering/ Abrupt end/Rounded/ Irregular
- Degree of dilatation of intra hepatic biliary radicals
- Minimal/Moderate/Marked
- Gall bladder pathology including size, wall, stones.
- Dilatation of pancreatic duct.
- Pancreatic atrophy, calcifications, and pseudocysts.
- Invasion of viscera, fascial planes.
- Presence of metastasis.

Then classification of imaging findings as benign or malignant cause of obstructive jaundice was based on following scale of confidence:

Definitely benign:
Biliary duct dilatation with a visible stone in the duct.

Probably benign:
Cystic dilatation of bile duct. Pancreatico-biliary duct dilatation considered benign (i.e. Sign of chronic pancreatitis).

Inconclusive:
Not confidently diagnosed as benign or malignant.

Definitely malignant:
Mass in the pancreatic head with consistent duct dilatation. Isolated CBD dilatation with an abrupt narrowing located cranial to the level of mass lesion.

Ultrasonography and MRI scans were analysed separately. All examinations were analysed by experienced eminent radiologists. Diagnosis were correlated with histopathology if any.

Statistical analysis

The data was entered and tabulated in Microsoft excel sheet. Appropriate descriptive statistical tests were used to describe the data. The data was analyzed using SPSS 21 trial version.

III. Result

A hospital-based cross-sectional study was done in the department of Radio diagnosis in Yenepoya medical college, Deralakatte, Mangalore on patients who are suspected with obstructive jaundice.

BASELINE CHARACTERISTICS

1. Total number of patients

The total patients included in the study was 30 nos. who were suspected with obstructive jaundice.

2. Gender wise distribution

The gender distribution showed that males were the majority 53 % (16 nos.) and females were less than half of the total patients 47 % (14 nos.).

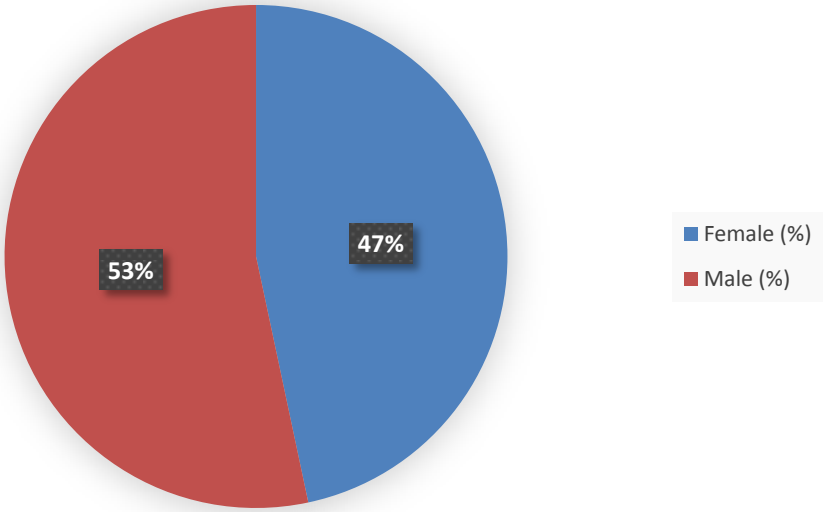

Chart 1: Gender (Male: n=16, Female: n=14 nos.)

3. Age and Gender wise distribution

The mean age of the study population is 50.3 ± 14.4 years, in that females were having higher mean age of 52.3 ± 9.3 years when compared to 48.5 ± 17.8 years for males.

Table 1: Age and gender distribution

Age groups (years)	Male n (%)	Female n (%)	Total n (%)
19 to 30	03 (18.8)	00 (0.0)	03 (10.0)
31 to 40	04 (25.0)	01 (7.1)	05 (16.7)
41 to 50	02 (12.5)	05 (35.7)	07 (23.3)
51 to 60	03 (18.8)	05 (35.7)	08 (26.7)
61 to 70	02 (12.5)	03 (21.4)	05 (16.7)
71 to 80	02 (12.5)	00 (0.0)	02 (06.7)
Total	16 (100)	14(100)	30 (100)

The age and gender wise distribution showed, males were higher in the age group 31 to 40 years (25 %), and females were highest in the age group 41 to 50 and 51 to 60 years (35.7 % each).

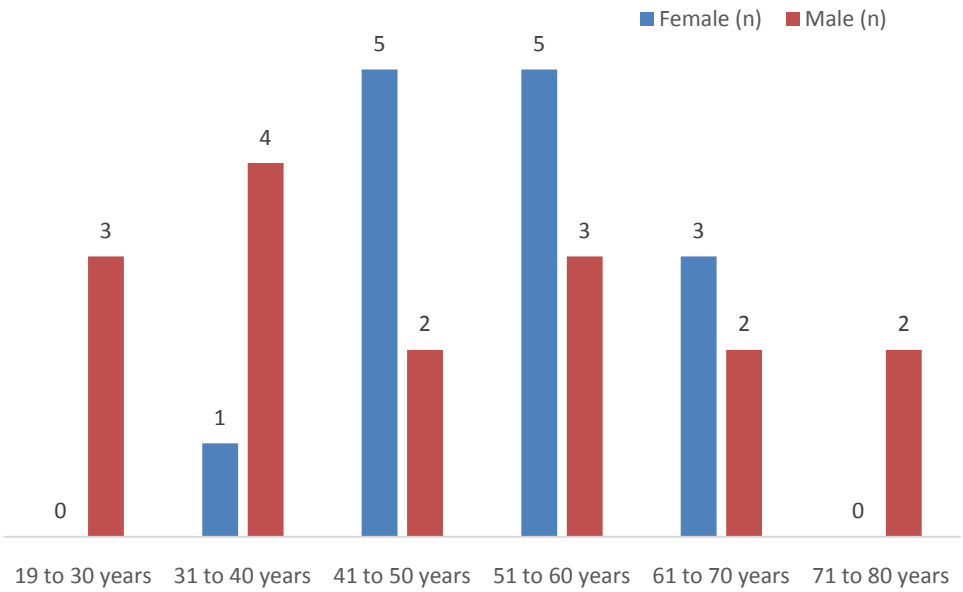

Chart 2: Age and gender wise distribution (Male: n=16, Female: n=14 nos.)

4. Presenting Complaints

Pain abdomen was seen in most of the patients (93.3%), followed by vomiting in 20 patients (66.7%) and jaundice in 18 (60%). All three complaints were presented in 13 patients (43.3%).

Table 2: Presenting complaints

Presenting complaints	Frequency	Percentage
Pain Abdomen	28	93.3
Vomiting	20	66.7
Jaundice	18	60.0

5. Investigations

Total Bilirubin Levels

The total bilirubin levels were normal in 13 patients (43.3%), followed by 17 patients with elevated levels of more than 1.3 mg/dL. The mean levels are 6.16 ± 7.4.

Table 3: Total Bilirubin level

Total Bilirubin level	Frequency	Percentage
0.1 to 1.2 mg/dL	13	43.3
1.3 to 4 mg/dL	5	16.7
4 to 10 mg/dL	4	13.3
10.1 to 20 mg/dL	7	23.3
>20 mg/dL	1	3.3
Mean Total bilirubin level: 6.16 ± 7.4 mg/dL		

Direct Bilirubin Levels

The direct bilirubin levels were normal in 7 patients (23.3%), followed by 9 patients each with elevated levels from 0.4 to 2 and2.1 to 10 mg/dL.5 patients had >10mg/dl(16.7%). The mean levels are 4.6 ± 6 mg/dL.

Table 4: Direct Bilirubin level

Direct Bilirubin level	Frequency	Percentage
< 0.3 mg/dL	7	23.3
0.4 to 2 mg/dL	9	30.0
2.1 to 10 mg/dL	9	30.0
> 10 mg/dL	5	16.7
Mean direct bilirubin level: 4.6 ± 6 mg/dL		

DUCTAL STATUS IN USG

By ultrasonographic investigation, in 20 patients there were intrahepatic biliary radical dilatation. The common hepatic duct was dilated in 17 patients and normal in 12. The common hepatic duct wall was thickened and showed irregular abrupt ending in one patient. The cystic duct was normal in majority (27 nos.) and dilated in 2. The common bile duct was dilated in 11, was thickened in 1 patient and there was non-visualization of duct in 4 patients. The pancreatic duct was dilated in 6 patients, not visualized in one and was normal in rest of the patients.

Table 5: Ductal status in USG

Ductal status in USG	Dilated (n)	Normal (n)	Non-visualized (n)	Wall thickening(n)	Abrupt ending irregular (n)
Intrahepatic biliary radical dilation	20	10	0	0	0
Common hepatic duct	17	12	0	1	1
Cystic duct	02	27	1	0	0
Common bile duct	11	15	4	1	0
Pancreatic duct	6	23	1	0	0

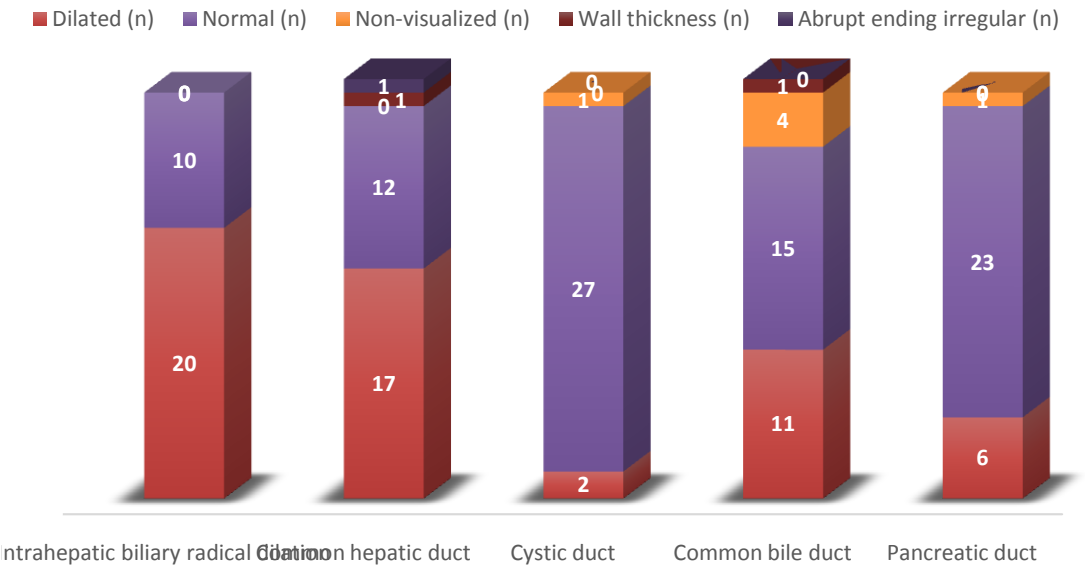

Chart 3: Ductal status in USG

DUCTAL STATUS IN MRCP

By MRCP investigation, 20 patients had intrahepatic biliary radical dilation. The Common hepatic duct was dilated in 17 patients and normal in 12, the wall was thickened in one patient. The Cystic duct was normal in majority (25 nos.) and dilated in 4. The Common bile duct was dilated in 8, wall thickened in 1 patient, had smooth narrowing in 6, regular abrupt ending in one patient and irregular abrupt ending in one patient. The pancreatic duct was dilated in 6 patients and normal in rest of the patients.

Table 6: Ductal status in MRCP

Ductal status in MRCP	Dilated (n)	Normal (n)	Non-visualized (n)	Wall thickness(n)	Abrupt ending irregular (n)	Smooth Narrowing (n)	Abrupt ending regular(n)
Intrahepatic biliary radical dilation	20	10	0	1	0	0	0
Common hepatic duct	17	12	0	1	1	0	0
Cystic duct	04	25	0	1	0	0	0
Common bile duct	08	13	0	1	1	6	1
Pancreatic duct	6	24	0	0	0	0	0

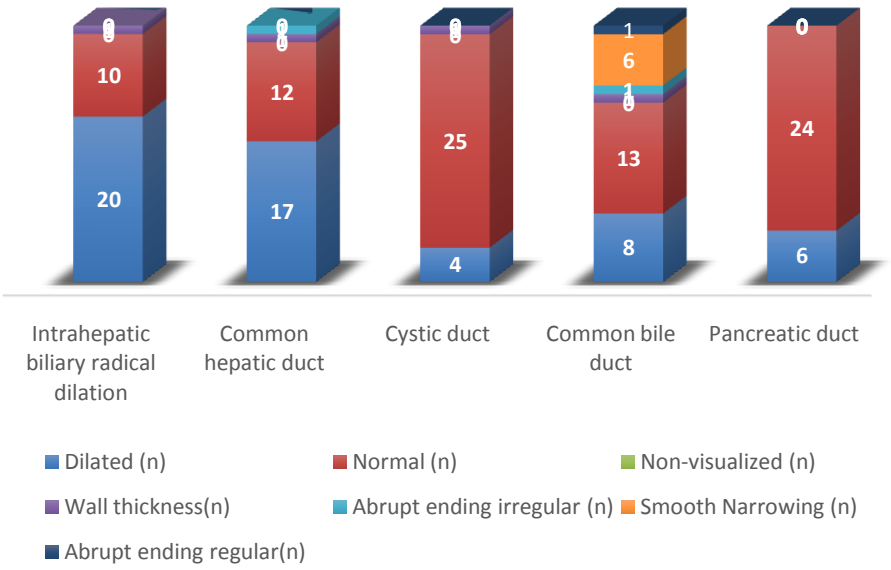

Chart 4: Ductal status in MRCP

CALCULI STATUS IN USG

Ultrasonographic evaluation was done to see for calculi in the hepatobiliary pancreatic system. The Cystic duct calculus was present in one, absent in 28 patients and the duct could not be visualized in one patient. The Common bile duct calculus was visualized in 2 patients, absent in 17 and not visualized in 11 patients. The gall bladder calculus was present in 14 and absent in 14 patients. Contracted gall bladder was seen in one patient. The pancreatic duct calculus was seen in 3 patients.

Table 6: Calculi in USG

Calculi in USG	Absent (n)	Non-visualized (n)	Present (n)	Contracted (n)
Cystic duct	28	1	1	0
Common bile duct	17	0	2	0
Gall Bladder	14	0	14	1
Pancreatic duct	26	1	3	0

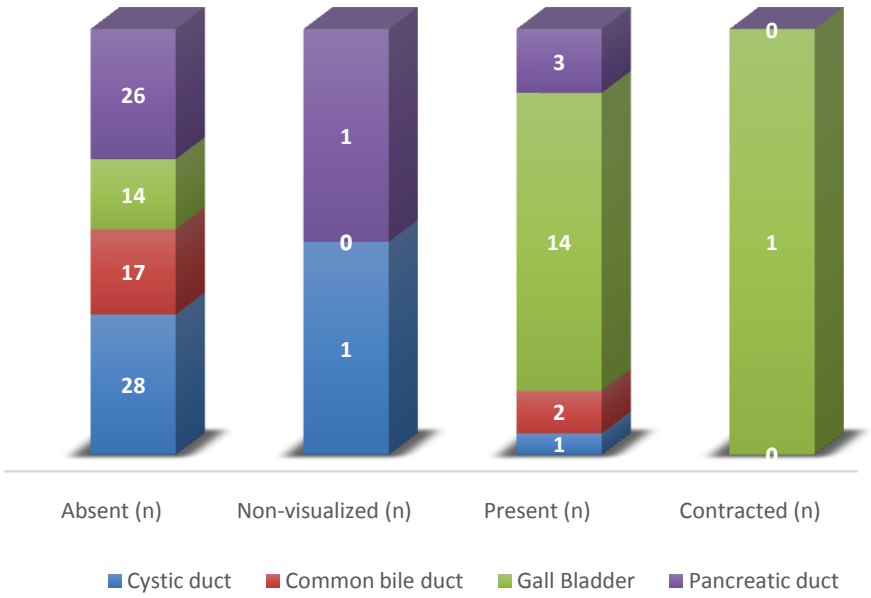

Chart 5: Calculi in USG

CALCULI STATUS IN MRCP

MRCP evaluation was done to see for calculi in the hepatobiliary pancreatic system. Cystic duct calculus was present in three and absent in 26 patients. The Common bile duct calculus was visualized in 11 patients and absent in 19. The gall bladder calculus was present in 16 and absent in 14 patients. In one patient, gall bladder was seen to be contracted. The pancreatic duct calculus was seen in 4 patients.

Table 7: Calculi in MRCP

Calculi in MRCP	Absent (n)	Dilated (n)	Present (n)	Contracted (n)
Cystic duct	26	0	3	0
Common bile duct	19	0	11	0
Gall Bladder	14	0	16	1
Pancreatic duct	26	1	4	0

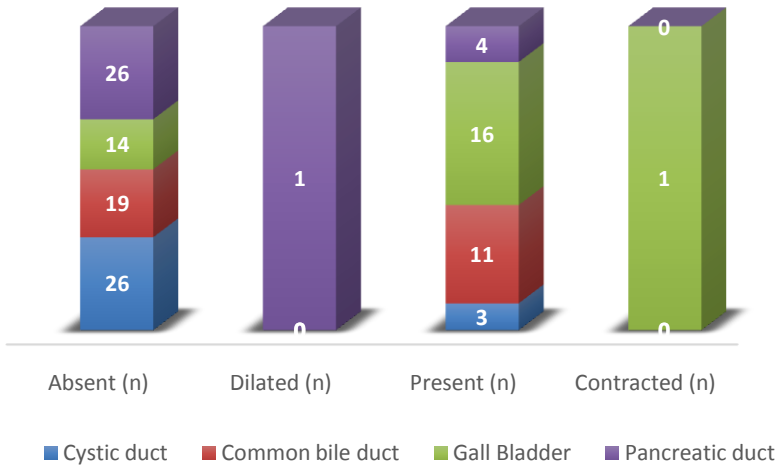

Chart 6: Calculi status in MRCP

LOCAL EFFECT/METASTASES

In 14 patients local effects and metastases were not seen and rest of the patient's details are given in table 9. Gall bladder wall thickening with pericholecystic fluid were seen in 6 patients, Organ invasion was observed in 5 patients and complications of pancreatitis was recorded in 2 patients.

Table 8: LOCAL EFFECT/METASTASES

Local effects/Metastases	Frequency	%
Nil	14	46.7
GB WT With Pericholecystic Fluid	6	20.0
Complications of Pancreatitis (Pseudocyst and Walled Off Necrosis)	2	6.7
Cholangitic Abscess	1	3.3
GB WT (Includes Irregular Gb WT)	1	3.3
GB WT	3	10.0
Organ Invasion (Liver Metastases/Liver Infiltration/Stomach/ Duodenum Infiltration)	5	16.7
Vessel Invasion	3	10.0

FINAL DIAGNOSIS ON USG

The final diagnosis of the patients who underwent USG are given in table 10.

Table 9: FINAL DIAGNOSIS ON USG

Final diagnosis on USG	Frequency	%
Calculous Cholecystitis	3	10.0
Distal CBD Obstruction	5	16.7
Chronic Calcific /Chronic Pancreatitis/Walled Off Necrosis of Pancreas	6	20.0
Cholelithiasis	10	33.3
Cholangiocarcinoma	4	13.3
Normal	2	6.7
Choledocholithiasis/ Hepatolithiasis	3	10.0
Acute Pancreatitis	1	3.3
Pancreatic Neoplasm	1	3.3
Gangrenous Cholecystitis	1	3.3
Contracted GB with wall thickening	1	3.3
Distal CBD obstruction	7	23.3

FINAL DIAGNOSIS ON MRCP

The final diagnosis of the patients after MRCP are given in the table 11

Table 10: FINAL DIAGNOSIS ON MRCP

	Frequency	Percentage
Calculous Cholecystitis	6	20.0
Choledocholithiasis	10	33.3
Chronic Calcific Pancreatitis/Chronic Pancreatitis/ walled of necrosis of pancreas	5	16.7
Acute pancreatitis	3	10.0
Cholangiocarcinoma	5	16.7

Benign stricture of CBD	4	13.3
Cholelithiasis	1	3.3
Cholangitic abscess	1	3.3
GB Carcinoma	1	3.3
Choledochal Cyst	1	3.3
GB Perforation	1	3.3
Hepatolithiasis	1	3.3

BENIGN or MALIGNANT,

On USG:

The diagnosis on USG showed majority (23 Nos.) were benign lesion, malignant in 2 patients and inconclusive in 5.

Table 11: Benign or malignant,on USG

Table 12: On USG	**Frequency**	**Percentage**
Benign	23	76.7
Inconclusive	5	16.6
Malignant	2	6.7

On MRI:

The diagnosis on MRCP showed majority (23 Nos.) were benign lesion, and malignant in 7 patients.

Table 13: Benign or malignant,on MRI

Table 13: On MRI	**Frequency**	**Percentage**
Benign	23	76.7
Malignant	7	23.3

Comparison of USG findings to HPR findings

There were 5 inconclusive results in USG, and those were excluded. The sensitivity of the USG to detect malignant cases is 25% and the specificity to rule out malignancy is 95.2%. The positive predictive value is 50% and negative predictive value of USG is 86.9%.

Table 14: Comparison of USG report to HPR

		Gold standard HPR		**Total**
		Benign (n)	**Malignant (n)**	
USG	**Benign (n)**	20 *True negative*	03 *False negative*	**23**
	Malignant (n)	01 *False Positive*	01 *True positive*	**2**
	Total	21	04	**Total (n) 25**
	Measures	***Specificity 95.2%***	***Sensitivity 25 %***	
Chi-square test value 1.869 (d.f 1); p value 0.171				

Sensitivity of USG scan 25.0%
Specificity of USG scan 95.2 %
Positive Predictive value 50.0%
Negative Predictive value 86.9%
True positives – 1 (Both USG and HPR findings coinciding)
True negative – 20(Both USG and HPR findings coinciding)

Comparison of MRCP findings to HPR findings.

There was 1 inconclusive result in MRCP, and that was excluded. The sensitivity of the MRCP to detect malignant cases is 57.4% and the specificity to rule out malignancy is 90.9 %. The positive predictive value is 66.6% and negative predictive value of USG is 86.9%.

Table 15: Comparison of MRCP report to HPR

Table 16: Comparison of MRCP report HPR		**Gold standard HPR**		**Total**
		Benign (n)	**Malignant (n)**	
MRCP	**Benign (n)**	20 *True negative*	03 *False negative*	**23**
	Malignant (n)	02 *False Positive*	04 *True positive*	**06**
	Total	22	07	**Total (n) 29**
	Measures	***Specificity 90.9 %***	**Sensitivity *57.4 %***	
Chi-square test value 7.4729 (d.f1); p value 0.006				

Sensitivity of MRCP scan 57.4%
Specificity of MRCP scan. 90.9%
Positive Predictive value 66.6%
Negative Predictive value 86.9%
True positives – 4 (Both MRCP and HPR findings coinciding)
True negative – 20(Both MRCP and HPR findings coinciding)

IV. Discussion

Diagnosing patients with suspected biliary or pancreatic pathologies in their early stage is most important in the 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. With the introduction of MR Cholangiopancreatography in addition with conventional MRI in diagnosing biliary and pancreatic ductal pathologies ,invasive procedure like ERCP can be avoided solely for the purpose of diagnosis.

Age and Gender wise distribution :

In our study the gender distribution showed that males were the majority. The mean age of the study population was 50.3 ± 14.4 years, in that females were having higher mean age. The age and gender wise distribution showed males were higher in age groups 31 to 40 years (25 %), and females were highest in the age group 41 to 50 and 51 to 60 years (35.7 % each). Our results are similar to a study done by Shivanand et al (2015) where the mean age of study population was 46.6 years.140Similar results have also been reported by Gajbhiye et al (2013) who reported higher number of patients in the age group of 40 – 70 years.[7]

Presenting Complaints :

In our study pain abdomen was the most common presenting complaint (93.3%), followed by vomiting in 20 patients (66.7%) and jaundice in 18 (60%). All three complaints were presented in 13 patients (43.3%).Our results are comparable to studies by other researchers who also reported pain abdomen as the most common symptom.[8,9]

Calculus in USG and MRCP :

In our study ,USG investigation was done to find out the presence of calculus in the hepatobiliary pancreatic system. The Cystic duct calculus was present in one, absent in 28 patients and the duct could not be visualized in one patient. The Common bile duct calculus was visualised in 2 patients, absent in 17 and not visualized in 11 patients. The gall bladder calculus was present in 14 and absent in 14 patients. Contracted gall bladder was seen in one patient. The pancreatic duct calculus was seen in 3 patients. MRCP evaluation was done to see for calculi in the hepatobiliary pancreatic system. Cystic duct calculus was present in three and absent in 26 patients. The Common bile duct calculus was visualised in 11 patients and absent in 19. The gall bladder calculus was present in 16 and absent in 14 patients. In one patient, gall bladder was seen to be contracted. The pancreatic duct calculus was seen in 4 out of 30 patients. Our study is in concordance with Soto et al 2000;In their study they found ,sensitivity of 94% and specificity of 100% for detecting biliary calculi in

MRCP.[10] Stephan et al 2006,in their study found the sensitivity of diagnosing CBD calculus was 87% and our study showed more superior results.[11]

Diagnostic Evaluation of Benign and Malignant Pathologies by USG& MRCP :

In our study the diagnosis on USG showed majority (23 Nos.)were benign lesions,malignant in 2 patients and inconclusive in 5.The diagnosis on MRCP showed majority (23 nos.)were benign lesions, and malignant in just 7 patients. The sensitivity of the USG to detect malignant cases was 25% and the specificity to rule out malignancy was 95.7%.The positive predictive value was 50% and negative predictive value of USG was 86.9%.The sensitivity of the MRCP to detect malignant cases was 57.4% and the specificity to rule out malignancy was 90.0%. The positive predictive value was 66.6% and negative predictive value of MRCP was 86.9%.

As per Kurian et al(2015), the sensitivity and specificity of ultrasonography in detecting malignant lesions were 83.33% and 94.4% with a positive predictive value of 83.33% and negative predictive value of 94.4%. The sensitivity and specificity of MRCP in detecting malignant lesions were 81.25% and91.66% with a positive predictive value of 81.25% and negative predictive value of 91.66%. [12]

Overall sensitivity and specificity of USG was low in comparison to MRCP. Multiple non-invasive & invasive methods have been used for the diagnosis of calculi in the bile duct. MRCP demonstrates a high sensitivity & specificity in detection of malignancy in comparison to USG and has very high positive predictive value & also negative predictive value. Adamek, et al.[13] studied the diagnostic accuracy of MRCP to determine whether MRCP may help to prevent unnecessary interventional procedures. In other similar study Stiris MG, et al.[14] performed a study to identify the effectiveness of MRCP and found that the sensitivity was 87.5%& positive predictive value was 96.6%.

Table 17: Comparison of benign and malignant pathologies by USG&MRCP

Authors	USG		MRCP	
	Sensitivity	Specificity	Sensitivity	Specificity
Kurian et al (2015)	83.33%	94.4%	81.25%	91.66%
Ferrari FS et al (2005)	61.12%	98.23%	72.23%	97.34%
Safa Al-Obaidi et al (2007)	36.3%	80.7%	90.0%	97.8%
Verma SR et al (2010)	85.3%	88.4%	92.3%	86.0%
Amandeep et al (2014)	79.17%	96.15%	95.83%	100.0%
Our present study	2 5.0%	95.7%	57.4%	90.9%

A study conducted by Onishi H et a1.[15]concluded that MR cholangiopancreatography at 3.0 T revealed equivalent or superior image quality compared with that at 1.5 T.

V. Conclusion

Ultrasound is a reasonably good diagnostic modality in diagnosing biliary obstruction, however the ability of ultrasound in diagnosing exact cause of biliary obstruction is limited. In our study, ultrasound could diagnose the causes of biliary dilatation in only 25% of cases, though the biliary dilatation was diagnosed in 95.2% of cases.

MRCP had the diagnostic accuracy of 90.9% in diagnosing the cause of biliary dilatation, in addition to identifying biliary dilatation.

The diagnostic accuracy of MRCP in our study showed that the sensitivity was better than USG in diagnosing malignancy. The ability of MRCP to exclude all malignancy and diagnose benign cases was higher than USG.

In conclusion, ultrasonography is an excellent modality as a screening tool in evaluating biliary obstruction, but MRCP is superior to ultrasonography in identifying the cause of biliary obstruction in addition to diagnosing biliary dilatation.

Further studies are required in evaluation of pancreato hepato biliary pathology using ultrasonography and MRCP.

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IMAGE GALLERY

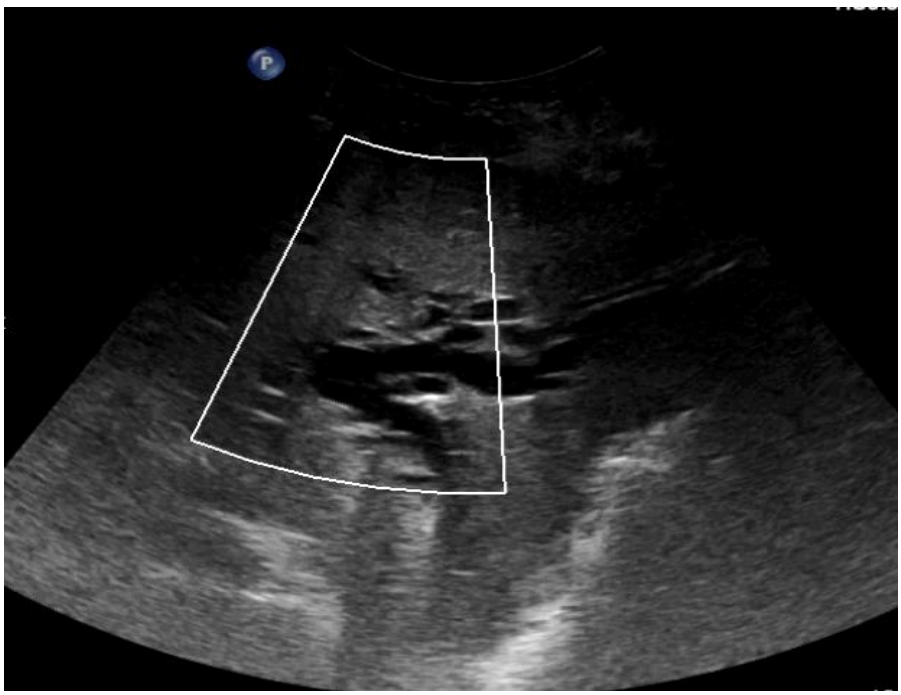

Image 1a: Ultrasonography of a 26 year old male patient showing moderate intrahepatic biliary radical dilatation

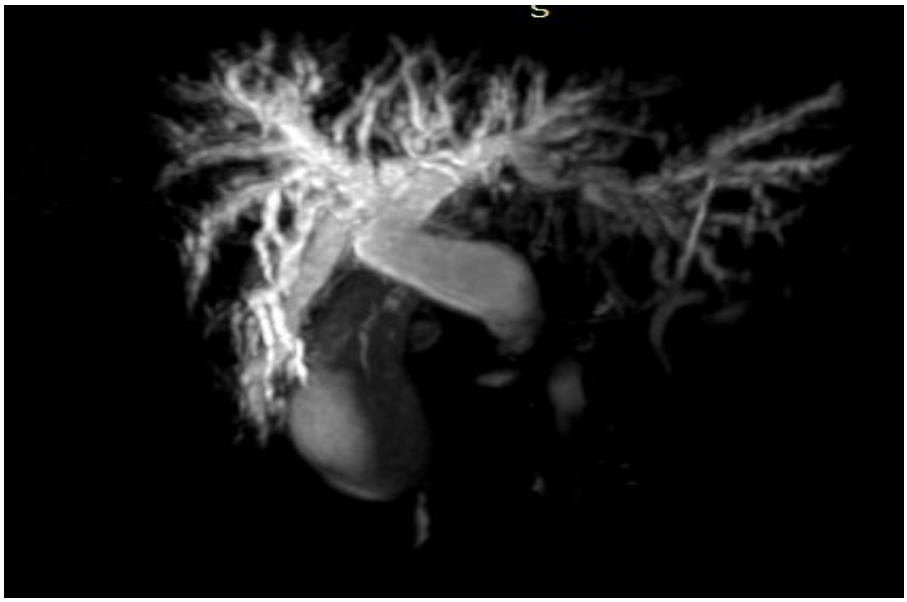

Image 1 b:3D MRCP image of the same patient showing severe bilobar intrahepatic biliary radical dilatation with benign stricture of distal CBD

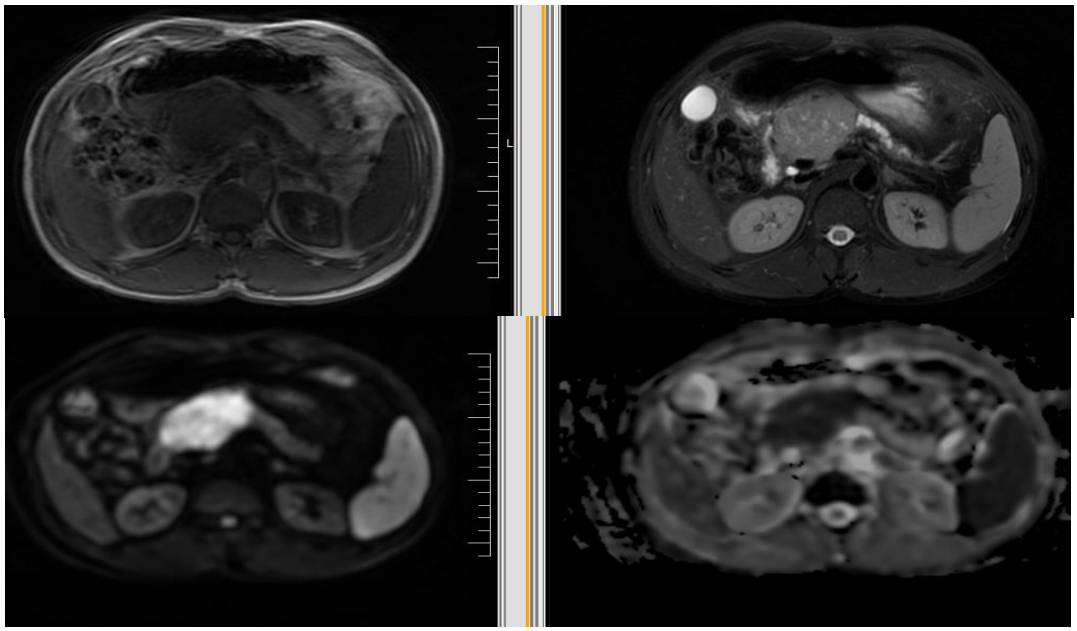

Image 2b: Axial T1 W ,T2FS , DWI and ADC images of the same patient .T2 hyperintense diffusion restricting mass lesion in the region of head and uncinate process of pancreas- suggestive of carcinoma head of pancreas.HPE confirmed the diagnosis .

Image 3a: Ultrasonography of a 65 year old female patient showing calculous within the gall bladder with pericholecystic fluid and wall thickening - calculous cholecystitis

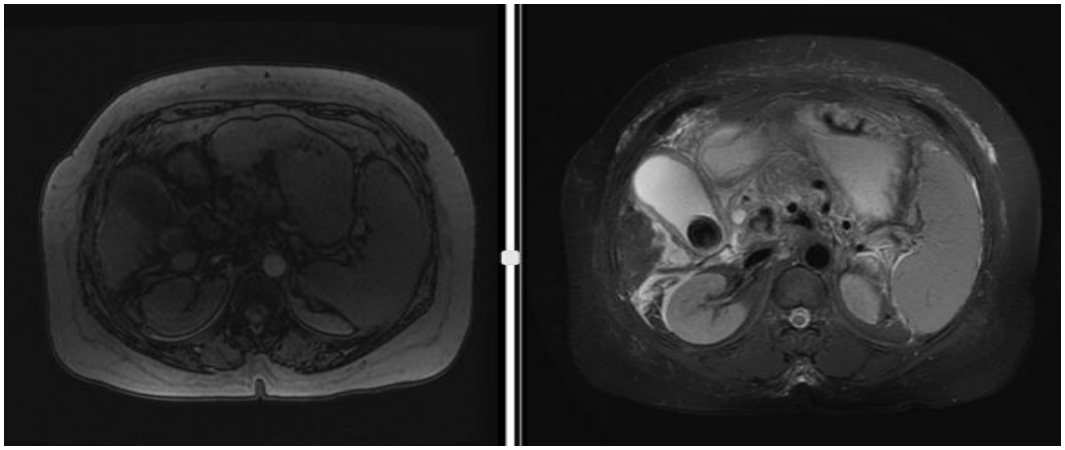

Image 3b: Axial T1 and T2 W FS images confirmed the findings of ultrasonography- calculous cholecystitis

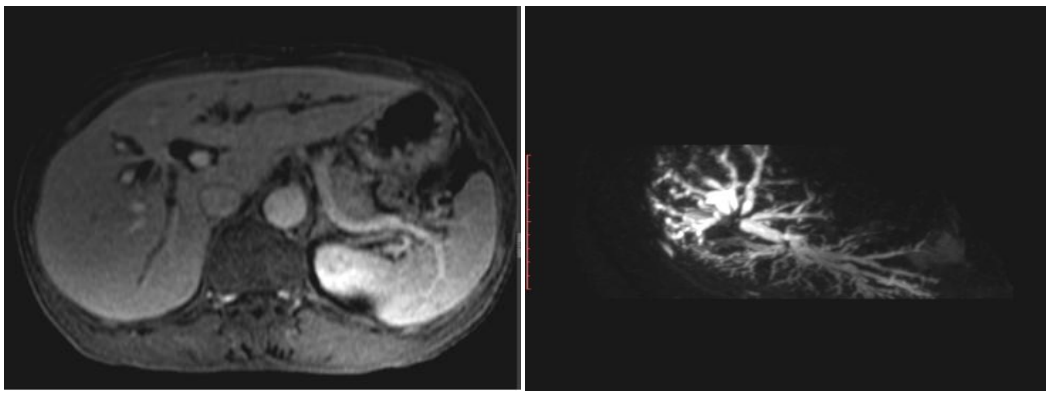

Image 4: Contrast enhanced and 3D MRCP images showing cholangiocarcinoma type II

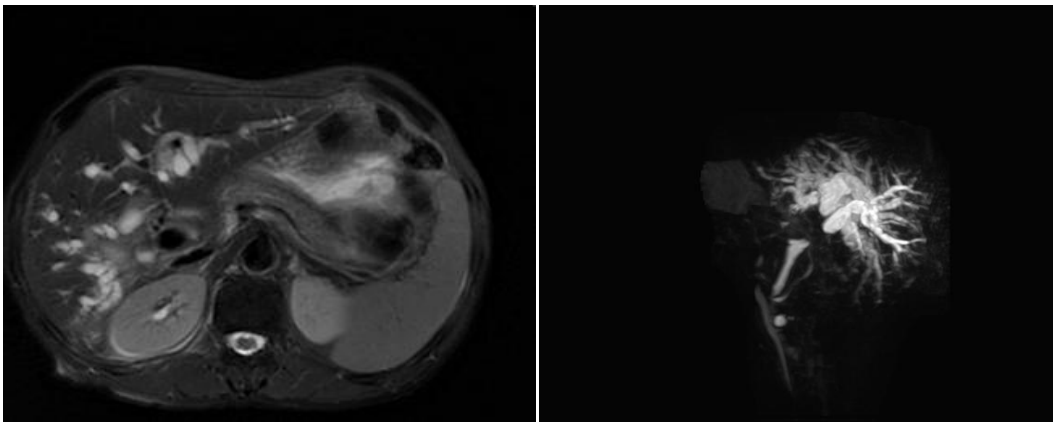

Image 5: T2 FS and 3D MRCP images .Lesion at confluence with extension into right branch of intrahepatic biliary radicle -cholangiocarcinoma type IIIa

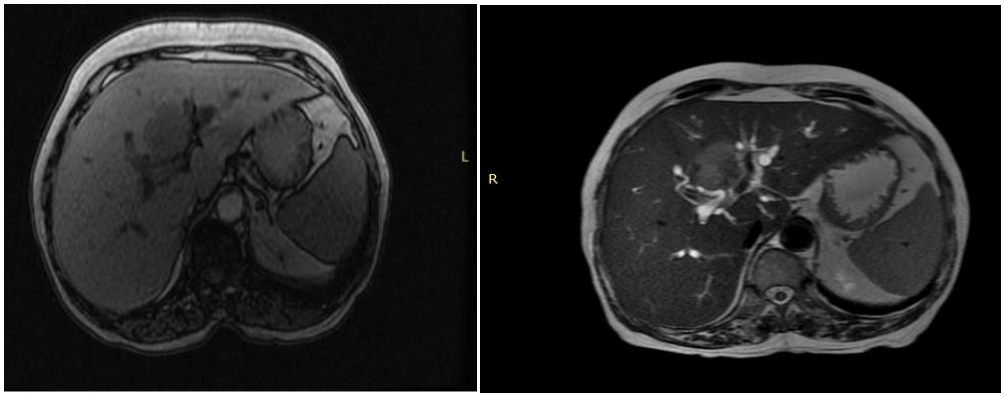

Image 6: Axial T1 and T2 W images .Lesion extending into the bifurcation of both right and left hepatic ducts. Mass forming type of cholangioarcinoma -cholangiocarcinoma type IV

Image 7a: Ultrasound image showing echogenic soft tissue mass lesion within the confluence of hepatic ducts causing IHBRD-could represent hilar cholangiocarcinoma.

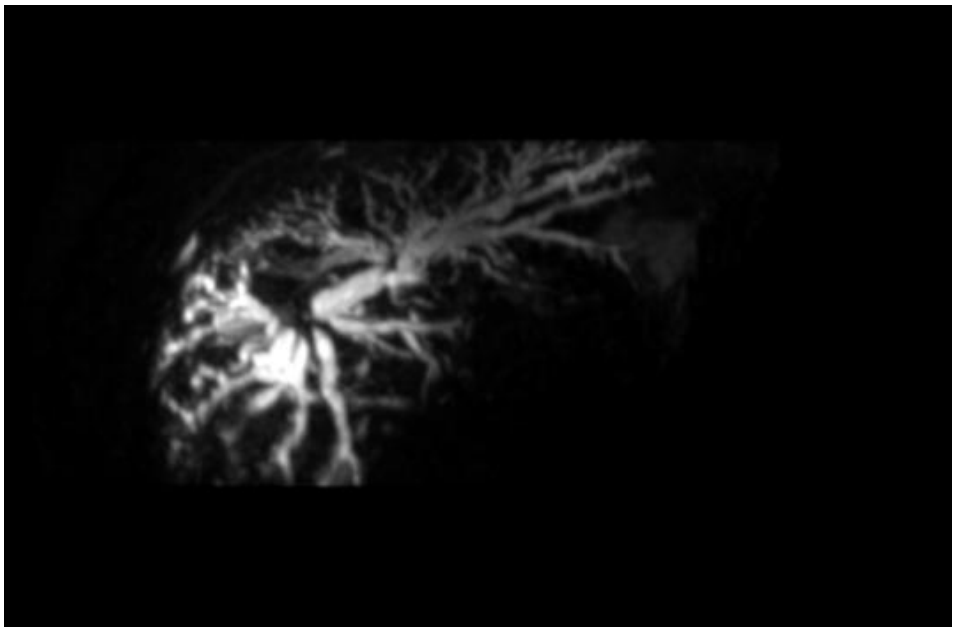

Image 7b: 3D MRCP showing hilar cholangiocarcinoma.HPE proved the diagnosis.

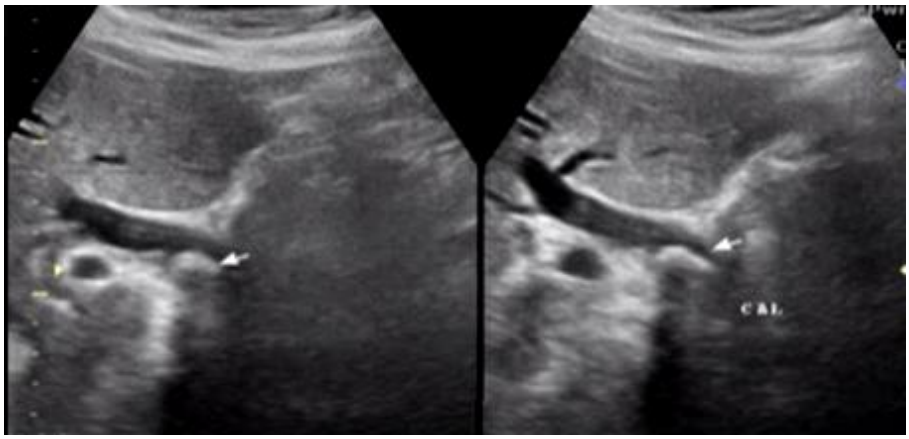

Image 8: Ultrasonography showing calculus in the distal common bile duct showing posterior acoustic shadowing--choledocholithiasis

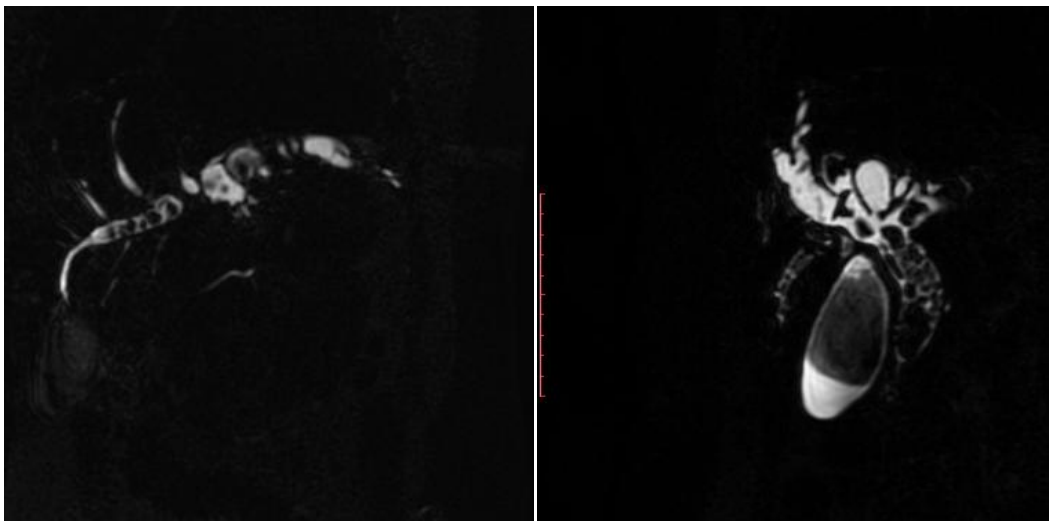

Image 9: 3D MRCP image showing *multiple filling defects in the gall bladder, intrahepatic biliary radicals, common hepatic duct and common bile duct , suggestive of multiple calculi –case of* ***cholecystolithiasis with choledocholithiasis and hepatolithiasis***

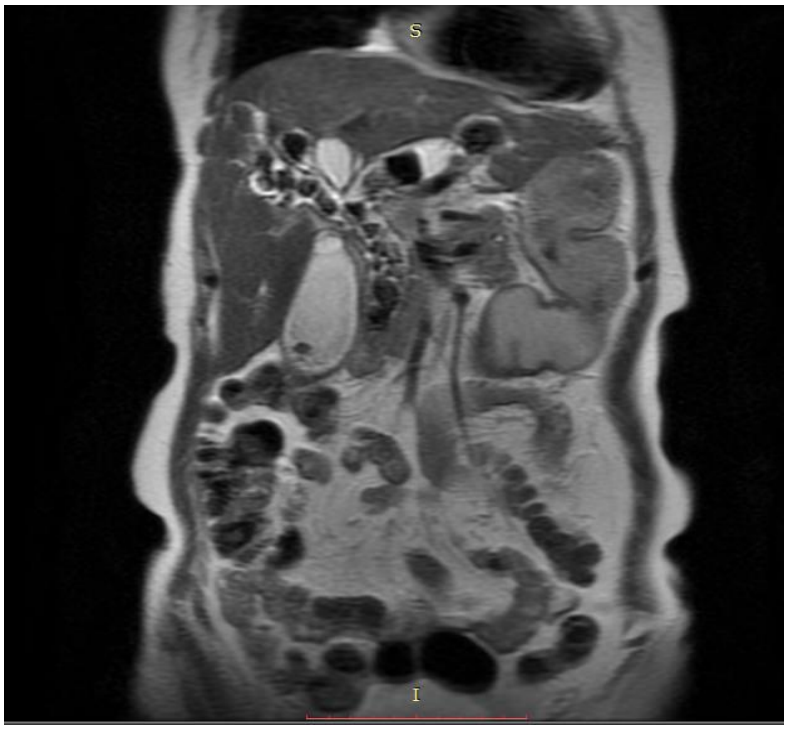

Image 10: Coronal T2W image showing choledocholithiasis with hepatolithiasis.

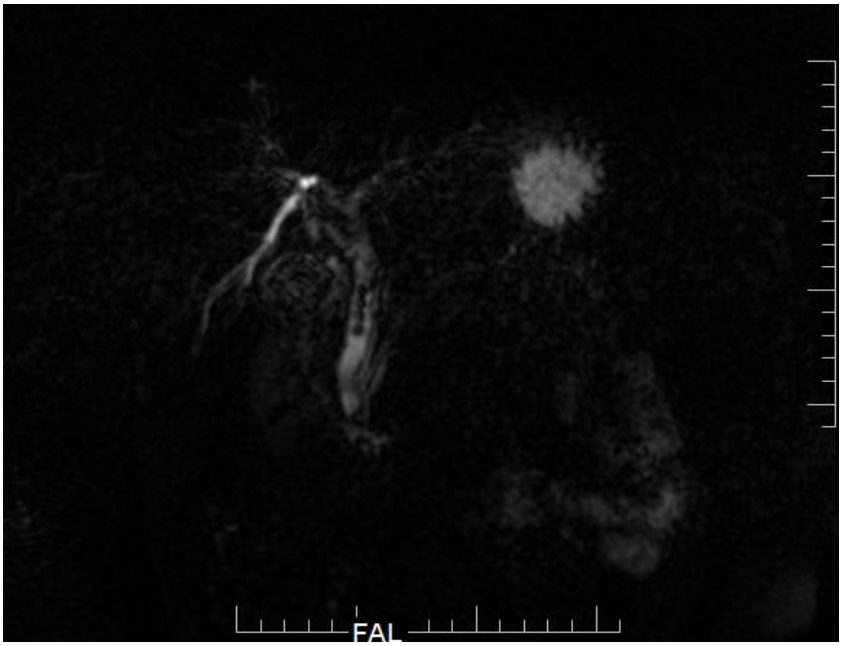

Image 11: MRCP showing multiple filling defects in the common bile duct, suggestive of calculi-choledocholithiasis

Image 12a: **Ultrasonography in a 28 year old male showing atrophic pancreas with intraparenchymal calcifications-chronic calcific pancreatitis**

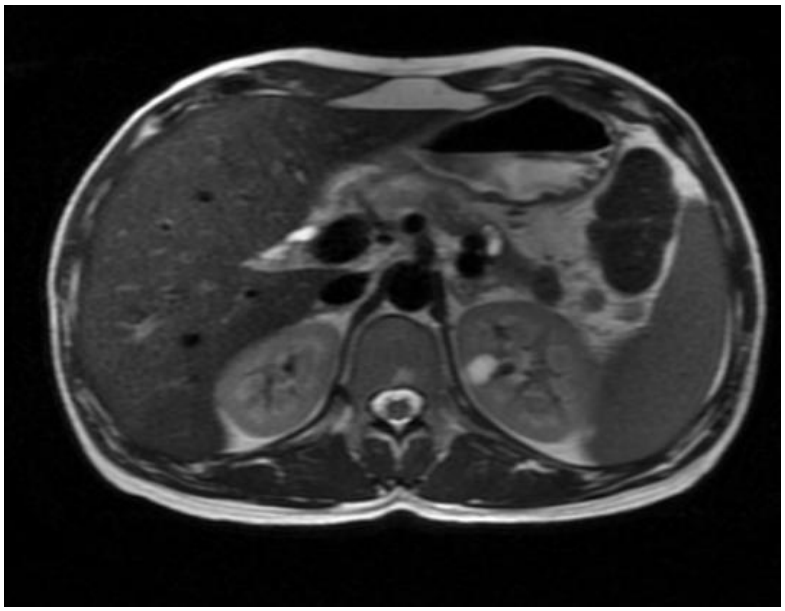

Image 12b : Axial T2W image of the same patient showing atrophic pancreas with intraparenchymal calcifications-chronic calcific pancreatitis.

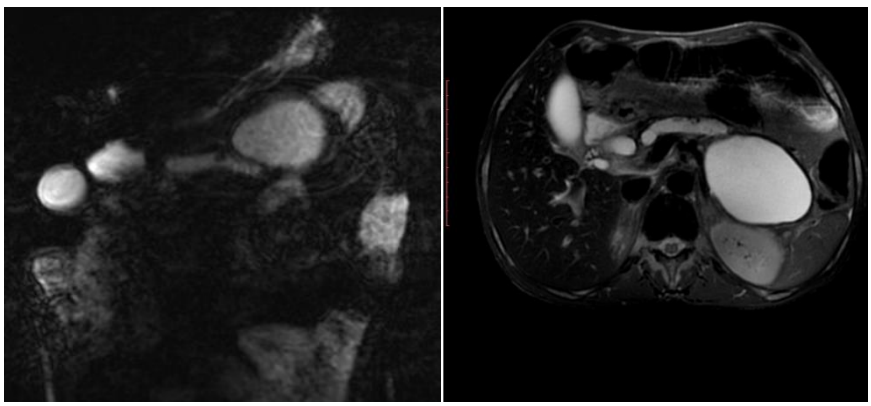

Image 13: 3D projection MRCP and axial T2FS images showing atrophic pancreas with dilated MPD; intraductal calculi and pseudocyst from tail of pancreas -chronic calcific pancreatitis with pseudocyst

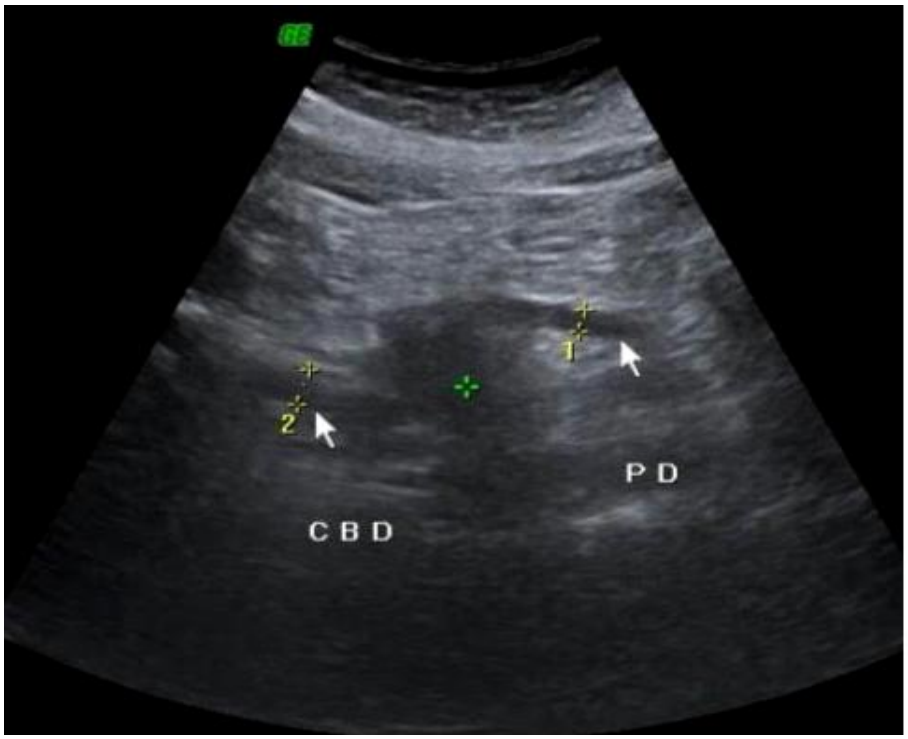

Image 1: Ultrasonography of a 40 year old male showing hypoechoic mass lesion in the region of head and uncinate process of pancreas with dilated CBD and PD.

Image 14a: Ultrasonography showing rent in wall of gall bladder with pericholecystic fluid

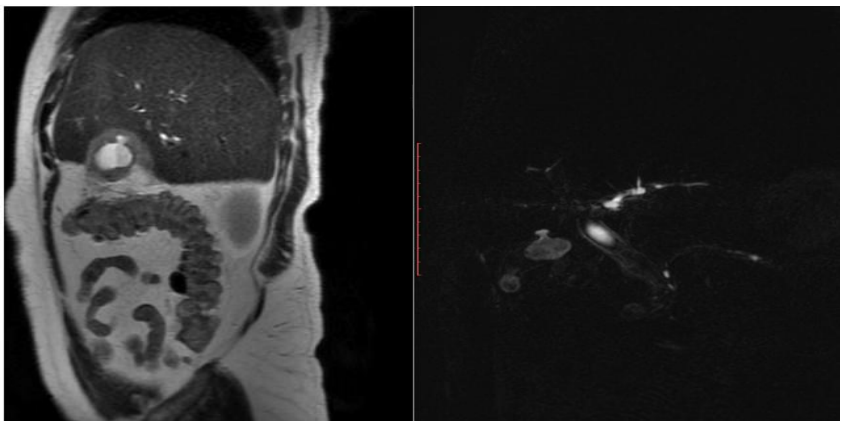

Image 14b: Sagittal T2W and 3D MRCP images showing rent in the wall of gall bladder -gall bladder perforation