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Review of Patients who had Undergone Magnetic Resonance Cholangiopancreatography Imaging in the Emergency Department

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Abstract

Objective: Magnetic resonance cholangiopancreatography (MRCP) enables a non-invasive evaluation of the anatomy and pathology of the pancreaticobiliary system rapidly, reliably, and without complications without using contrast agents. This research aimed to elucidate the routine use of MRCP imaging in emergency departments (EDs) and help patients receive more precise and rapid diagnoses in shorter periods.

Materials and Methods: This retrospective cross-sectional study included 368 patients who applied to the ED and underwent MRCP. An expert radiologist with at least 5 years of experience evaluated MRCP imaging. The images were examined based on choledocholithiasis, gallstone, bile sludge, biliary duct dilatation and cholecystitis, gallbladder perforation, acute pancreatitis, and tumor. The demographic characteristics of the patients, imaging indications, and bilirubin values were analyzed.

Results: MRCP examination revealed cholecystitis in 53.0% (n=195) of the patients, gallbladder perforation in 1.4% (n=5), acute pancreatitis in 22.0% (n=81), and gallbladder or goatskin tumor in 11.4% (n=42). None of these pathologies was found in 32.6% (n=120). Regarding gender, MRCP findings, imaging method and indications, and bilirubin grades based on four MRCP diagnoses, cholecystitis was detected in 57.8% of patients with choledocholithiasis, while the tumor was detected in only 5.8% (p=0.004). Most patients with gallstone were diagnosed with cholecystitis (70.9%), while cancer was diagnosed in only 8.5% of patients (p<0.001 and p=0.036, respectively). Biliary duct dilatation was the most common finding in patients with tumors. There was no significant difference between MRCP findings, diagnoses, and bilirubin grades in all three imaging options. Tumoral formations were detected more in patients with high bilirubin levels, while acute pancreatitis was more in patients with low bilirubin levels (p<0.05).

Conclusion: MRCP is a non-invasive , ionizing, radiation-free, complication-free, contrast-free, and premedication-free examination method with as high an accuracy rate as endoscopic retrograde cholangiopancreatography in pancreaticobiliary diseases.

Keywords: Magnetic resonance cholangiopancreatography (MRCP), pancreaticobiliary disease, cholecystitis, tumors

Introduction

Bile duct pathologies are a significant group of diseases affecting a considerable population worldwide. Bile duct stones can result in choledocholithiasis, and late diagnosis can lead to cholangitis and pancreatitis. Transabdominal ultrasound (USG) is the first-line imaging modality for evaluating biliary colic and right upper quadrant pain due to its wide availability and high sensitivity in detecting gallstones [1]. However, the ability to detect common bile duct stones with USG is limited, with sensitivity ranging from 22-55%. Other tests with better diagnostic accuracy for evaluating choledocholithiasis include endoscopic USG and endoscopic retrograde cholangiopancreatography (ERCP), both of which have sensitivities ranging from 93-97% and specificities ranging from 77-96%; however, their use in

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practice is low because they are invasive procedures, require sedation, and cannot be performed in every center [1,2].

Computed tomography (CT) is a non-invasive imaging technique widely used to diagnose and monitor most pancreatic and biliary system diseases. It complements magnetic resonance cholangiopancreatography (MRCP) in imaging biliary tract diseases. CT and magnetic resonance (MR) can also provide information about the extra biliary spread of gallbladder and bile duct diseases that cannot be obtained with USG. MRCP is a non-invasive alternative imaging method with a diagnostic profile comparable to endoscopic ultrasound and ERCP, having a sensitivity ranging from 85-92% and a specificity of 93-97% [3]. The American Society of Gastrointestinal Endoscopy recommends MRCP in cases of symptomatic cholelithiasis [4].

MRCP is now the preferred imaging modality for diagnosing biliary obstruction. When performed in the emergency department (ED), the procedure can help identify the underlying cause of obstruction, and expedite triage for patients needing ERCP. MRCP can shorten the length of stay in the ED and enable patients to reach the correct diagnosis more quickly [5].

Because USG is operator-dependent and CT involves radiation exposure, MRCP is considered the gold standard for diagnosing biliary tract pathologies with high accuracy [6]. Within the scope of this research, we aimed to elucidate the routine use of MRCP imaging in EDs and help patients receive more precise and rapid diagnoses in EDs.

Materials and Methods

This retrospective cross-sectional study included 368 patients who presented to the ED of Giresun Training and Research Hospital between 01.01.2020 and 31.12.2022 and underwent MRCP. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Ethics committee approval has been granted by the Clinical Research and Ethics Committee of Giresun Training and Research Hospital (approval number: 02, date: 27.02.2023). An expert radiologist with at least 5 years of experience evaluated MRCP imaging. The images were examined based on four findings (choledocholithiasis, gallstone, bile sludge, and biliary duct dilatation) and four diagnoses [cholecystitis, gallbladder perforation, acute pancreatitis, and tumor (gallbladder or klatskin)]. The demographic characteristics of the patients (age, gender), imaging indications, and bilirubin values (both numerical and group) were noted.

Inclusion Criteria

- Having presented to the ED
- Being over 18 years of age
- Having MRCP imaging performed within medical necessity

Exclusion Criteria

- Having MRCP performed after 24 hours of applying to the ED
- Patients whose request was ED without applying to the ED due to technical difficulties
- Patients whose MRCP images could not be accessed for any reason

Standardized Magnetic Resonance Cholangiopancreatography Protocol in the Emergency Department

- MRCP was ordered based on predefined clinical criteria, including:
- Persistently elevated bilirubin levels (>2 mg/dL)
- Biliary colic with inconclusive USG findings
- Suspected choledocholithiasis not confirmed by USG
- Pancreatitis of unclear etiology

Statistical Analysis

Patient data collected within the scope of the study were analyzed with the IBM Statistical Package for the Social Sciences (SPSS) for Windows 26.0 (IBM Corp., Armonk, NY). Frequencies and percentages for categorical data, and means and 95% confidence intervals (CI) for continuous data, were provided as descriptive values. For comparisons between groups, the "independent sample t-test" was used for two groups, and the "Pearson chi-square test" was used to compare categorical variables. The results were considered statistically significant when the p-value was less than 0.05.

Results

A total of 368 patients, 167 (45.4%) of whom were women, were included in the study. The mean age of women was 70.1±18.3, and the mean age of men was 69.1±15.2, with a total mean age of 69.7±17.0. As a result of MRCP examination, cholecystitis was detected in 53.0% (n=195) of the patients, gallbladder perforation in 1.4% (n=5), acute pancreatitis in 22.0% (n=81), and gallbladder or Klatskin tumor in 11.4% (n=42). None of these pathologies was found in 32.6% (n=120).

Table 1 denotes the imaging methods, gender, MRCP findings, and diagnoses, imaging indications, and bilirubin levels. Patients who underwent MRCP without USG, or CT, those who underwent CT before, and those who underwent both USG and CT before, were compared separately. There was no significant difference among MRCP findings, diagnoses, and bilirubin grades in all three imaging options.

Table 2 shows gender, MRCP findings, imaging method and indications, and bilirubin grades, based on four MRCP diagnoses. Cholecystitis was detected in 57.8% of patients with

choledocholithiasis, while tumor was detected in only 5.8% (p=0.004). Most patients with gallstone were diagnosed with cholecystitis (70.9%), while cancer was diagnosed in only 8.5% of patients (p<0.001 and p=0.036, respectively). Biliary duct dilatation was the most common finding in patients with tumors.

Table 3 compares MRCP diagnoses with age and bilirubin (total and direct) levels. Tumoral formations were more commonly detected in patients with high bilirubin levels, while acute pancreatitis was more common in patients with low bilirubin levels (p<0.05).

Table 4 indicates patients not diagnosed with the four primary diagnoses as investigated using MRCP. While at least one pathology was detected in most patients with gallstones, no clear association could be found between bilirubin levels and the absence of pathologies.

Univariate and multivariate logistic regression analyses were performed to evaluate the relationship between demographic factors and laboratory values and pathology detection in MRCP (Table 5). In both models, age was significantly associated with pathology detection [odds ratio (OR): 1.016, 95% CI: 1.003-1.029, p=0.017]

Table 1. Comparison of imaging methods performed before MRCP examination with gender, MRCP findings and diagnoses, imaging indication and bilirubin grades

		No imaging (USG or CT)	p-value	CT	p-value	Both USG and CT	p-value
Gender	Female	16 (8.0)	0.725	166 (82.6)	0.316	31 (15.4)	0.341
	Male	15 (9.0)		131 (78.4)		20 (12.0)	
Choledocholithiasis	No	14 (6.5)	0.125	170 (79.4)	0.468	34 (15.9)	0.184
	Yes	17 (11.0)		127 (82.5)		17 (11.0)	
Gallstone	No	16 (10.3)	0.263	123 (79.4)	0.575	22 (14.2)	0.874
	Yes	15 (7.0)		174 (81.7)		29 (13.6)	
Bile sludge	No	28 (11.5)	**0.003**	194 (79.5)	0.414	28 (11.5)	0.063
	Yes	3 (2.4)		103 (83.1)		23 (18.5)	
Biliary duct dilatation	No	8 (6.1)	0.222	105 (79.5)	0.677	24 (18.2)	0.073
	Yes	23 (9.7)		192 (81.4)		27 (11.4)	
Imaging indication	Biliary duct dilatation	47 (28.7)	0.286	143 (87.2)	0.586	22 (13.4)	0.842
	Choledochus stone	2 (40.0)		5 (100)		0 (0.0)	
	Gallstone	19 (33.9)		47 (83.9)		12 (21.4)	
	Mass	4 (23.5)		15 (88.2)		2 (11.8)	
	Other	39 (41.1)		87 (91.6)		15 (15.8)	
Bilirubin grade	<1 mg/dL	6 (9.4)	0.188	51 (79.7)	0.404	5 (7.8)	0.371
	1-2 mg/dL	6 (8.1)		61 (82.4)		9 (12.2)	
	2-5 mg/dL	10 (7.0)		117 (82.4)		24 (16.9)	
	5-10 mg/dL	4 (6.2)		53 (81.5)		11 (16.9)	
	>10 mg/dL	5 (21.7)		15 (65.2)		2 (8.7)	
Bilurubin. total <2 mg/dL	<2 mg/dL	12 (8.6)	0.910	113 (81.3)	0.824	14 (10.1)	0.101
	>2 mg/dL	19 (8.3)		184 (80.3)		37 (16.2)	
Bilurubin. total <5 mg/dL	<5 mg/dL	22 (7.8)	0.460	230 (81.9)	0.318	38 (13.5)	0.738
	>5 mg/dL	9 (10.3)		67 (77.0)		13 (14.9)	
Cholecystitis	No	16 (9.2)	0.592	139 (80.3)	0.869	21 (12.1)	0.368
	Yes	15 (7.7)		158 (81.0)		30 (15.4)	
Gallbladder perforation	No	31 (8.5)	0.495	293 (80.7)	0.968	51 (14.0)	0.367
	Yes	0 (0.0)		4 (80.0)		0 (0.0)	
Acute pancreatitis	No	21 (7.3)	0.150	233 (81.2)	0.662	45 (15.7)	0.057
	Yes	10 (12.3)		64 (79.0)		6 (7.4)	
Tumor (glallbladder or klatskin)	No	29 (8.9)	0.364	260 (79.8)	0.197	47 (14.4)	0.388
	Yes	2 (4.8)		37 (88.1)		4 (9.5)	

MRCP: Magnetic resonance cholangiopancreatography, CT: Computed tomography, USG: Ultrasound

Discussion

Unlike CT and X-ray, which involve ionizing radiation with potential long-term risks, magnetic resonance imaging (MRI) offers superior contrast resolution and tissue differentiation. Thus, it is widely preferred for imaging various structures, including the brain, spinal cord, bone marrow, musculoskeletal system, cardiovascular system, and abdominal and pelvic organs. It is the method that reveals the relationship between anatomical structures in the optimal way [7]. MRCP is a non-invasive method that can be preferred in the diagnosis of bile duct pathologies due to its features, including lack of ionizing radiation, absence of complication risk, no requirement for patient preparation, applicability during pancreatitis and cholangitis attacks, and the ability to obtain images in different planes [8]. With this method, the anatomy and pathology of the bile and pancreatic ducts are evaluated rapidly, reliably, and without complications, using no contrast agents [9]. MRCP shows stationary fluids such as bile and pancreatic fluid with higher signal intensity than the surrounding soft tissues. Only stagnant or slowly moving fluids within anatomical structures

Table 2. Comparison of MRCP diagnoses with gender, MRCP findings, imaging methods and bilirubin grades

	Cholecystitis		Acute pancreatitis		Tumor (gallbladder or klatskin)		Gallbladder perforation	
	n (%)	p-value	n (%)	p-value	n (%)	p-value	n (%)	p-value
Gender								
Female	111 (55.2)	0.346	44 (21.9)	0.951	23 (11.4)	0.984	2 (1.0)	0.509
Male	84 (50.3)		37 (22.2)		19 (11.4)		3 (1.8)	
Choledocholithiasis	89 (57.8)	0.117	32 (20.8)	0.629	9 (5.8)	**0.004**	2 (1.3)	0.933
Gallstone	151 (70.9)	**<0.001**	52 (24.4)	0.192	18 (8.5)	**0.036**	3 (1.4)	0.923
Bile sludge	81 (65.3)	**0.001**	17 (13.7)	**0.006**	15 (12.1)	0.769	1 (0.8)	0.514
Biliary duct dilatation	131 (55.5)	0.195	48 (20.3)	0.301	38 (16.1)	**<0.001**	3 (1.3)	0.846
Ultrasound	52 (57.1)	0.360	13 (14.3)	**0.040**	7 (7.7)	0.198	1 (1.1)	0.805
CT	158 (53.2)	0.869	64 (21.5)	0.662	37 (12.5)	0.197	4 (1.3)	0.968
Imaging								
No imaging	15 (48.4)	0.608	10 (32.3)	0.078	2 (6.5)	0.409	0 (0.0)	0.484
USG or CT	150 (52.4)		65 (22.7)		36 (12.6)		5 (1.7)	
USG and CT	30 (58.8)		6 (11.8)		4 (7.8)		0 (0.0)	
Imaging indication								
Biliary duct dilatation	93 (56.7)	0.075	30 (18.3)	0.110	27 (16.5)	**<0.001**	1 (0.6)	0.550
Choledochus stone	3 (60.0)		2 (40.0)		0 (0.0)		0 (0.0)	
Gallstone	36 (64.3)		8 (14.3)		2 (3.6)		1 (1.8)	
Mass	7 (41.2)		3 (17.6)		6 (35.3)		0 (0.0)	
Other	41 (43.2)		28 (29.5)		5 (5.3)		3 (3.2)	
Bilirubin grade								
<1 mg/dL	27 (42.2)	**0.003**	19 (29.7)	0.065	4 (6.3)	**<0.001**	1 (1.6)	0.772
1-2 mg/dL	50 (67.6)		22 (29.7)		7 (9.5)		2 (2.7)	
2-5 mg/dL	75 (52.8)		27 (19.0)		9 (6.3)		1 (0.7)	
5-10 mg/dL	37 (56.9)		11 (16.9)		13 (20.0)		1 (1.5)	
>10 mg/dL	6 (26.1)		2 (8.7)		9 (39.1)		0 (0.0)	
Bilirubin total <2 mg/dL								
<2 mg/dL	78 (56.1)	0.349	41 (29.5)	**0.007**	11 (7.9)	0.100	3 (2.2)	0.302
>2 mg/dL	117 (51.1)		40 (17.5)		31 (13.5)		2 (0.9)	
Bilirubin total <5 mg/dL								
<5 mg/dL	152 (54.1)	0.466	68 (24.2)	0.069	20 (7.1)	**<0.001**	4 (1.4)	0.847
>5 mg/dL	43 (49.4)		13 (14.9)		22 (25.3)		1 (1.1)	

MRCP: Magnetic resonance cholangiopancreatography, CT: Computed tomography, USG: Ultrasound

can be seen [10]. Although ERCP is still the standard reference for evaluating bile and pancreatic ducts, MRCP is used for diagnostic purposes in many centers [11]. MRCP has lower spatial resolution compared to conventional cholangiographic methods. Therefore, small ductal pathologies and peripheral bile ducts may not be observed. Another disadvantage is that it cannot be used for therapeutic purposes [12]. In our study, no significant differences were observed among MRCP findings, diagnoses, and bilirubin grades across all three imaging options.

Choledocholithiasis is the most common cause of obstruction in the extrahepatic bile ducts. MRCP and ERCP have similar accuracy rates in detecting choledocholithiasis. Many studies have shown the sensitivity of MRCP as 81 to 100% and the specificity as 85 to 100%. Gallstones appear as round or oval low-signal intensity filling defects in the bile duct. Stones with diameters 2-3 mm can be seen in MRCP [13]. Small gallstones may not dilate the bile ducts and are best seen on axial images. In the differential diagnosis of filling defects in the bile ducts, air bubbles, tumors, blood clots, metallic stents, surgical clip artifacts, and the ampullary appearance of the cystic duct opening into the main hepatic bile duct should be considered [14]. Air bubbles are seen in the non-dependent region of the bile ducts and often create air-fluid levels. Impacted stones in the ampulla region may be confused with stenosis due to the lack of peripheral hyperintense bile. In a case with a high suspicion of choledocholithiasis, if a stone is detected in the common bile duct by ultrasonography, ERCP should be performed to avoid delaying interventional procedures. MRCP is indicated in patients whose ultrasonography does not detect stones but who are clinically suspected to have common bile duct stones [15].

Cholangiocarcinoma is the most common primary malignant tumor of the bile ducts, located in the common bile duct in 30-36% of cases, in the common hepatic duct in 15-30% of cases, and in the biliary bifurcation in 10-26% of cases; seen as stenosis without a mass. MRCP has an essential role in perihilar cholangiocarcinomas. It is characterized by sudden biliary obstruction and dilatation of the bile ducts distally in MRCP. With conventional MR examination, the detection of the lesion, its spread, and its relationship with neighboring organs is more clearly revealed. MRCP has a sensitivity of 81-100% and a specificity of 93-94% in bile duct malignancies [16].

90% of malignant pancreatic neoplasms are adenocarcinomas of ductal origin. 62% of pancreatic carcinomas are located in the head of the pancreas, 26% in the body, and 12% in the tail [17]. Obstruction in the pancreatic and bile ducts, and dilation in the distal section are detected in MRCP. Dilation in the common bile and pancreatic ducts is an important finding (double duct sign). However, it is not specific to pancreatic cancer and can also be seen in chronic pancreatitis and ampullary tumors. In pancreatic head cancers, dilation is detected in both the bile and pancreatic ducts in 77%, in only the bile duct in 9%, and in only the pancreatic duct in 12% [18]. Our study's MRCP findings, imaging methods and indications, and bilirubin grades are based on four MRCP diagnoses. Cholecystitis was detected in 57.8% of patients with choledocholithiasis; tumor detected in only 5.8%. Gallstones were diagnosed with cholecystitis in 70.9% of cases; cancer

Table 3. Comparison of MRCP diagnoses with age and bilirubin levels

		Age (years)	Bilirubin total (mg/dL)	Bilirubin direct (mg/dL)
Cholecystitis				
	No (n=173)	68.5 (66.0-70.9)	4.12 (3.46-4.79)	3.03 (2.48-3.58)
	Yes (n=195)	70.7 (68.2-73.1)	3.58 (3.06-4.10)	2.55 (2.11-2.99)
	p-value	0.078	0.608	0.684
Gallbladder perforation				
	No (n=363)	69.6 (67.8-71.3)	3.85 (3.43-4.27)	2.79 (2.44-3.14)
	Yes (n=5)	78.6 (62.6-94.6)	2.95 (0.57-6.47)	1.72 (0.48-3.91)
	p-value	0.216	0.561	0.520
Acute pancreatitis				
	No (n=287)	70.1 (68.1-72.1)	4.17 (3.66-4.67)	3.06 (2.64-3.49)
	Yes (n=81)	68.2 (64.4-72.0)	2.67 (2.67-3.23)	1.76 (1.33-2.20)
	p-value	0.290	**0.001**	**0.001**
Tumor (glallbladder or klatskin)				
	No (n=326)	69.0 (67.1-70.9)	3.39 (3.02-3.75)	2.38 (2.08-2.68)
	Yes (n=42)	74.8 (71.3-78.2)	7.31 (5.20-9.43)	5.84 (4.09-7.58)
	p-value	0.090	**<0.001**	**<0.001**

MRCP: Magnetic resonance cholangiopancreatography

diagnosed in only 8.5%. Biliary duct dilatation was the most common finding in patients with tumors.

Although bile duct obstruction is present in 20% of cases, the width of the pancreatic duct is normal. The positive predictive value of MRCP in showing the cause of malignant bile duct obstruction is 86%, and the negative predictive value is 98%. Some recommend using ERCP as a diagnostic imaging method for malignant and benign strictures due to the similarity of their morphological features in MRI, increased spatial resolution, and the possibility of taking biopsies. In addition, ERCP is superior to MRCP in differential diagnosis, mainly because it can directly visualize ampullary region pathologies such as ampullary tumors, inflammatory stenosis, sphincter of Oddi dysfunction, and impacted stones [19]. Two essential factors in the etiology of acute pancreatitis are alcohol and gallstones. Performing ERCP during acute pancreatitis is not preferred because it may increase the severity of the disease. Therefore, MRCP has an essential role in revealing the etiology of the disease. It may indicate choledochal stones, pancreas division, pancreatic carcinoma, and pancreaticobiliary junction anomalies [20]. In acute pancreatitis, the choledochus is usually of normal width and ends by gradually thinning distally. Choledochal stones causing acute pancreatitis are mainly observed as filling defects. In conventional MRIs, focal or diffuse thickening of the pancreas, contour irregularity,

Table 4. Comparison of patients with no pathology detected in MRCP examination for gender, MRCP findings, imaging indication, imaging methods and bilirubin grades

		No pathology	At least one pathology	p-value
Gender	Female	66 (32.8)	135 (67.2)	0.919
	Male	54 (32.3)	113 (67.7)	
Choledocholithiasis	No	69 (32.2)	145 (67.8)	0.860
	Yes	51 (33.1)	103 (66.9)	
Gallstone	No	73 (47.1)	82 (52.9)	**<0.001**
	Yes	47 (22.1)	166 (77.9)	
Bile sludge	No	87 (35.7)	157 (64.3)	0.080
	Yes	33 (26.6)	91 (73.4)	
Biliary duct dilatation	No	49 (37.1)	83 (62.9)	0.167
	Yes	71 (30.1)	165 (69.9)	
Imaging indication	Biliary duct dilatation	47 (28.7)	117 (71.3)	0.286
	Choledochus stone	2 (40.0)	3 (60.0)	
	Gallstone	19 (33.9)	37 (66.1)	
	Mass	4 (23.5)	13 (76.5)	
	Other	39 (41.1)	56 (58.9)	
Ultrasound	No	90 (32.5)	187 (67.5)	0.933
	Yes	30 (33.0)	61 (67.0)	
CT	No	22 (31.0)	49 (69.0)	0.745
	Yes	98 (33.0)	199 (67.0)	
Imaging	No imaging	9 (29.0)	22 (71.0)	0.904
	USG or CT	94 (32.9)	192 (67.1)	
	USG and CT	17 (33.3)	34 (66.7)	
Bilirubin grade	<1 mg/dL	26 (40.6)	38 (59.4)	**0.040**
	1-2 mg/dL	14 (18.9)	60 (81.1)	
	2-5 mg/dL	52 (36.6)	90 (63.4)	
	5-10 mg/dL	19 (29.2)	46 (70.8)	
	>10 mg/dL	9 (39.1)	14 (60.9)	
Bilurubin total <2 mg/dL	<2 mg/dL	40 (28.8)	99 (71.2)	0.222
	>2 mg/dL	80 (34.9)	149 (65.1)	
Bilurubin total <5 mg/dL	<5 mg/dL	93 (33.1)	188 (66.9)	0.720
	>5 mg/dL	27 (31.0)	60 (69.0)	

MRCP: Magnetic resonance cholangiopancreatography, CT: Computed tomography, USG: Ultrasound

hyperintense signal change in T2-weighted images, and peripancreatic fluid collections may be observed. Diffuse compression secondary to edema in the pancreatic duct may be detected [21]. Chronic pancreatitis diagnostic criteria for chronic pancreatitis, in MRCP are characterized by multifocal dilatation, stenosis, and irregularity in the primary and side branch ducts. The most obvious and specific feature of chronic pancreatitis is side branch dilation. Irregularity of the pancreatic contour, pseudocysts, and ductal filling defects secondary to stones and debris can be seen. Stones up to 2 mm can be seen. ERCP, which has a higher spatial resolution, is more sensitive in revealing duct changes in the early stage. MRCP can be used to show chronic pancreatitis complications and monitor advanced cases [22].

ERCP is an invasive method that carries a mortality rate of 0.2-1% and a morbidity rate of 1-7%, and requires experienced operators: these factors makes it difficult to use for diagnostic purposes. MRCP is a reliable and non-invasive examination method for pancreatic and biliary system diseases. It does not require contrast material and allows multiplanar and cross-sectional imaging. Therefore, MRCP is preferred after USG. A comparative study of MRCP, CT, and USG in pancreaticobiliary system diseases found agreement between USG and MRCP in 92% of the cases. A statistically significant difference was found between the evaluations of extrahepatic bile ducts by USG and MRCP [23]. A study involving 106 patients compared axial and coronal 2D T2 TSE-suppressed sequences with 3D maximum intensity projection images. The accuracy of 2D T2 TSE sequences in detecting biliary system pathology was found to be 94% [24]. In another study conducted with 108 patients using respiratory-averaged 2D FSE sequences, the specificity of MRCP in detecting biliary system pathology was 97%, sensitivity was 99%, and accuracy was 98% [25]. In a study by Regan et al. [26], ERCP, MRCP, and US results were compared. The sensitivity and specificity values of USG, MRCP, and ERCP in detecting choledochal stones were 57% and 100% for USG, 87% and 75% for MRCP, and 100% for ERCP, respectively. In a study conducted by Fulcher et al. [27] on 300 cases using the Half-Fourier Acquisition Single-Touch Echo sequence, the sensitivity, specificity, and accuracy of MRCP in detecting choledochal stones were reported as 100%. In another study comparing MRCP, USG, and direct cholangiography in the detection of choledocholithiasis, the sensitivity, specificity, and accuracy rates were found to be 91%, 98%, and 97% for MRCP, and 38%, 100%, and 89% for USG, respectively [28]. In a study of 300 cases conducted by Fulcher et al. [27] using the Half Fourier Rapid Acquisition with Relaxation Enhancement sequence, the sensitivity of MRCP in the diagnosis of malignant obstructions was found to be 100%, specificity 97.6%, and accuracy 98.2%.

The most crucial advantage of MRCP in malignant pathologies is that it non-invasive ly, visualizes the bile and pancreatic ducts. Resectability and spread of a tumor can be evaluated by adding conventional MR sequences. In a study conducted with respiratory averaged 3D fat-suppressed T2 TSE sequence, the sensitivity, specificity, and accuracy of MRCP in detecting malignant and other pathologies were found to be 100% [29]. In a study conducted by Park et al. [30], the sensitivity, specificity, and accuracy rates of MRCP (81%, 70%, 76%) and ERCP (74%, 70%, 72%) in differentiating cholangiocarcinoma-related stricture from benign stricture were found to be respectively. The most commonly used non-invasive imaging method in patients with suspected bile duct obstruction is USG. The sensitivity of USG varies between 20% and 80% depending on its use, and its specificity is over 90%. Hussein et al. [31] reported the specificity, sensitivity, and accuracy of MRCP in diagnosing bile duct obstruction as 100%. The characteristics that limit the use of MRCP are its low-resolution power, inability to show small ductal pathologies, and lack of capability to perform therapeutic interventions during the procedure.

The logistic regression analysis revealed that age was significantly associated with pathology detection in MRCP, with older patients having a higher likelihood of positive findings (OR: 1.016, 95% CI: 1.003-1.029, p=0.017). This suggests that age may serve as an independent predictor of biliary pathology, reinforcing the importance of considering patient demographics when determining the necessity of advanced imaging. However, no significant association was found between gender, total bilirubin, and direct bilirubin levels and pathology detection. These results imply that bilirubin levels alone may not be a sufficient indicator for justifying MRCP in the emergency setting, highlighting the need for a more comprehensive clinical assessment before ordering advanced imaging. Future studies should further investigate the interplay of these variables and explore refined protocols to optimize MRCP utilization while maintaining diagnostic accuracy.

Table 5. Univariate and multivariate analysis of demographic and laboratory predictors of pathology detection in MRCP"

	Univariate logistic regression		Multivariate logistic regression	
	OR (95% CI)	p	OR (95% CI)	p
Age (years)	1.016 (1.003-1.029)	0.017	1.016 (1.003-1.029)	**0.017**
Gender	1.023 (0.660-1.585)	0.919	1.031 (0.660-1.610)	0.894
Bilirubin, total	0.991 (0.941-1.045)	0.749	1.077 (0.827-1.404)	0.581
Bilirubin, direct	0.985 (0.925-1.049)	0.638	0.898 (0.655-1.232)	0.506

OR: Odds ratio, CI: Confidence interval

Study Limitations

One of the significant limitations of this study is the scarce literature available on the use of MRCP in the ED. The lack of existing data detailing the characteristics, diagnostic and therapeutic characteristics and processes of ED patients undergoing MRCP makes it challenging to interpret our findings within a broader context. This limitation also restricts the generalizability of the study's results. However, the strengths of this study include a pioneering evaluation of the role of MRCP in a critical clinical setting such as the ED. This offers a valuable perspective that can serve as a foundation for future research. Additionally, by conducting a retrospective analysis of a large patient cohort, the study enables a practical assessment of the clinical impacts of MRCP in the ED. In this context, our study not only highlights the existing knowledge gap but also provides a starting point for further investigations in this field.

Conclusion

MRCP is a valuable non-invasive imaging modality for biliary pathologies in the ED. However, its routine use should be reconsidered given that 32.6% of MRCPs yielded normal findings. A protocol-driven approach may improve its utility while reducing unnecessary imaging. The findings of this study suggest that while MRCP is highly effective in diagnosing significant biliary pathology, its routine use in the ED should be approached with caution. The high proportion of normal MRCP findings indicates a potential for overuse, highlighting the need for more refined selection criteria. Additionally, cost-effectiveness should be considered when choosing MRCP over alternative imaging methods such as USG and CT, which may be sufficient in many cases. While MRCP offers superior diagnostic accuracy, especially for detecting choledocholithiasis, its cost and accessibility limit its widespread routine use. Future research should focus on developing optimized protocols that balance the clinical benefits of MRCP with economic constraints and patient outcomes.

Ethics

Ethics Committee Approval: Ethics committee approval has been granted by the Clinical Research and Ethics Committee of Giresun Training and Research Hospital (approval number: 02, date: 27.02.2023).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: İ.A., S.A., Concept: İ.A., S.A., Design: İ.A., S.A., Data Collection or Processing: İ.A., S.A., Analysis or Interpretation: İ.A., S.A., Literature Search: İ.A., S.A., Writing: İ.A., S.A.

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