



VARIATIONS OF BILIARY DUCTAL ANATOMY ON MRCP

Radiodiagnosis

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ABSTRACT

Introduction:- Biliary anatomy and its common and uncommon variations are of considerable clinical significance when performing living donor transplantation, radiological interventions in hepatobiliary system, laparoscopic cholecystectomy, and liver resection (hepatectomy, segmentectomy). Thus, magnetic resonance cholangiopancreatography (MRCP) has become the modality of choice for noninvasive evaluation of abnormalities of the biliary tract. The purpose of this study is to describe the variations of biliary ductal anatomy on MRCP. **Material And Method:-** Hospital based prospective study for a period of 1 year and 6 months in Department of Radiodiagnosis, AIMS Bathinda after applying inclusion and exclusion criteria and after obtaining their informed written consent. **Results:-** In our study of the anatomical type of right hepatic duct, A1 type was most commonly found type in 75.2% (n=100) of patients out of which 65% (n=65) of patients were found to be females and 35% (n=35) were found to be males. Left hepatic duct was found to be A1 type in 100% of patients out of which 65.4% was females and 34.5% was males. In our study, cystic duct insertion was found to be right lateral in 78.9% (n=105) of patients out of which 64.8% (n=68) of patients were found to be females and 35.2% (n=37) were found to be males. **Conclusion:-** It was noticed that A1 remains the most common type of right hepatic duct but still one should be cautious for other types as they still make for one fourth of cases. Similarly, In case of cystic duct, although Right lateral type was most commonly encountered but since other types were found in nearly one fourth of patients, one should be on active look out for them too.

KEYWORDS

INTRODUCTION

The detailed mapping of biliary anatomy is an essential preoperative requirement for the proper choice of therapeutic approach as well as for reduction of iatrogenic biliary pathology which can negatively affect the hepatobiliary surgery outcome.⁽¹⁾ Despite the gross improvement in the surgical techniques of liver transplantation and the better survival rates, the biliary complications is still on the top of the complication in living donor liver transplantation, occurring in 7–10% of donors; also, biliary complication has a prevalence of 3.6–8.1% after hepatic tumor resection.⁽²⁾ Even in low complication rate procedure such as laparoscopic cholecystectomy (complications < 1%), the pre-operative biliary mapping can avoid iatrogenic biliary injuries of non-recognized anatomical variants.⁽³⁾ Biliary mapping using the diagnostic endoscopic retrograde cholangiography has major complication ranging from 1.4 to 3.2%, so having a non-invasive, simpler, and more safe technique would be of great value.⁽⁴⁾ Biliary variants, including those of the CD, can be the direct cause of different diseases. Low insertion of the CD has a stronger association with CBD stone formation, CBD dilatation and positive bacterial culture from the bile than CD with a normal joint with the EHBD.⁽⁵⁾

Therefore, it is crucial to acquire appropriate knowledge about normal and variant anatomies of intrahepatic and extrahepatic biliary systems.⁽⁶⁾ Magnetic resonance cholangiopancreatography (MRCP) is the most accurate imaging modality for assessing the intrahepatic and extrahepatic bile tracts and the CD owing to its multiple abilities; it is the preferred non-invasive technique for evaluating the biliary tract if immediate therapy for a known problem is not the primary aim.^(7,8)

Although establishing the correct diagnosis of CD variants is essential for assessing subjects at higher risks of both spontaneous and surgical bile duct injury, to the best of our knowledge, no large series has focused on the evaluation of CD variants using MRCP.⁽⁹⁾ Thus, This study was conducted to study the variation of biliary duct on MRCP.

MATERIAL AND METHODS

Setting: Hospital based**Study Design:** Hospital based prospective study**Time Frame:** 1 year and 6 months (MAY, 2021 to October, 2022)**Sample Size:** Total of 133 Patients were selected as and when they presented to the Department of Radiodiagnosis, AIMS Bathinda after applying inclusion and exclusion criteria and after obtaining their informed written consent.**Methods:** Variations of biliary ductal anatomy on MRCP**Outcome Measures:** To see the variations of biliary ductal anatomy on MRCP

Statistical Analysis

Frequencies and percentages for categorical variables were computed and presented in tables. Chi square test was used to compare the anatomic variation between male and female groups.

Inclusion Criteria

1. Patients willing to enroll in the study after giving the informed consent.
2. Patients who underwent MRCP for assessment of biliary tract neoplastic pathology and non neoplastic pathology.

Exclusion Criteria

1. Patient not giving consent for the study.
2. Pt. with known history of post surgical or traumatic biliary injury.
3. Patient having cardiac pacemakers, bypass surgery, aneurysmal clips, nails in bones, joint replacement, cochlear implants, electromagnetic implants.

METHODOLOGY

MRCP Protocol – All patients who presented for MRCP were made to fast for at least 6 hours prior to the examination to reduce fluid secretions within the stomach and duodenum, reduce bowel peristalsis and promote gallbladder distension.

MRCP Procedures were done in a SIEMENS 1.5 Tesla (18 Channel) MAGNETOM Avanto MRCP was done using T2 weighted half Fourier acquisition single shot turbo spin echo (HASTE) in three planes. (Image 8)

The whole study took around 18–20 minutes in a cooperative patient maximum intensity projection (MIP) were generated from MRCP sequences, allowing to obtain multiplanar images with different slice thickness.

Classification Of Biliary Tract Was Done As Following

Classification of Right Hepatic Duct variations was done according to Huang - Huang Type Description⁽¹⁰⁾

A1	Right posterior duct drains into right anterior sectoral duct (Image-9)
A2	Trifurcation pattern of insertion of RPSD, RASD, and left hepatic duct (Image-10)
A3	RPSD drains into LHD (Image-11)
A4	RPSD drains into the common hepatic duct (Image-12)
A5	RPSD drains into the cystic duct (Image-13)

Classification of left hepatic duct variations according to Cho A et al -

Classification	Description
Type I	Segment 2 and 3 duct join to form single lateral segmental duct with one or two segment 4 ducts opening into this and

Type2	forming LHD A common trunk of segment 2 and 3 ducts forms the common channel and segment 2 duct joins to form LHD
Type3	Segment 2,3, and 4 joins together to form LHD

Cystic Duct Variants

1. Low cystic duct insertion
2. Medial cystic duct insertion
3. Parallel course between the cystic duct and common hepatic duct
4. High cystic duct insertion

OBSERVATION AND RESULTS

Total of 185 patients underwent MRCP, out of which 52 were excluded in view of exclusion criteria (30 patients underwent cholecystectomy, 22 had bile duct injury)

AGE DISTRIBUTION

Table 1 Showing The Age Distribution In The Study Population

AGE GROUP	No. of cases (n)	Percentage (%)
< 40	34	25.6
40-60	46	34.6
> 60	53	39.8
Total	133	100.0

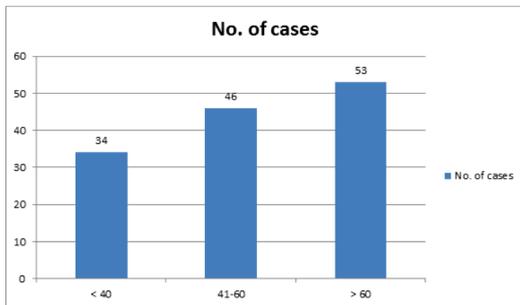


Fig. 1 Showing The Age Distribution In The Study Population

More than one third of patients(39.8%) patients enrolled in our study were of age group between >80 year of age with group 40-60 year of age being second most populated group.

SEX DISTRIBUTION

Table 2 Showing The Gender Distribution In The Study Population.

SEX	FREQUENCY	PERCENTAGE %
FEMALE	87	65.41
MALE	46	34.59
TOTAL	133	

Fig. 2 Showing The Gender Distribution In The Study Population.

Nearly two third of patients enrolled in our study were females as compared to only one third of males.

FREQUENCY OF TYPES OF RIGHT HEPATIC DUCT

Table 3 Showing Distribution Of Types Of Right Hepatic Duct

Right Hepatic duct	No. of cases	Percentage
A1	100	75.2
A2	13	9.8
A3	12	9.0
A4	8	6.0
Total	133	100.0

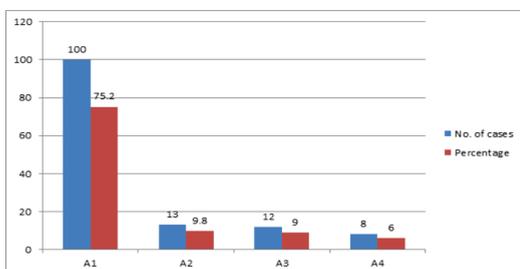


Fig. 3 Showing Distribution Of Types Of Right Hepatic Duct

Nearly three fourth of patients were found to have A1 type of Right Hepatic Duct type in our study with A2 being the second most common type with A3 being the close third. No case of A5 type was reported in our study group.

FREQUENCY OF TYPES OF LEFT HEPATIC DUCT

Table 4 Showing Distribution Of Types Of Left Hepatic Duct

Left Hepatic Duct	No. of cases	Percentage
Type 1	133	100.0

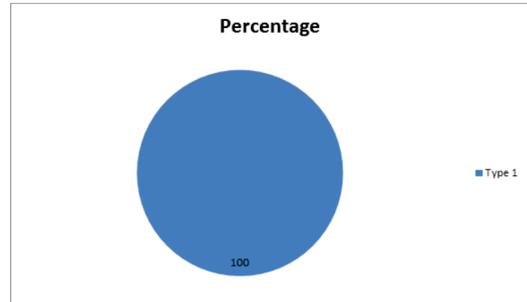


Fig. 4 Showing Distribution Of Types Of Left Hepatic Duct

All the cases observed in this study were of Type 1 left hepatic duct only.

FREQUENCY OF TYPES OF CYSTIC DUCT

Table 5 Showing Distribution Of Types Of Cystic Duct

Cystic Duct	No. of cases	Percentage
High cystic duct insertion	1	.8
Low cystic duct insertion	11	8.3
medial cystic duct insertion	16	12.0
Right lateral	105	78.9
Total	133	100.0

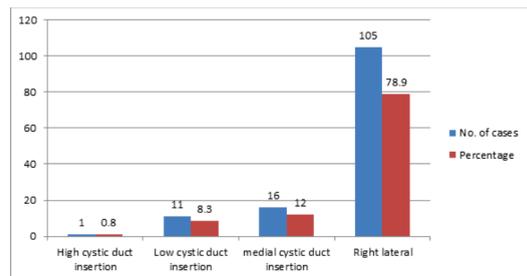


Fig. 5 Showing Distribution Of Types Of Cystic Duct

More than three fourth of patients were found to have Right lateral type of cystic duct in our study with medial insertion being the second most common type and low insertion being the third most common type. Only a single case of high insertion was observed whereas No case of parallel insertion was reported in our study group.

Sex Wise Age Distribution

Table 6 Showing Sex Wise Age Distribution

	SEX	F		M		Tot al	Chi-square value	p-value
		No. of cases	Percentage	No. of cases	Percentage			
Age Group	< 40	18	52.9%	16	47.1%	34	4.691	0.096
	41-60	35	76.1%	11	23.9%	46		
	> 60	34	64.2%	19	35.8%	53		
Total		87	65.4%	46	34.6%	133		

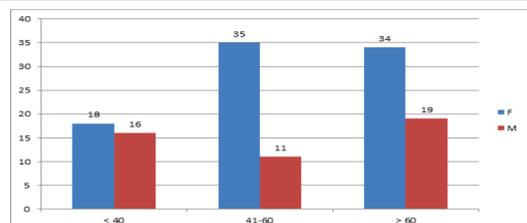


Fig. 6 Showing Sex Wise Age Distribution

SEX WISE DSITRIBUTION OF RIGHT HEPATIC DUCT TYPES

Table 7 Showing Sex Wise Distribution Of Right Hepatic Duct Types

		F		M		Total	Chi-square value	p-value
		No. of cases	Percentage	No. of cases	Percentage			
Right Hepatic duct	A1	65	65.0%	35	35.0%	100	1.065	0.786
	A2	10	76.9%	3	23.1%	13		
	A3	7	58.3%	5	41.7%	12		
	A4	5	62.5%	3	37.5%	8		
Total		87	65.4%	46	34.6%	133		

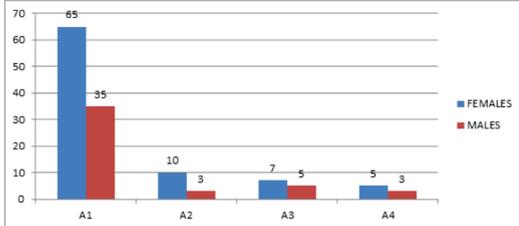


Fig. 7 Showing Sex Wise Distribution Of Right Hepatic Duct Types

A1 was the most common right hepatic duct type with occurrence in nearly three fourth of patients in both male and female groups.

SEX WISE DISTRIBUTION OF LEFT HEPATIC DUCT TYPES

Table 8 Showing Sex Wise Distribution Of Left Hepatic Duct Types

		F		M		Total	Chi-square value	p-value
		No. of cases	Percentage	No. of cases	Percentage			
Left Hepatic Duct	Type 1	87	65.4%	46	34.6%	133	0.000	1.000
Total		87	65.4%	46	34.6%	133		

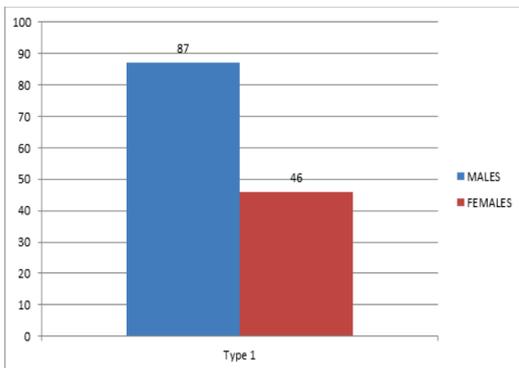


Fig 8 Showing Sex Wise Distribution Of Left Hepatic Duct Types

SEX WISE DSITRIBUTION OF CYSTIC DUCT TYPES

Table 9 Showing Sex Wise Distribution Of Cystic Duct Types

		F		M		Total	Chi-square value	p-value
		No. of cases	Percentage	No. of cases	Percentage			
Cystic Duct	High cystic duct insertion	1	100.0%	0	0.0%	1	0.869	0.833
	Low cystic duct insertion	8	72.7%	3	27.3%	11		
	medial cystic duct insertion	10	62.5%	6	37.5%	16		
	Right lateral	68	64.8%	37	35.2%	105		
Total		87	65.4%	46	34.6%	133		

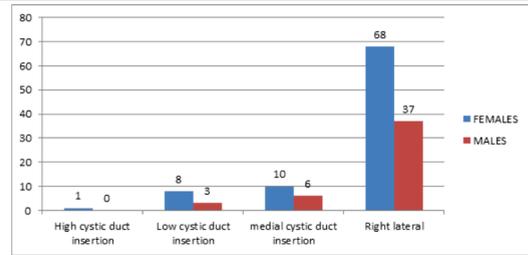


Fig. 9 Showing Sex Wise Distribution Of Cystic Duct Types

Right lateral was the most common right hepatic duct type with occurrence in more than three fourth of patients in both male and female groups.

DISCUSSION

Variations of biliary ductal anatomy was studied in the Adesh Institute of Department of Radiodiagnosis on MRI procedure was done on machine SEIMENS 1.5 TESLA (18 channel) MAGNETOM AVANTO MRCP was done using T2 weighted half Fourier acquisition single shot turbo spin echo (HASTE) in three planes.

Total of 185 patients underwent MRCP, out of which 52 were excluded in view of exclusion criteria (30 patients underwent cholecystectomy, 22 had bile duct injury), so total 133 patients were enrolled in the study, out of which 65.4% (n=87) was found to be females and 34.6% was found to be males (n=46)

In our study 25.6% (n = 34) of patients were less than 40 years, 34.6% (n= 46) of patients were between 40-60 years and 39.8% (n= 53) was more than 60 years.

In our study the anatomical type of right hepatic duct were observed.

A1 type was found in 75.2% (n=100) of patients out of which 65% (n= 65) of patients were found to be females and 35% (n=35) were found to be males. A2 type was found in 9.8% (n=13) of patients out of which 76.9% (n= 10) of patients were found to be females and 23.1% (n=3) were found to be males. A3 type was found in 9% (n=12) of patients out of which 58.3% (n=7) of patients were found to be females and 41.7% (n=5) were found to be males. A4 type was found in 6% (n=8) of patients out of which 62.5% (n=5) of patients were found to be females and 37.5% (n=3) were found to be males. No case was found to be of A5 type.

In our study Left hepatic duct was found to be A1 type in 100 % of patients out of which 65.4 was females and 34.5 % was males.

In our study, cystic duct insertion was found to be right lateral in 78.9% (n=105) of patients out of which 64.8% (n= 68) of patients were found to be females and 35.2% (n=37) were found to be males. Medial cystic duct insertion was found in 12% (n=16) of patients out of which 62.5% (n= 10) of patients were found to be females and 37.5% (n=6) were found to be males. Low cystic duct insertion was found in 8.3% (n=11) of patients out of which 72.7% (n= 8) of patients were found to be females and 27.3% (n=3) were found to be males. High cystic duct insertion was found in a single case.

CONCLUSION

Total of 185 patients underwent MRCP after applying the exclusion criteria total 133 patients were enrolled in the study, out of which 65.4% (n=87) was found to be females and 34.59% was found to be males (n=46).

Nearly three fourth of patients were found to have A1 type of Right Hepatic Duct type in our study with A2 being the second most common type with A3 being the close third. No case of A5 type was reported in our study group.

More than three fourth of patients were found to have Right lateral type of cystic duct and medial insertion being the second most common type and low insertion being the third most common type. Only a single case of high insertion was observed whereas no case of parallel insertion was reported in our study group.

A1 type of hepatic duct was found in all the cases.

Thus, It was noticed that A1 remains the most common type of right hepatic duct but still one should be cautious for other types as they still make for one fourth of cases. Similarly, In case of cystic duct, although Right lateral type was most commonly encountered but since other types were found in nearly one fourth of patients, one should be on active look out for them too.

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