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An Analysis of Magnetic Resonance in a Cross-Sectional Study Diagnosing Pancreaticobiliary Diseases with Cholangiopancreatography

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ABSTRACT

Prior evaluations of suspected biliary blockage have made use of a variety of imaging modalities, including Ultrasonography (USG), Computed Tomography (CT), and Invasive Cholangiography (IVC). Endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic cholangiogram (PTC) are invasive procedures that are necessary due to the restriction of ultrasonography (USG) and computed tomography (CT) in visualising intraductal stones. Noninvasive magnetic resonance cholangiopancreatography (MRCP) offers clear pictures of the liver and gallbladder.

Using a Siemens Magnetom Symphony 1.5 T with a field of view of 50 cm, a quantum gradient, and an RF application system with Syngo Windows based software version, 50 patients with pancreaticobiliary disorders underwent magnetic resonance cholangiopancreatography (MRCP) at KBNTGH linked to KBNUFMS in Kalaburagi over the course of 1.5 years.Using all of the MRCP sequences and photos, my guide checked for pancreaticobiliary disorders. Surgical follow-up, endovascular revascularization, biopsy, and histology all corroborated the results. Thirteen of the fifty patients were men and nineteen were women. The most common age group was patients older than 40 years. Fourteen individuals (nine men and five women) out of fifty who had MRCP developed cholangiocarcinoma.

Out of the total number of patients, 11 had pancreatits (eight men and three females), 7 had choledocholithiasis (two males and five females), 06 had periampullary carcinoma, 05 had pancreatic cancer, 03 had gall bladder cancer, and the remaining patients had post-operative stricture/choledochal cyst. Out of the 12 patients who had biliary strictures, 5 had benign strictures and 7 had malignant ones. Distal common bile duct benign strictures were prevalent. At the point where the right and left major hepatic ducts meet, malignant strictures often formed.

Magnetic resonance imaging (MRI) and magnetic resonance contrast pulsography (MRCP) are sensitive, non-invasive imaging techniques that help with early illness identification and diagnosis and provide important insights about treatment and prognosis.

Keywords: Pancreatico-Biliary diseases; cholagiocarcinoma; chronic pancreatitis; Magnetic Resonance Cholangio-Pancreatography (MRCP); Ultrasonography (US); Computed Tomography (CT); Endoscopic Retrograde Cholangio-Pancreatography (ERCP).

I.INTRODUCTION

Prior evaluations of suspected biliary blockage have made use of a variety of imaging modalities, including Ultrasonography (USG), Computed Tomography (CT), and Invasive Cholangiography (IVC). Endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic cholangiogram (PTC) are invasive procedures that are necessary due to the restriction of ultrasonography (USG) and computed tomography (CT) in visualising intraductal stones. One non-invasive imaging technique that offers clear pictures of the biliary tract is magnetic resonance cholangiopancreatography (MRCP).

There are now two main non-invasive diagnostic procedures for bile duct obstruction: ultrasonography (USG) and computed tomography (CT). However, as compared to endoluminal retrograde cholangiopancreatography (ERCP), the sensitivity of both approaches is limited, limiting their accuracy in detecting stones in the common bile duct. However The ERCP operation is associated with a 1-7% morbidity rate and a 0.2%-1% death rate; it is also an invasive method that depends on the operator. 2.

Given the limits of USG and CT as well as the invasiveness of PTC, IVC, and ERCP, a noninvasive imaging technique that provides high resolution projection pictures of the biliary and pancreatic ducts is necessary.

Magnetic resonance imaging (MRI) confirms the diagnosis of several pancreaticobiliary tract diseases.In primary sclerosing cholangitis, magnetic resonance imaging (MRI) may reveal a number of telltale signs, such as anomalies in the bile ducts, thickening of the liver's wall, and an increase in the enhancement of the extrahepatic bile duct.

Magnetic resonance imaging (MRI) clearly shows signs of haemorrhage and pseudocyst development, which help to differentiate acute pancreatitis from chronic pancreatitis. Contrasting localised enlargement from pancreatic cancer with that from chronic pancreatitis is often possible using magnetic resonance imaging (MRI)4. Furthermore, it may reveal the full scope of gall bladder cancers and aid in disease staging5.Intestinal gas shadow is not an issue with this non-invasive imaging method, unlike USG, which uses ionising radiation.

Due to its inherent high contrast resolution, multiplanar capability, rapidity, and virtually artefact free display of anatomy and pathology in the region, magnetic resonance cholangiopancreatography (MRCP) has evolved greatly since its 1991 introduction by Wallner, who mainly used it as an optional imaging sequence. Newer pulse sequences and stronger magnetic fields have made MRCP the imaging modality of choice for patients with pancreaticobiliary diseases.

When compared to direct cholangiography, these projectional-type pictures produced by this imaging technology look and feel just as professional. There is no need for an operator since it does not include the use of ionising radiation or intravenous (IV) contrast. Recent research has shown that MRCP can reliably detect 81-100% of common bile duct stones. There is enough anatomical detail to see biliary strictures to tell how much blockage there is and, in certain cases, to tell benign from malignant reasons. There may be two main benefits to MRCP for neoplastic pancreatico-biliary blockage. If you want to know what else MRCP may show, it's the extraductal tumour. ERCP, on the other hand, just shows the duct lumen. The second advantage of MRCP is that it does not have the 3% significant complication rate that ERCP has, which includes complications including infection, haemorrhage, bile leak, and death6.

It is very difficult to diagnose and cure neoplasms of the pancreatic and bile ducts. These tumours may start in the ducts or spread to other parts of the pancreas, gall bladder, pancreas, or nearby lymph nodes, affecting the pancreatico-biliary tree as a secondary site of involvement. It is crucial to establish the amount of blockage and its source before deciding on a treatment.

Against this backdrop, the study's overarching goal is to evaluate MRI's precision in a prospective setting.

II. AIMS AND OBJECTIVES

1 In order to learn how MRCP may help with pancreatico-biliary disease screening and diagnosis.
2 In order to investigate the magnetic resonance cholangiopancreatography (MRI) appearance of pancreaticobiliary disorders.

III. REVIEW OF LITERATURE

In 1986, MRCP was first detailed. Later on, because to technological advancements, non-invasive cholangiography became a viable diagnostic option. Using a breath-hold 2D T2W gradient echo sequence with Steady State Free Precision (SSFP), Wallner BK et al. conducted the first clinical application investigation using MRCP in 1991.

MRCP

The first clinical use of magnetic resonance imaging (MRCP) occurred more than ten years ago, when the method was still in its infancy and had dubious promise for imaging the pancreatic and biliary ducts. In MR computed tomography (MRCP), the stationary fluid generates a strong signal due to the use of rapid gradient echo sequences and highly T2W turbo spin echo sequences.

MRCP uses the fact that bodily fluids have a very strong signal on highly T2W MRI to its advantage. Tissues in the background provide some signal, whereas fluid-filled structures like the bile and pancreatic ducts show up as hyperintense regions. The use of a contrast agent is not necessary for MRCP because to the intrinsic signal intensity difference9, 10.

The standard method for doing MRCP involves employing a thoracic phased array coil in conjunction with either a thick collimation multisection approach or a single section technique, as well as fast spin echo or SSFSE (Single Shot Fast Spin Echo). One uses the axial plane to examine the pancreatic duct and CBD11, while the other uses the coronal plane to show cholangiography.

In 1991, the researchers Wallner BK et al. used a breath hold T2W gradient echo sequence that utilised SSFP. Cholangiograms were the results of these sequences' projection. These pictures of a dilated biliary tree were of satisfactory quality. Nevertheless, there was a severe lack of contrast for pancreatic and bile ducts of normal diameter. Low contrast between the abdominal backdrop and extra hepatic bile ducts, caused by high signal intensity from intra-abdominal fat, made it impossible to depict tiny structures. The sequence also had a huge field of view, required thick sections, and had a poor signal-to-noise ratio.

By using 3D-SSFP sequences, Morimoto et al. hoped to enhance picture quality and enable the usage of thinner slices. The limits of gradient echo sequences are evident in both 2-D and 3-D sequences. Magnetic susceptibility artefacts, such as clips made of metal or intestines, may wreak havoc on these sequences when they move. In addition, the SSFP sequences required lengthy breath holds, which restricted their use to patients who were cooperative and highly motivated. We added fast spin echo sequences. Motion artefacts, sluggish flow, and magnetic susceptibility were less of an issue for these episodes. There was a considerable improvement over SSFP sequences in terms of signal-to-noise and contrast-to-noise ratios. In the beginning, we used 2D Fast Spin Echo (FSE) sequences; later, we added 3D FSE respiratory triggered sequences, which allowed for thinner slices. The MRCP uses fast spin echo sequences, which may be either breath hold or non-breath hold techniques. Patients who are recalcitrant or who cannot maintain a prolonged breath hold are the primary candidates for the non-breath hold. The breath hold sequences produced superior images compared to the non-breath hold sequences12.

Takhera et al.'s breath hold sequences need a 44-second breath hold. There needed to be shorter breath hold sequences because of this lengthy hold period. There has been a recent introduction of modified FSE sequences. The acronyms RARE and half Fourier acquisition stand for "rapid acquisition with relaxation enhancement." The HASTE sequence is a single-shot turbo spin echo sequence.13. Laubenberger invented the RARE sequence, which is a one-shot echo planar procedure that uses a single thick oblique coronal slice ranging from 2 to 7 cm thick. This series of images shows the pancreatic ducts and biliary tree in one projectional picture. This sequence's main selling point is the short 2-to 7-second breath hold it demands. The sequence's drawbacks include the fact that the pictures are single projections, the lack of source images, and the impossibility of post processing. The solution is to take several oblique coronal pictures from various angles and planes.14.

The HASTE sequence is a turbo spin echo that uses half-fourier acquisition. In only 18 to 20 seconds of holding your breath, you may get several thin slices, each between 2 and 7 millimetres thick. The benefits of this method include the elimination of respiratory motion artefacts and the reduction of magnetic susceptibility artefacts caused by intestine and surgical clips to a minimal level. A large body of research has compared multislice HASTE sequences to 2D/3D FSE and Gradient Echo (GRE) SSFP sequences 15, 16, 17, and 18. With regard to the Signal-to-Noise (S/N) and Contrast-to-Noise (C/N) ratios, all the research indicated that multislice HASTE sequences were noticeably better than the alternatives. In order to determine the best MRCP sequence, several recent research have also compared the RARE and HASTE sequences.

Direct projectional pictures are a downside of RARE sequences, because they don't provide you any source images to work with afterwards. Compared to HASTE multi-slice sequences, RARE has a much poorer signal-to-noise and signal-to-noise ratio. It would seem that HASTE multi slice photos have better picture quality. In contrast to HASTE, RARE sequences are better at visualising the ampulla, periampullary region, and pancreaticobiliary tree abnormalities. When assessing the architecture and potential consequences of a pancreaticobiliary duct system that has undergone surgical alteration, half-fourier RARE MRCP is an effective imaging method.

Morimoto et al. found that single shot RARE had better picture quality, greater visibility, less artefact, and faster acquisition time than other methods. Nevertheless, bile duct stones could go unnoticed due to volume averaging. Consequently, choledocholithiasis suspicions should still lead to the acquisition of multislice HASTE sequences. In order to determine the diagnostic efficacy of single shot RARE sequences in pancreatic duct and intrahepatic duct disease 20, larger studies are necessary.

It is possible to overlook tiny CBD stones on HASTE multislice Multiple Intensity Projection (MIP) images because of the high biliary density. The HASTE multislice sequence and a rare photograph both show these stones. According to their research, the HASTE multislice approach produces similarly good images either using 2 mm or 7 mm slice thickness.

Soto et al. compared non-breathhold 3D-FSE, double-slice half-Fourier RARE, and single-section half-Fourier RARE during breathholds. When it came to detecting choledocholithiasis, all three MRCP sequences were quite sensitive and specific21.

Researchers Hiroshi Kondo et al. found that while diagnosing choledocholithiasis, volume rendered MRCP performed better than both MIP and thick section MRCP in terms of observer performance. Reconstructing MRCP22 using volume rendering could be a viable option.

Pancreatic parenchyma evaluations use gadolinium-enhanced imaging. Around 30 to 45 seconds is when the typical peak enhancement occurs.22, 24. New rapid GRE T1W breath hold sequences like FLASH (rapid Low Angle Shot), Turbo FLASH, Fast Field Echo (FFE), or Fast Multiplanar Spoiled Gradient Recalled imaging (FMPSPGR) 21 provide the finest immediate post contrast images for evaluating the viability of the pancreatic parenchyma.

Volume imaging phased array multicoil systems have recently been developed25,26. When compared to imaging alone using a body coil, using a body phased array coil enhances the signal-to-noise and contrast-to-noise ratios 27, 28. Rapid sequences, a torso phased array coil, and a phased array coil work together to identify ducts as small as 1 mm29.

Reducing respiratory artefacts and abdominal wall motion is possible with phased array coils and wrapped array coils. Some drawbacks include the extra system's price, uneven signal intensity, and the fact that it doesn't cover the whole abdomen. The possibility of ascites or fluid accumulation obstructing ductal architecture is MRCP's main restriction. Nevertheless, the adoption of multi-oblique approaches may help somewhat address the challenges faced by Arslan et al. 30. The intestinal, pancreatic and biliary ductal systems, and even MRI are seeing more and more usage for evaluation. I am now evaluating novel approaches for magnetic resonance imaging (MR) that might potentially give functional and anatomical information. One such technique is diffusion and perfusion weighted pictures.[31].

ROLE OF KINEMATIC MRCP TO EVALUATE BILIARY DILATATION

Matos was the first to describe using serial MRCP images to study the sphincteric segment's dynamic changes; since then, this method has been applied to evaluate pancreatic exocrine function, uncover abnormal pancreatico-biliary duct union in choledochal cysts, and study the sphincteric segment's morphology and contractility.

In order to assess the shape and pliability of a typical sphincteric segment, Van hol explains how kinematic MRCP might be helpful. All patients without periampullary lesions showed signs of sphincter relaxation in this investigation, but only 2 out of 16 patients with periampullary lesions did. Therefore, periampullary blockage is present if kinematic MRCP does not reveal sphincteric relaxation. The sensitivity and specificity of the modality are 88% and 100%, respectively.

According to the results, kinematic MRCP may assist determine whether biliary dilatation needs intervention. It is not necessary to provide any medication or prepare for the treatment in advance. To further decrease the frequency of false negative and false positive instances, kinematic MRCP following cholecystokinin or fatty meal consumption may cause transitory biliary dilation, which would be helpful. In cases when biliary dilatation is present, kinematic MRCP may help establish if biliary intervention is necessary.[32].

ROLE OF DYNAMIC MRCP AFTER SECRETIN ADMINISTRATION:

Traditional methods still fail to show the whole pancreatic duct in certain cases. Excluding patients with ductal strictures greatly enhanced the visualisation of side branches in individuals with chronic pancreatitis. Since secretin did not improve picture quality, it should not be given to patients whose duct width was more than 5 mm before to administration. When compared to traditional MRCP, dynamic MRCP had a negative predictive value of 98%. There may be no need for endoscopic retrograde pancreatography (ERCP) since secretin dynamic investigations conclusively shown that individuals with suspected pancreatic illness did not really have the disease. One study found that secretin-enhanced MRCP may identify chronic pancreatitis with an 89% sensitivity rate, up from 77% before. Therapeutic intervention is unnecessary in cases of low-grade strictures in chronic pancreatitis seen following secretin administration; monitoring with dynamic MRCP imaging is enough in the event that clinical symptoms worsen. Patients suffering from severe blockage and chronic pancreatitis will not get any relief. With MRCP, the pancreatic duct may be better visualised in patients with pancreas divisum and chronic pancreatitis, which boosts diagnostic confidence. 33.

The diagnostic strategy for recurrent pancreatitis may include Secretin-MRCP as the first-choice technique. Comparable to endoscopic retrograde cholangiopancreatography (ERCP), it accurately detects the different etiological causes of recurrent acute pancreatitis. One of its benefits is that it makes diagnostic and therapeutic ERCPs more efficient by reducing the need for time-consuming procedures that aren't strictly essential. With Secretin-MRCP, we may measure pancreatic exocrine secretion and sphincter of Oddi resistance indirectly, and it's more accurate when it comes to pancreaticobiliary morphology than with Secretin-ultrasonography (USG-S). Even though Secretin-MRCP's diagnostic power isn't as great as manometry's in patients with suspected sphincter of Oddi dysfunction, it could help reduce the high rate of manometry-related pancreatitis by allowing doctors to selectively choose patients with a doubtful diagnosis to undergo manometry.

MR CHOLANGIOPANCREATOGRAPHY: IMPROVED DUCTAL DISTENSION WITH INTRAVENOUS MORPHINE ADMINISTRATION

With the exception of dilated segmental intrahepatic ducts, MR cholangiopancreatography consistently shows the major extrahepatic and intrahepatic bile ducts. However, in order to assess potential donors for living-related liver transplantation, it is essential to see their normal (i.e., nondistended) biliary system. Preoperative examination of potential liver donors commonly involves MR cholangiopancreatography because to the occurrence of variable biliary architecture.

If you want better images from your magnetic resonance cholangiopancreatography (MR cholangio) scan, try injecting yourself with some morphine beforehand. This will tighten the sphincter of Oddi, which will raise the pressure within the pancreatic and biliary channels and induce distension. Primary sclerosing cholangitis, malignant neoplasms (such as cholangiocarcinoma), cystic benign pancreatic neoplasms (that do not distort organs), and other conditions may benefit from morphine administration during examination.

People who have ferromagnetic or electronic implants, such as those for heart pacemakers, aneurysm clips, intraocular metal fragments, cochlear implants, implanted medication infusion devices, or prosthetic heart valves, should not undergo magnetic resonance cardiotomy (MRCP). Sometimes, MRI machines aren't big enough to accommodate obese individuals, so doctors will have to send them to a different facility that uses magnets with a more rectangular or open design. Examining people with claustrophobia may also benefit from an open MRI.[35].

IV. METHODOLOGY

STUDY DESIGN

A Cross sectional study.

SOURCE OF DATA

Patients admitted to the Department of Radio-diagnosis at Khaja Banda Nawaz Teaching and General Hospital, which is affiliated with Khaja Banda Nawaz University-Faculty of Medical Sciences in Kalaburagi, and who have a clinical suspicion or confirmed case of pancreatico-biliary illness are eligible for MRCP.

SAMPLE SIZE

We will be studying fifty examples. Fifty patients with pancreaticobiliary disease will be a part of the study. This number was determined by evaluating the average number of similar cases in the past three years at Khaja Banda Nawaz Teaching and General Hospital, which is connected to Khaja Banda Nawaz University-Faculty of Medical Sciences in Kalaburagi. During the 18 months of the research, there were around 50 instances, which is 80% of the average across three years.

INCLUSION CRITERIA

1. All patients with pancreaticobiliary disorders, whether suspected or proved, who were referred to the MRCP are included in the research.
2. Individuals identified using ultrasonography as having biliary tract pathology.
3. Patients of all age group.

EXCLUSION CRITERIA

1. Cardiac pacemaker implantation.

2. Prosthetic valves.

3. Cochlear implants.
4. Metal coils in blood vessels.
5. Any metallic orthopaedic implants.
6. Severe claustrophobia.
7. Pregnant and lactating women's.
8. New born.

STATISTICAL ANALYSIS

Data collection follows the proforma after the patient gives their consent to take part in the trial.
My guide will verify the results of the MRCP, and then we will save the photos on a CD.
We used IBM SPSS 25.0 to analyse the data. We built a master chart and distributed the collected data out on an Excel page. I used the master chart to build my tables and graphs. In order to analyse quantitative data, descriptive statistics such as mean and standard deviation were first calculated. To compare the means of two variables for statistical significance, an independent samples "t" test was utilised. In contrast, a chi-square test was employed for qualitative data analysis. A statistically significant result was defined for all comparisons when the p-value was less than or equal to 0.05.

EQUIPMENTS

Using Syngo, a Windows-based software version, the apparatus consists of a Siemens Magnetom Symphony 1.5 T with a field of view of 50 cm, quantum gradient, and RF application system.
Patients' full names, ages, sexes, occupations, and presenting ailments were part of the comprehensive clinical history. After that, the patient had a thorough physical examination, including a full evaluation of the abdomen and any other vital organs or systems.

PREPARATION OF THE PATIENT FOR THE SCAN

A 6-hour fast was required of all patients before the assessment. We performed the examination while the patient was lying down, holding their breath during inspiration. We employed respiratory triggering on a small number of very sick, recalcitrant youngsters.

MRI SCAN PARAMETERS

The following scan parameters were used for the patients.

SEQUENCES

Parameters	T2 HASTE	FLASH;FS	FLASH	FISP	T1 TSE	T2 TSE
TR (ms)	1000	100	145	4.3	800	2800
TE (ms)	83	2.66	4.76	2.15	16	1100
Flip Angle	150	70	70	10	160	150
FOV (mm)	300-350	350	350	300	340	350

Matrix	512x512	512x512	512x512	256x512	256x256	512x512
SliceThickness (mm)	4.0	5.5	5.5	5.0	5.0	5.0
TA	00.67 secs	11.5 secs	24.8 sec	0.18secs	2.08 min	1.26miN

Follow-up:- There was appropriate clinical, biochemical, and radiological follow-up for each case. The radiological diagnosis was cross-referenced with the endovascular catheterization (ERCP) results, surgical observations, and histology.

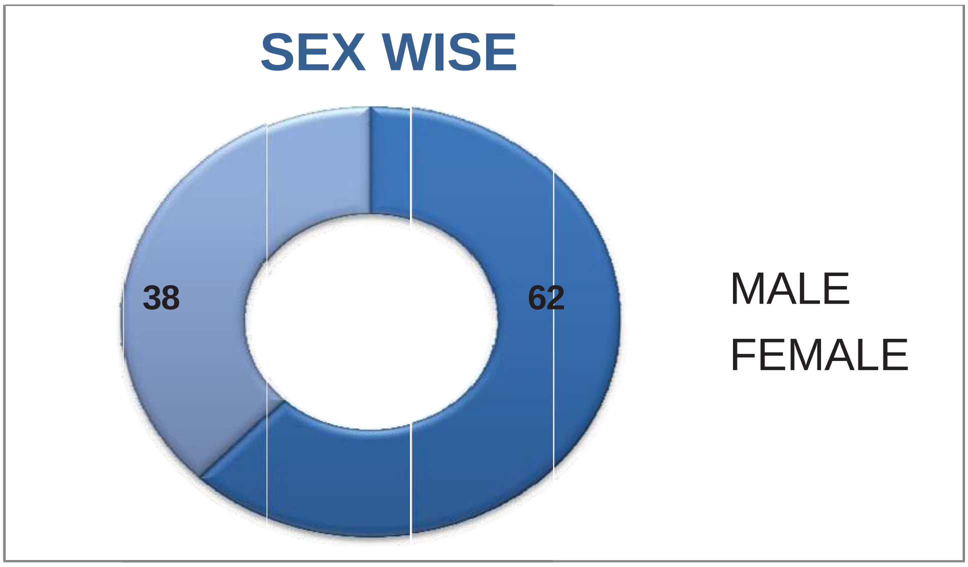
Fig.1- Siemens Magnetom Symphony 1.5 T, Quantum gradient and RF application system with Syngo windows based software version.

V. RESULTS

Table No.1Sex wise distribution of Pancreaticobiliary diseases

Sex	No. of Cases	Percentage
MALE	31	62 %
FEMALE	19	38 %
Total	**50**	**100**

Chart No.1 – Sex wise distribution of cases in Pancreaticobiliary diseases



In the present study there is male preponderance, male: female ratio being 1.6:1.

Table No.2 Age wise distribution of Pancreaticobiliary diseases

Age	No . of Cases	Percentage
≤20yrs	3	6 %
21-40yrs	6	12 %
41-60yrs	29	58 %
>60yrs	12	24%
Total	**50**	**100 %**

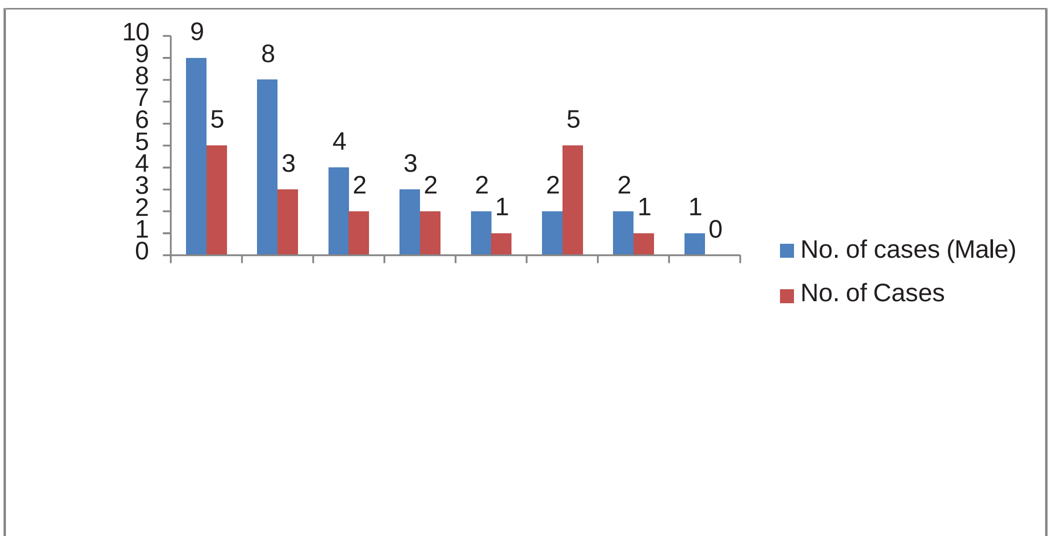
Table No.3 Various diagnoses of Pancreaticobiliary diseases on MRCP

Diagnosis	No. of cases	Percentage
CHOLANGIO CARCINOMA	14	28 %
CRONIC PANCREATITIS	11	22 %
PERIAMPULLARY CARCINOMA	6	12 %
CARCINOMA PANCREAS	5	10 %
CARCINOMA GALL BLADDER	3	6 %
CHOLEDOCHOLITHIASIS	7	14 %
POST OPERATIVE STRICTURE	3	6 %
CHOLEDOCHAL CYST	1	2 %
TOTAL	**50**	**100%**

Table No.4 Sex wise distribution of diagnosis on MRCP

Diagnosis	No. of cases (Male)	Percentage	No. of Cases (Female)	Percentage
CHOLANGIO CARCINOMA	09	29.03 %	05	26.31 %
CRONIC PANCREATITIS	08	25.80 %	03	15.78 %
PERIAMPULLARY CARCINOMA	04	12.90 %	02	10.52 %
CARCINOMA PANCREAS	03	9.67 %	02	10.52 %
CARCINOMA GALL BLADDER	02	6.45 %	01	5.26 %
CHOLEDOCHOLITHIASIS	02	6.45 %	05	26.31 %
POST OPERATIVE STRICTURE	02	6.45 %	01	5.26 %
CHOLEDOCHAL CYST	01	3.22 %	00	00 %
TOTAL	**31**	**100%**	**19**	**100%**

Chart No.2 Sex wise distribution of diagnosis on MRCP

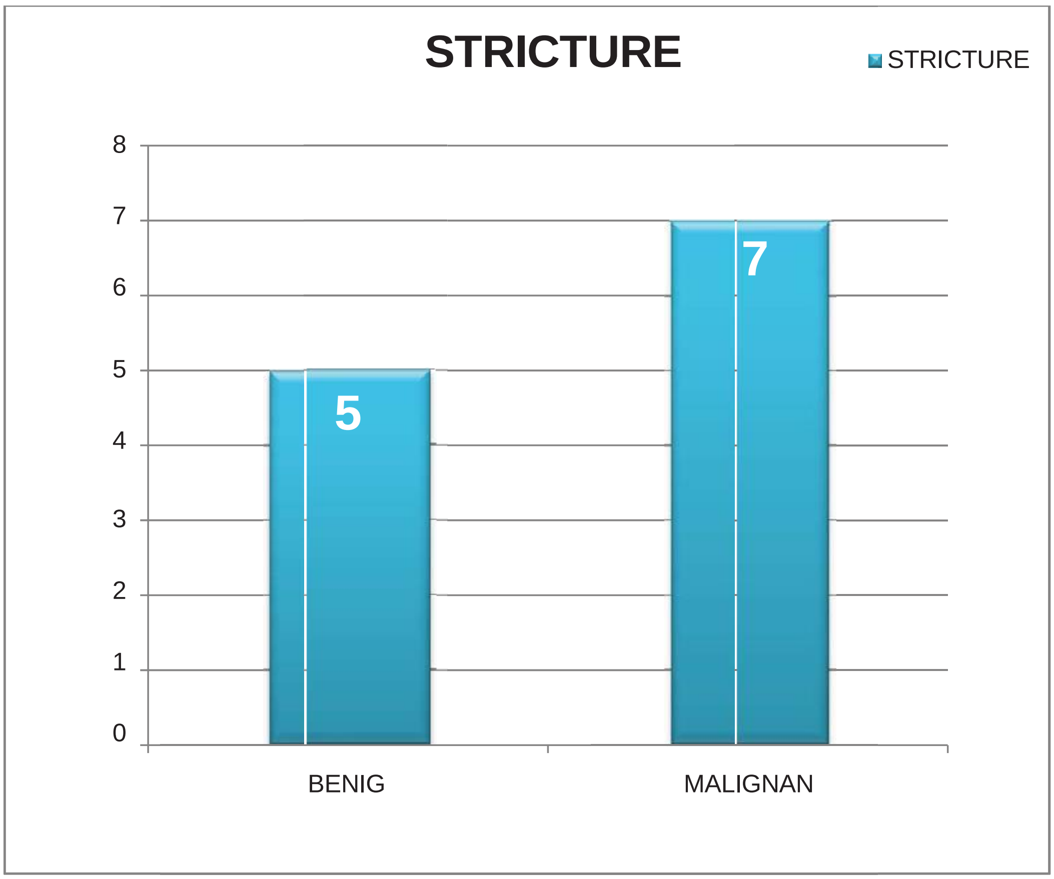


We discovered that choledocholithiasis was more prevalent in females, but cholangiocarcinoma and chronic pancreatitis were more common in men, respectively, in our research.

Table No.5 Pancr eaticobiliary diseases based on stricture (including pre perative a d postoperative strict res)

Type of Stricture	No. of Cases	Percentage
BENIGN	5	41.6%
MALIGNANT	7	58.4%
Total	**12**	**10 %**

Chart No.3 Pancreaticobiliary based on Stricture



The study reveals malignant strictures common than the benign strictures.

Table No.6 Benign Pancreaticobiliary diseases based on site of stricture

Site of Stricture	No. of Cases	Percentage
Proximal CBD	1	20 %
Distal CBD	3	60 %
ampulla	1	20 %
Total	**5**	**100**

Table No. 7 Malignant Pancreaticobiliary diseases based on site of stricture

Site of Stricture	No. of Cases	Percentage
Right Main Hepatic duct	1	14.28 %
Left Main hepatic du t	0	0
Confluence of Right & left Main hepatic duct	4	57.15%
Proximal CBD	1	14.28 %
Distal CBD	1	14.28 %
Total	7	**100 %**

Table No. 8 Comparison between initial radiologicaldiagnosis and follow up diagnosis.

Sr. No.	Diagnosis	No. of cases	Initial Radiological diagnosis	Percentage	On follow up diagnosis confirmatory cases	Percentage
1	CHOLANGIO CARCINOMA	14	14	100%	13	92.86%
2	CRONIC PANCREATITIS	11	11	100%	9	81.81%
3	PERIAMPULLARY CARCINOMA	6	6	100%	4	66.67%
4	CARCINOMA PANCREAS	5	5	100%	5	100%
5	CARCINOMA GALL BLADDER	3	3	100%	2	66.67%
6	CHOLEDOCHOLITHIASIS	7	7	100%	6	85.71%
7	POST OPERATIVE STRICTURE	3	3	100%	3	100%
8	CHOLEDOCHAL CYST	1	1	100%	1	100%
	TOTAL	50	50	100%	43	86%

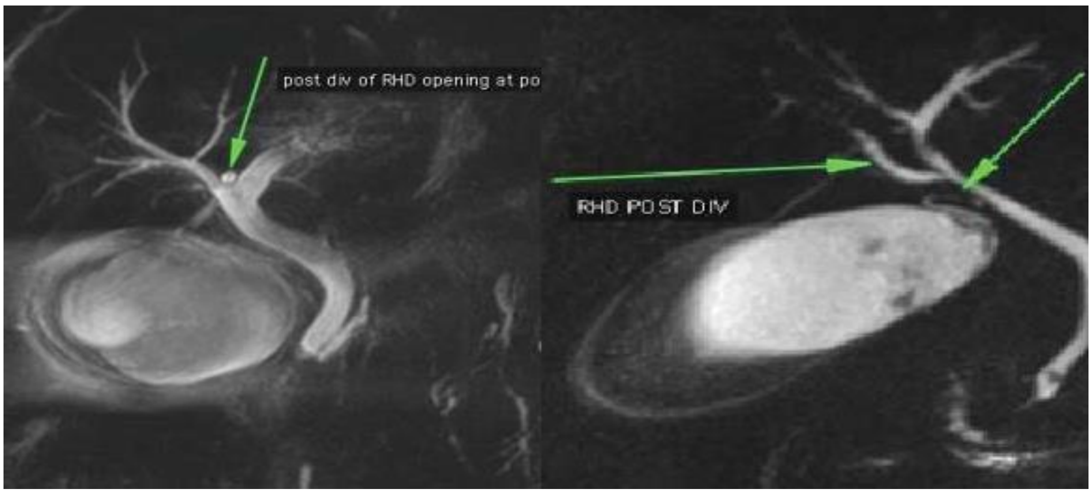
Table No. 9 Statistical comparison between initial radiologicaldiagnosis and follow up diagnosis.

STATISTICS	VALUES	95% CONFIDENCE INTERVAL (CI)
Sensitivity	88.89%	70.84% to 97.56%
Specificity	82.61%	61.22% to 95.05%
Positive predictive value (PPV)	85.71%	70.91% to 93.66%
Negative predictive value (NPV)	86.36%	68.19% to 94.93%
Accuracy	86.00%	73.26% to 94.18%

STATISTICAL DATA ANALYSIS

The IBM SPSS 25.0 version software was used for data analysis. A master chart and an Excel sheet were used to organise the collected data. Tables and graphs were created using the master chart. Initial descriptive statistics for quantitative data analysis included means and standard deviations; for qualitative data analysis, a chi-square test was utilised for statistical significance, and an independent samples "t" test was employed to compare the means of two variables. Statistical significance was determined for all comparisons when $P < 0.05$.

ANATOMICAL VARIANTS OF BILIARY TREE

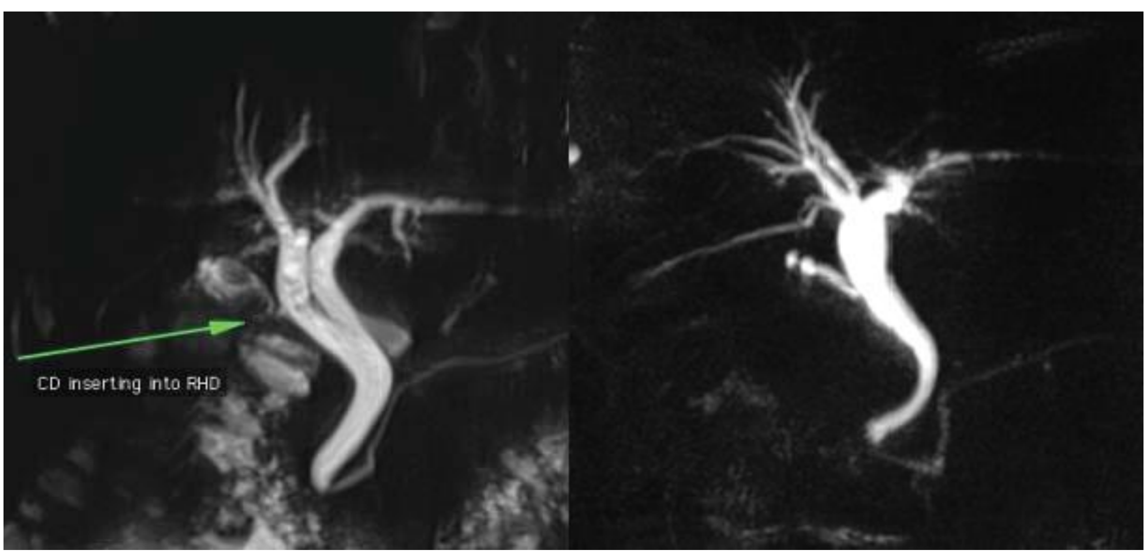


A

Fig 2A: Posterior division of RHD opening at the porta (TRIFURCATION)

B

Fig 2B: Right hepatic duct opening into common hepatic duct



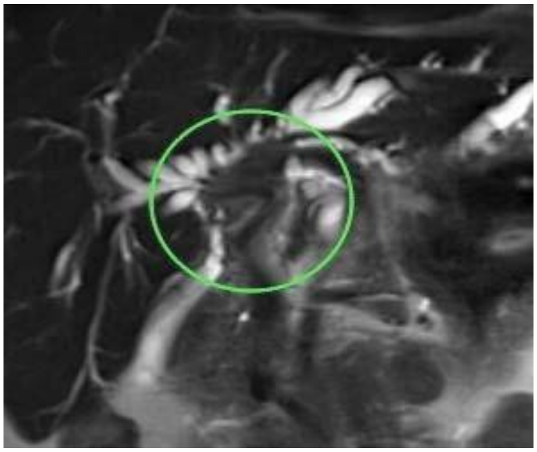
C

Fig 2C: Cystic duct opening into right hepatic duct and low fusion of right and left hepatic ducts.

D

Fig 2D: Post cholecystectomy dilatation of CBD.

KLATSKIN TUMOR AND CHOLANGIO CARCINOMA OF CBD



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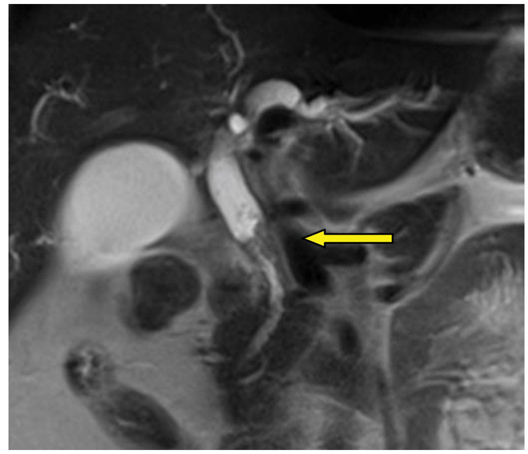

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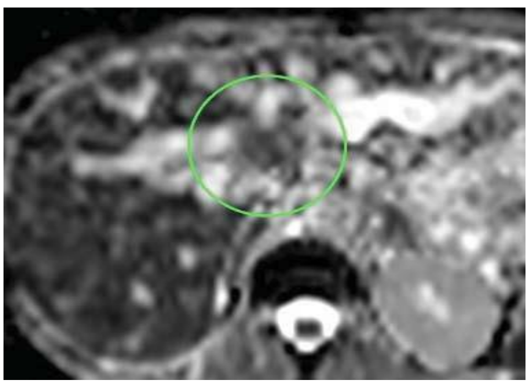

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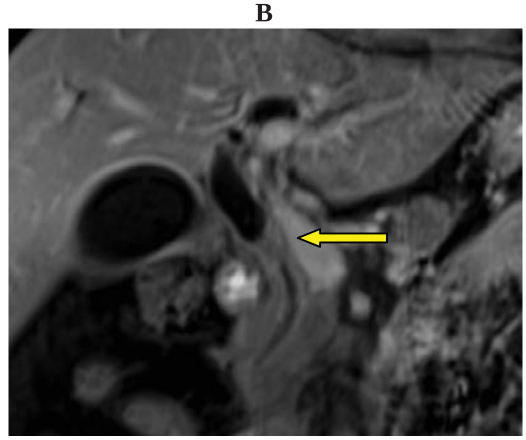
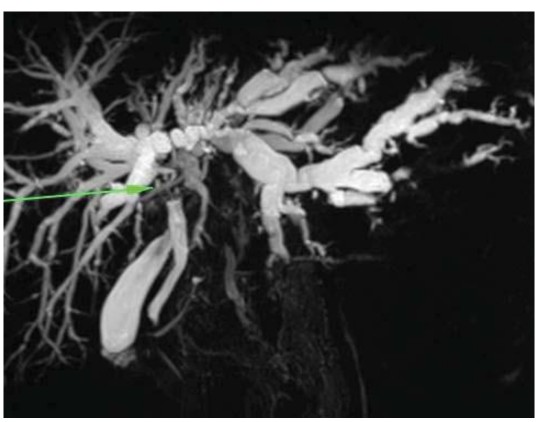


D



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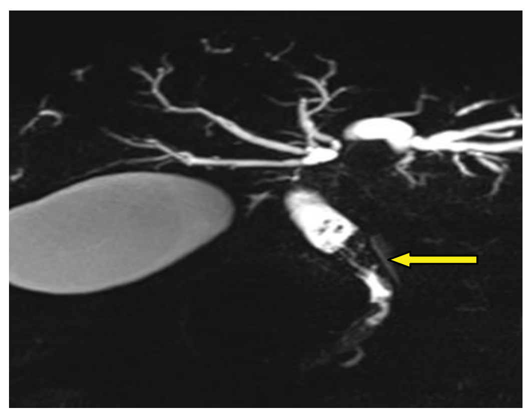
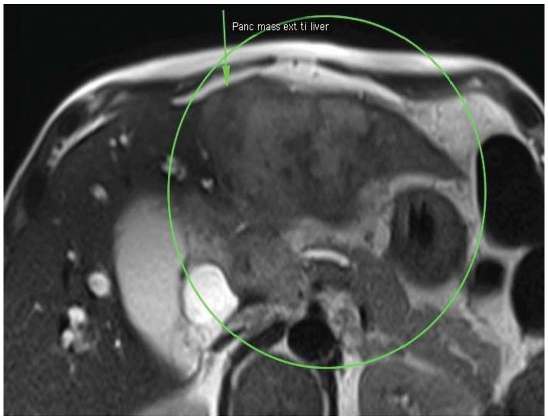


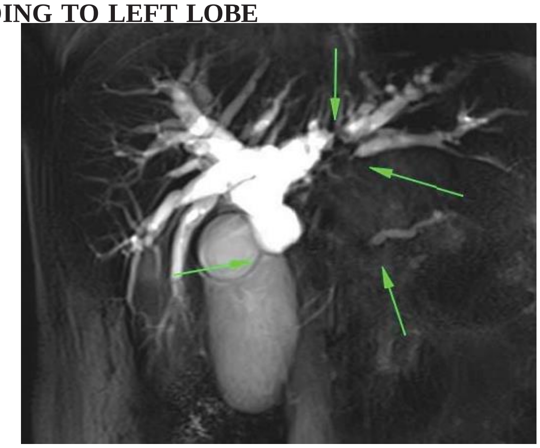
F

Fig3: Klatskin tumor-fig A, B & C soft tissue lesion at the hilum and proximal CHD showing low ADC values. Fig 3: D: irregular soft tissue intencity delayed enhancing intraluminal mass lesion within mid CBD (arrows)

Fig3 E - IHBRD in both lobes with malignant obstruction at hilum. Fig 3F: obstruction at mid CBD by irregular mass lesion with shouldering.

CHOLANGIO CARCIN MA EXTENDING TO LEFT LOBE



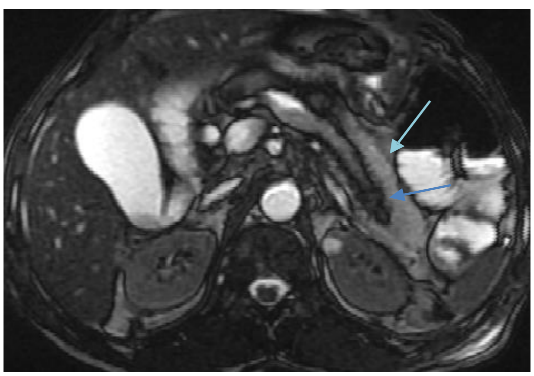


A B

Fig 4 A: T2HASTE: T2 hyper intense mass l sion involving CBD a d extending to left

Fig 4B: MRCP-2D Thick slab obstruction at mid and distal CBD with dilated proxi al CBD

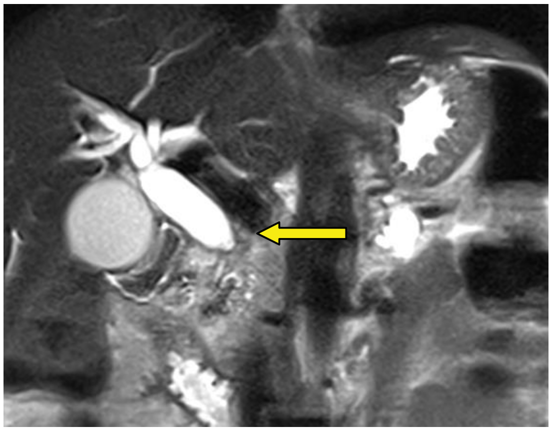
ACU TE ON CH RONIC PANCREATITIS



A B

Fig 5: T2TRUFI : A & B Atrophy of the pancreatic parenchyma with fatty infiltration (blue arrows) with non visualisation of the proximal pancreatic duct and with few filling defects within it (orange arrow). Minimal peripancreatic fat stranding noted.

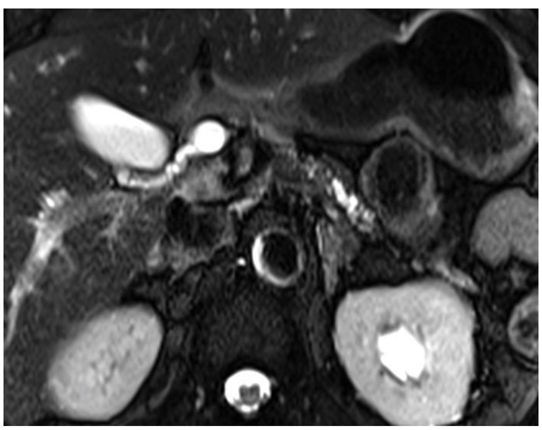
CHRONIC PANCREATITIS



Chronic pancreatitis with distal CBD stricture(A &B)
Fig 6A: chronic pancreatitis with obstructive jaundice due to distal CBD stricture (arrow)

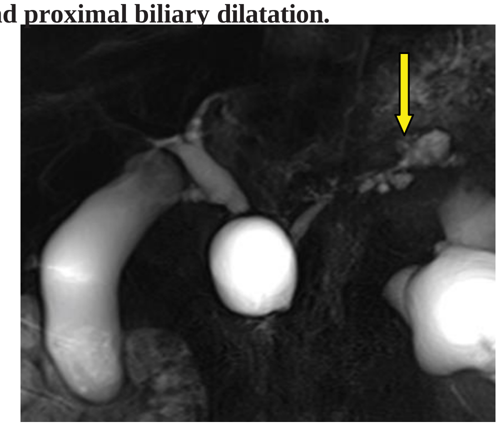
B

Fig 6B: Same pt as in fig A, multiple filling defects within dilated proximal PD (thin arrow) representing stones within MPD with distal CBD stricture (thick arrow) and proximal biliary dilatation.



A

Chronic pancreatic with pseudo cyst Fig 6Fig A: Chronic pancreatitis with irregularly dilated PD and pancreatic atrophy.



B

Fig 6B: Same patient as in A with cystic lesion in the region of pancreatic head representing pseudocyst with irregular dilatation of distal pancreatic duct.

AMPULLARY CARCINOMA, DISTAL CHOLANGIOCARCINOMA AND ADJACENT ORGAN INVASION AND METASTASIS

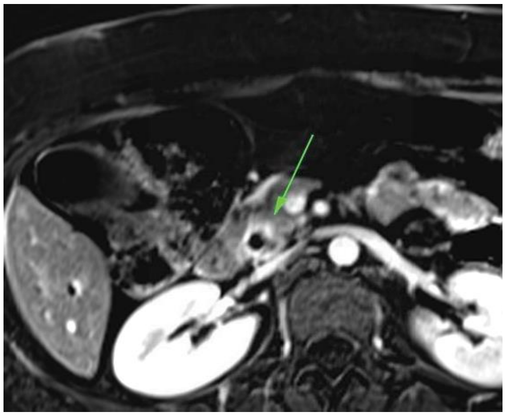


Fig 7A- Delayed Post contrast image showing mural thickening and enhancement ,post ERCP biopsy proved it to be cholang ocarcinoma

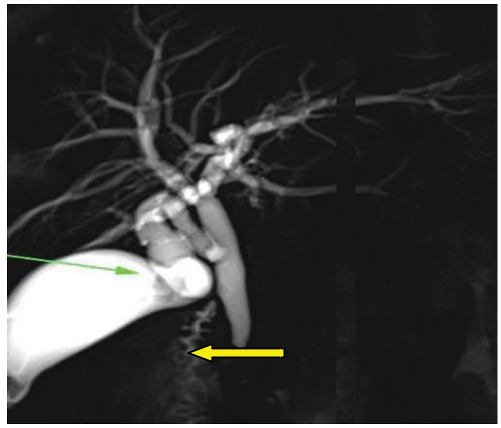
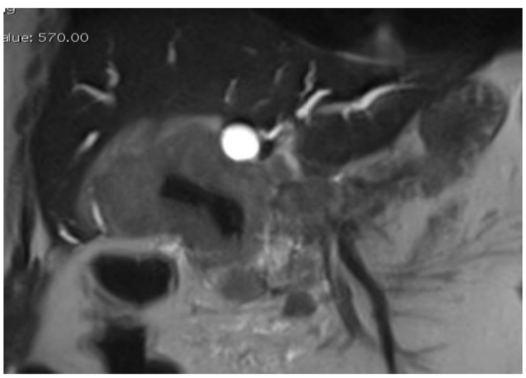
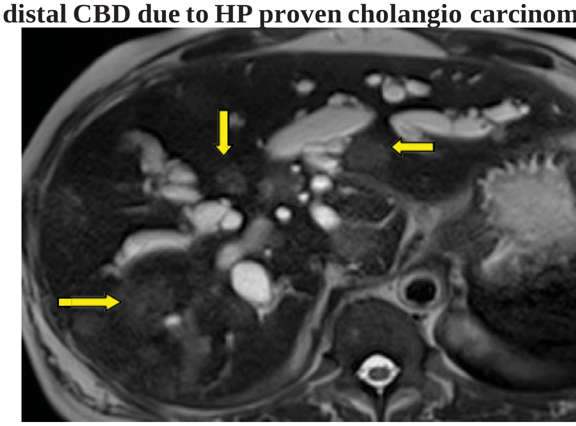


Fig 7 B: same patient as in fig A, 2D thick slab MRCP image showing GB calculi in neck, with sudden cut- off of distal CBD due to HP proven cholangio carcinoma.





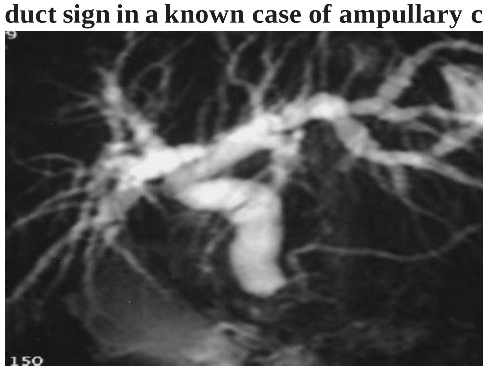
B

A

Fig 8A: Showing cholangiocarcinoma involving and encasing duodenum. c

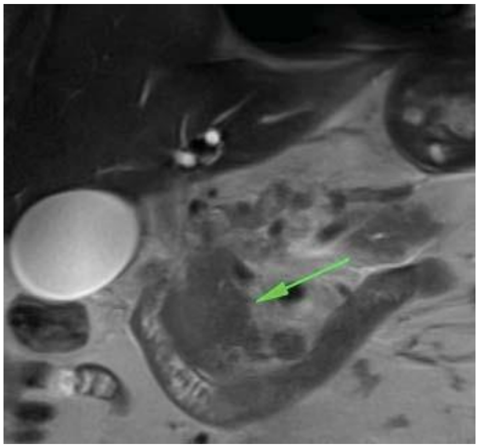
Fig 8 B: Another case of cholangiocarcinoma with multiple T2 hyperintense liver metastases in both lobes of liver

Fig 8 C: Double duct sign in a known case of ampullary carcinoma

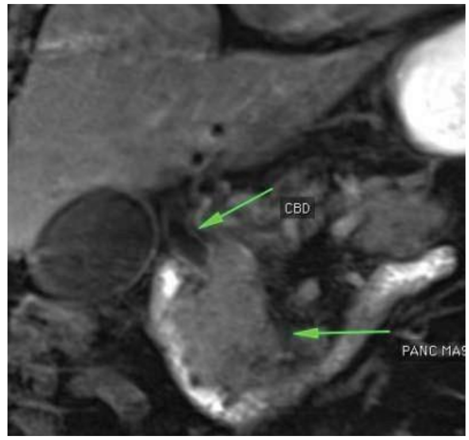


C

CARCINOMA HEAD OF PANCREAS

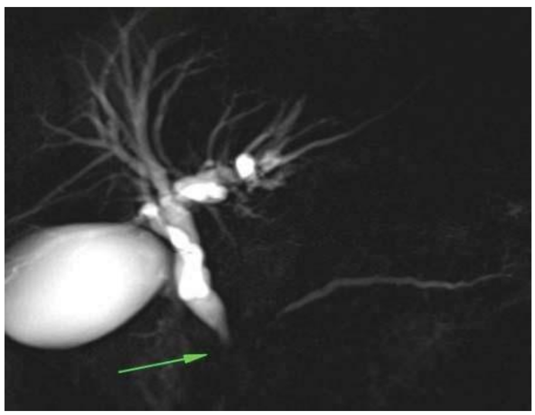


A

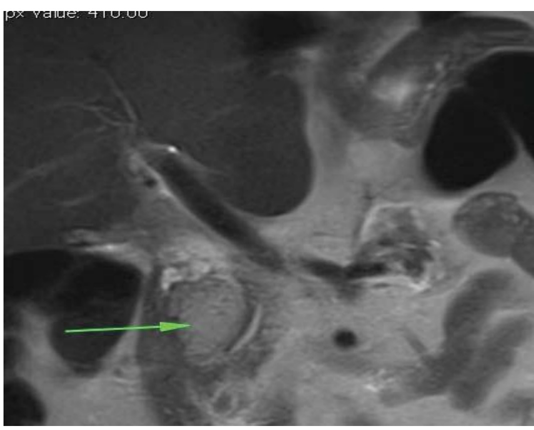


B

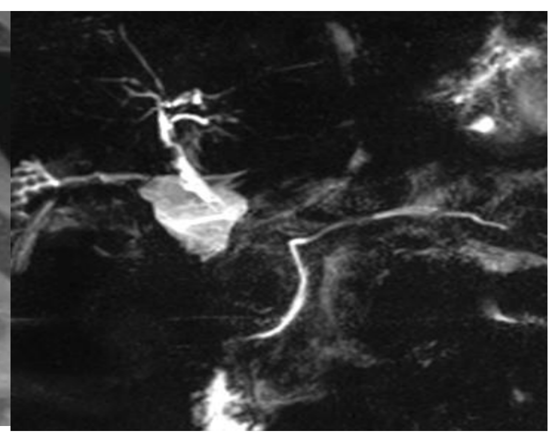
CA head of pancreas: Fig 9 A: Homogenous soft tissue mass lesion in the region of head of pancreas, showing mild heterogenous enhancement in Fig 9 B and involving medial wall of duodenum.
Fig 9 C: MRCP image showing double duct sign with obstruction at the level of pancreatic head.



C



A

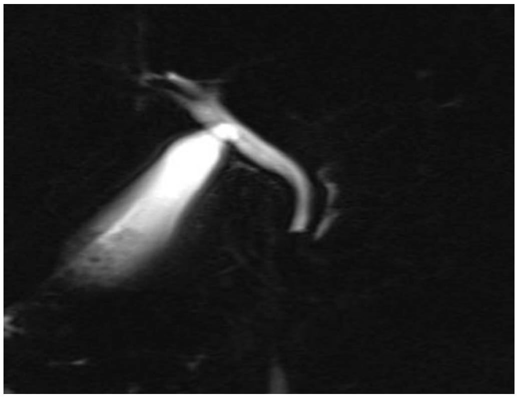


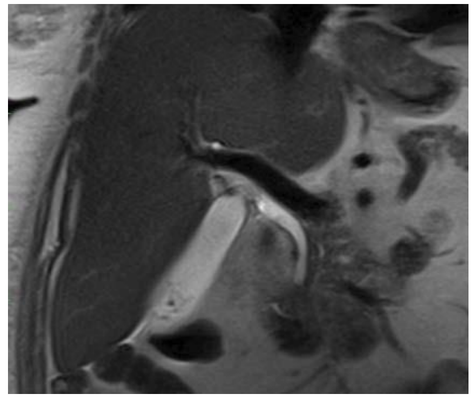
B

Fig 10A: CA pancreas, compressing and obstructing the duodenum

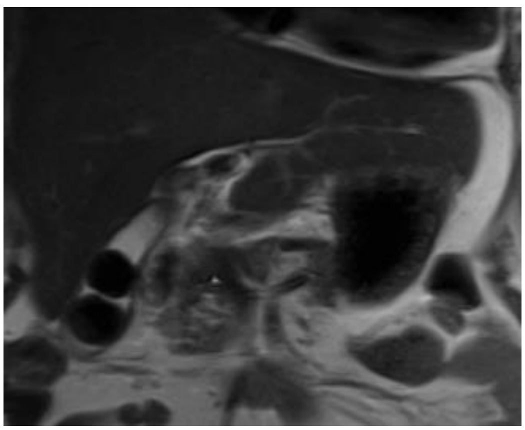
Fig 10 B: same as in A, Ca Pancreas with double duct sign and duodenal obstruction with dilated first part of duodenum (arrow)

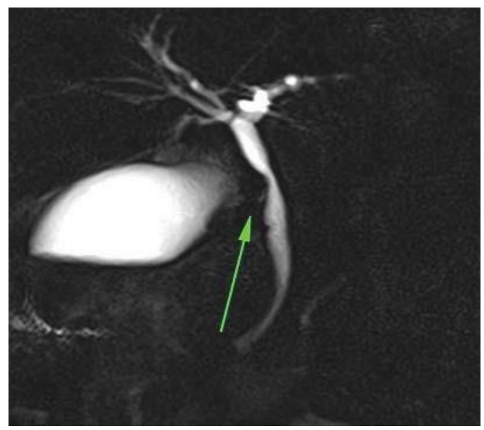
GALL BLADDER CALCULI (CHOLELITHIASIS)



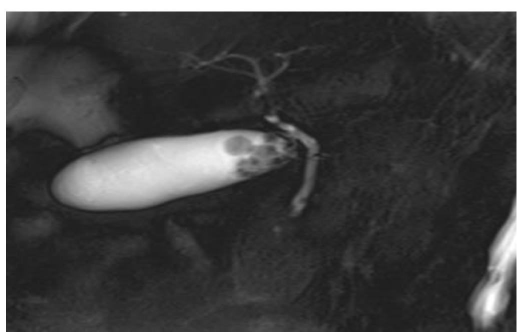


B





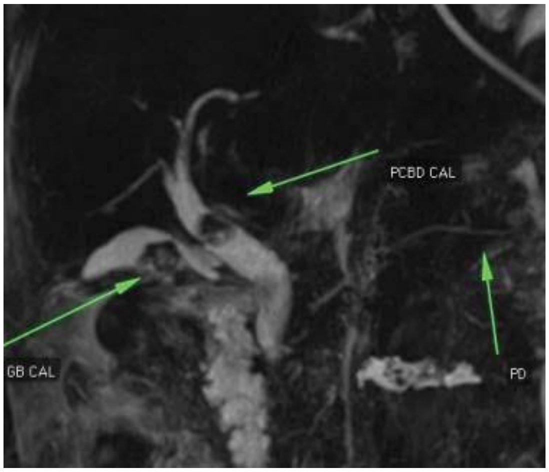
C **D**



E

Fig 11 A(MRCP) &11 B(T2 HASTE):Multiple tiny filling defect in gall bladder representing multiple GB calculi.
Fig 11 C (T2 HASTE): Large filing defects in GB, large GB stones.
Fig 11 D: Impacted stone at the neck of GB causing indentation and obstruction of CBD (MIRIZZI SYNDROME)
Fig 11 E: Multiple filling defects at the GB neck representing calculi.

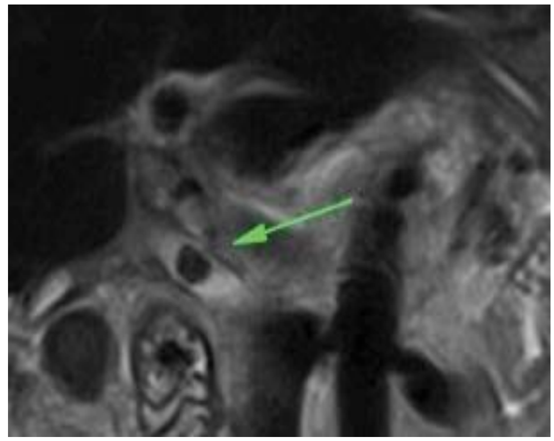
CHOLELITHIASIS & CHOLEDOCHOLITHIASIS



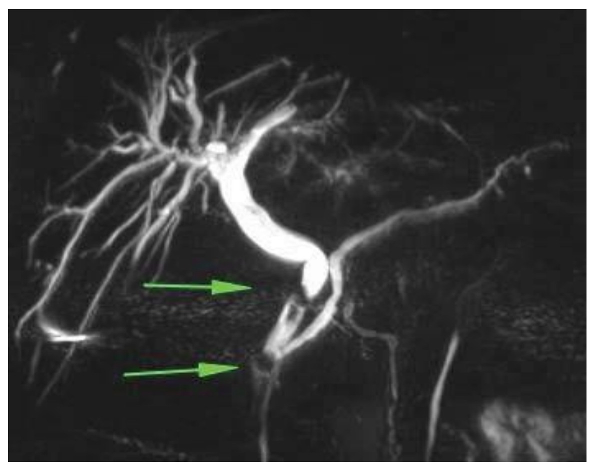
A

B

Fig 12 A & 12B: (A- MRCP, B-T2 HASTE) calculus in proximal CBD and GB (arrows) as a filling defect



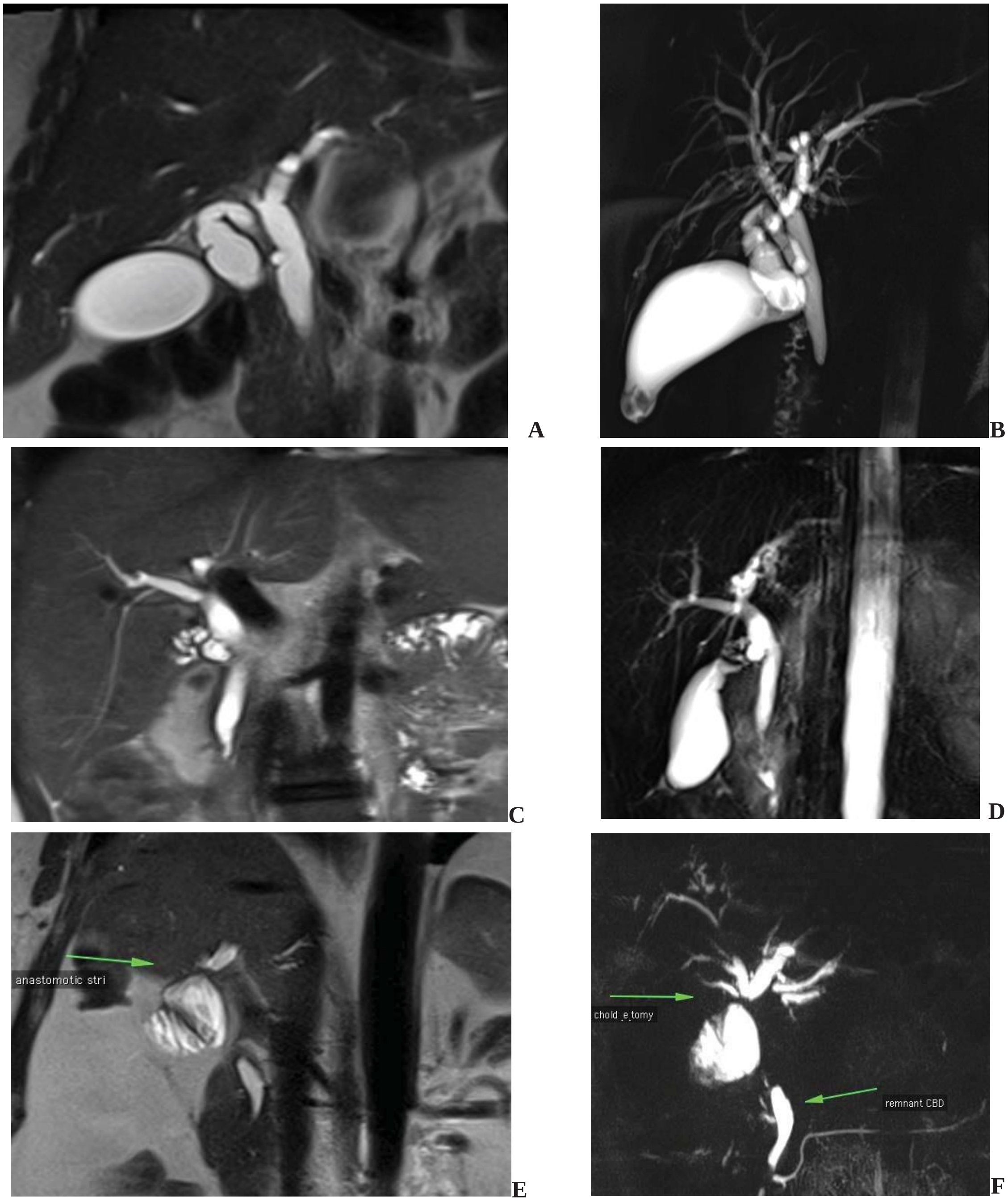
C



D

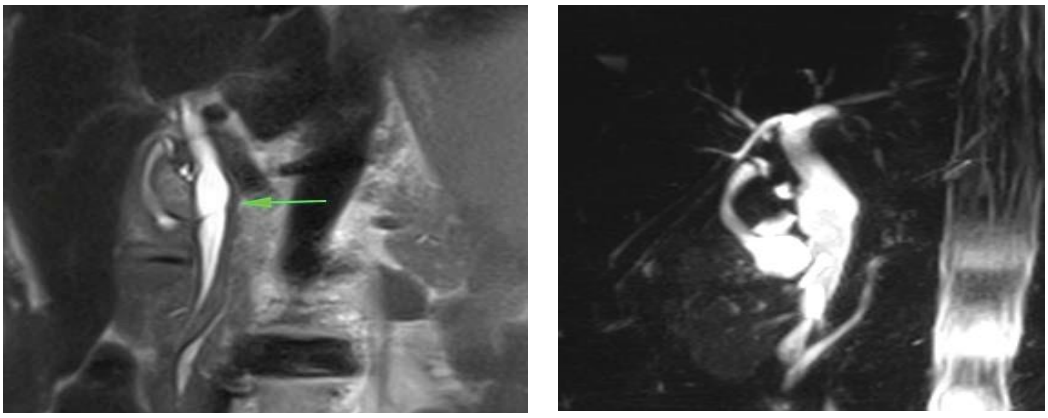
Fig 12 C: Multiple stones in distal CBD and Gall bladder Fig D: stones in distal CBD and an impacted stone at the ampulla with double duct sign

BENIGN STRICTURES

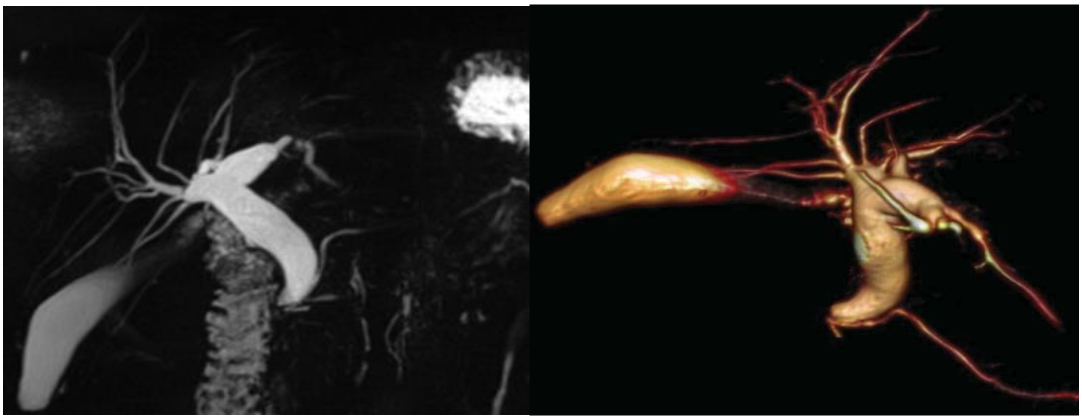


BENIGN CBD STRICTURE: Fig 13 A &B: smooth tapering of distal CBD with proximal dilatation in a case of distal CBD benign stricture. Fig 13 C & D: another case benign stricture of distal CBD with smooth tapering of distal end. ANASTOMOTIC SITE STRICTURE: Fig 13E & F following choledochojejunostomy. Arrows showing stricture site and remnant distal CBD in fig F.

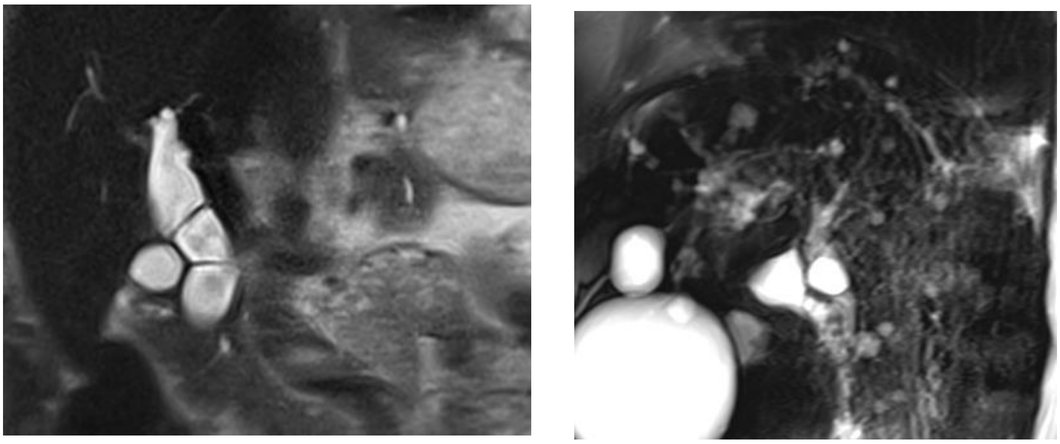
CHOLEDOCHAL CYST



A **B**



C **D**



E **F**

Choledochal cyst: Fig 14 A & B: showing fusiform dilatation of CBD representing type I choledochalcyst .
Fig 14 C and D: dilatation of common bile duct and left hepatic duct and normal right hepatic duct representing type I C choledochal cyst.
Fig 14 E and F: multiple intrahepatic cysts along IHBR with dilated CBD and extrahepatic cyst representing type IV-A choledochalcyst.

VI. DISCUSSION

Traditional methods for assessing biliary blockage have included imaging tests including invasive cholangiography, computed tomography (CT), and ultrasonography (US). The invasiveness of procedures like ERCP and PTC, as well as the restricted visibility of intraductal stones on US and CT scans, limit the use of these techniques. With MRCP, a non-invasive imaging technique, the hepatic biliary system may be clearly seen41,119.According to Venkata S. Katabathina et al., patients with biliary obstruction due to malignant lesions can see the blockage's location and the extent of the bile duct dilatation with magnetic resonance cholangiopancreatography (MRCP). However, to find the tumor's organ of origin and to define the lesion's margins, additional cross sections of magnetic resonance imaging (MRI) acquired using conventional sequences are helpful and required.Patients with dilated bile ducts are the most common candidates for MRCP because of its non-invasive nature, according to T Hyodo et al. 121.

Among the fourteen cholangiocarcinoma patients that underwent magnetic resonance imaging (MRI), one showed gallbladder involvement and very little metastasis. The surgical results showed gallbladder cancer. Imaging might be challenging when there is inflammation of both the gall bladder and the bile duct. As part of the pre-operative assessment, MRI helped establish the disease's degree, extent, and staging.

Research by Guibaud et al. 107, Barish M. A. and Soto 17., and Pavone et al. 101 found diagnostic accuracies for amount of blockage ranging from 91% to 100%, specificities of 96% to 98.2%, and sensitivity of 80-86%.

We looked at six instances of periampullary cancer. To aid in lesion staging, MRI might define the lesion's size, level, and local infiltration. Both the presence of intestinal gas shadows and the patient's weight made ultrasonography evaluation of periampullary lesions challenging. The diagnosis accuracy was 96%, specificity was 100%, and sensitivity was 88% in the investigation of 25 instances of periampullary tumours conducted by Sugita et al. 115.

Three of the five pancreatic cancer instances included the head and body area, whereas two involved the distal and tail regions. Aside from one instance when MRI had trouble distinguishing neoplasm from chronic pancreatitis, in every other case MRI could distinguish well between pancreatic cancer and pancreatitis. It is challenging to accurately identify the loco-regional spread with ultrasonography. In a study of 66 instances of suspected pancreatic tumours, Eric Tam et al.114 observed a sensitivity of 80% and specificity of 95%; Enrique Lopez Haminem et al.117 reached the same conclusions, with a diagnostic accuracy of 91%, sensitivity of 95%, and specificity of 96%.

We used magnetic resonance imaging (MRI) as a diagnostic technique in three instances of gall bladder cancer. Everything about the staging was spot on. MRI picked up on all three instances, finding localised spread and mild lesions in the liver. For pre-operative staging as well, it was helpful. The use of ultrasonography as a staging technique for gallbladder cancer is not yet possible, although it may serve as a main investigative tool. Ultrasound for staging will have a very poor diagnostic accuracy.

Eleven pancreatitis patients were MRI-evaluated in our research. In early stages of acute pancreatitis, when ultrasound characteristics were normal, magnetic resonance imaging (MRI) revealed diffuse homogenous enhancement of the whole gland. In instances requiring surgical intervention due to chronic pancreatitis, the main pancreatic duct was more clearly defined on magnetic resonance imaging (MRI). A recognised drawback of magnetic resonance imaging (MRI) is that it may be difficult to differentiate between chronic pancreatitis and neoplastic change; this was the case in one case.

Cases of pancreatitis will not show many notable changes on ultrasound. Rarely were pseudocysts and necrotic alterations found. Probe discomfort and intestinal gas made it impossible to ascertain the precise extent. In instances of chronic pancreatitis, the changed gland shape is obvious, but the primary pancreatic duct's calibre is not.

Seven choledocholithiasis patients were MRI-evaluated in our investigation.Contrary to what ultrasonography can't show, MRCP makes the IHBR dilatation, CBD calibre, and calculus placement quite obvious, particularly in the distal CBD. With respect to MRCP74, Varghese et al. found a sensitivity of 91%, specificity of 98%, and diagnostic accuracy of 97%. The diagnostic accuracy, specificity, and sensitivity with MRCP73 were 97%, 100%, and 91%, respectively, according to Sugiyama et al. Research conducted by Caroline Reinhold et al.118 on MRCP demonstrated a sensitivity of 90%, specificity of 100%, and accuracy of 97%. When it comes to cholecystectomy, MRCP is a great main tool for finding or ruling out CBD stones, according to Mandelia, A. et al.[122]

VII. CONCLUSION

The development of magnetic resonance imaging (MRCP) has made it much easier to study the pancreatic duct and the rest of the biliary tree in both healthy and diseased states.
The outcomes of our research allow us to conclude the following conclusions:

- Magnetic resonance imaging (MRI) provides a precise, non-invasive, and non-ionizing imaging method for the evaluation of pancreatico-biliary architecture and pathology.
- Ultrasound is still the gold standard for conducting investigations.
- When combined, MRI and MRCP allow for the safe decision-making of surgical care.
- Patients undergoing biliary enteric anastomosis may benefit from this in determining the location and severity of strictures.
- Very helpful for kids and adults who are overweight.

IX. SUMMARY

The goal of the research was to assess pancreaticobiliary illnesses using MRCP in 50 patients with a clinical suspicion of such conditions.

1. The participants' ages ranged from 1 to 75, with an average of 40.5 years.
2. The most common age group was patients older than 40 years.
3. The bulk of the patients were men.
4. Constipation, diarrhoea, jaundice, vomiting, and loss of weight were the most common first symptoms.
5. After periampullary cancer and pancreatic carcinoma, the most common findings were cholangiocarcinoma, pancreatitis, and choledocholithiasis.
6. Both cholangiocarcinoma and pancreatitis are more common in males.
7. The prevalence of malignant strictures is higher than that of benign ones.
8. Distal common bile duct benign strictures were prevalent.
9. At the point where the right and left major hepatic ducts meet, malignant strictures often formed.
10. For distal CBD diseases that USG failed to adequately assess, MRI cross-sectional imaging with MRCP was the way to go because of its enhanced sensitivity and improved lesion characterisation.
11. Magnetic resonance imaging (MRI) and magnetic resonance contrast pulsography (MRCP) are sensitive, non-invasive imaging techniques that help with early illness identification and diagnosis and provide important insights about treatment and prognosis.

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