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RESEARCH

Morphometric examination of the hepatobiliary duct system in healthy individuals and patients with cholelithiasis: A radio-anatomic magnetic resonance cholangiopancreatography study

Sağlıklı bireylerde ve kolelitiazisli hastalarda hepatobiliyer kanal sisteminin morfometrik incelenmesi: Bir radyo-anatomik manyetik rezonans kolanjiyopankreatografi çalışması

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Abstract

Purpose: Cholelithiasis is a common gallbladder disease with high morbidity and treatment cost. Although the disease has many formation factors such as bile duct obstruction, congenital anomalies, genetic and metabolic diseases, the main cause is gallstones. The aim of this study is to examine the radio-anatomic and demographic characteristics of the bile ducts of patients who have cholelithiasis due to gallstones by using magnetic resonance cholangiopancreatography (MRCP) and to compare with healthy individuals.

Materials and Methods: The study was carried out by retrospectively scanning the MRCP images of 113 patients diagnosed with cholelithiasis and 87 healthy individuals who were referred to the hospital for various indications and had no gallbladder pathology.

Results: According to the Spearman rho correlation test performed by ignoring gender, a significant correlation was found between right hepatic duct diameter (RHD-D) and right hepatic duct – cystic duct angle (RHDCD-A), and between left hepatic duct diameter (LHD-D) and common bile duct diameter (CBD-D). In the correlation analysis performed only among males, a significant correlation was found between RHDCD-A and right hepatic duct – left hepatic duct angle (RLHD-A), RHDCD-A and common hepatic duct diameter (CHD-D) parameters. In the correlation analysis performed only among women, a significant relationship was found between age and RHD-D, LHD-D, CHD-D, CBD-D, between RHDCD-A and

Öz

Amaç: Kolelitiazis, morbiditesi ve tedavi maliyeti yüksek, sık görülen bir safra kesesi hastalığıdır. Hastalığın safra kanalı tıkanıklıkları, doğumsal anomaliler, genetik ve metabolik hastalıklar gibi birçok oluşum faktörü bulunsa da asıl nedeni safra taşlarıdır. Bu çalışmanın amacı safra taşı nedeniyle kolelitiazis gelişen hastaların safra yollarının radyo-anatomik ve demografik özelliklerini manyetik rezonans kolanjiyopankreatografi (MRCP) ile incelemek ve sağlıklı bireylerle karşılaştırmaktır.

Gereç ve Yöntem: Çalışma kolelitiazis tanısı alan 113 hasta ile çeşitli endikasyonlarla hastaneye başvuran ve safra kesesi patolojisi olmayan 87 sağlıklı bireyin MRCP görüntülerinin retrospektif olarak taranmasıyla gerçekleştirildi.

Bulgular: Cinsiyet dikkate alınmadan yapılan Spearman rho korelasyon testine göre sağ hepatik kanal çapı (RHD-D) ile sağ hepatik kanal – sistik kanal açısı (RHDCD-A) arasında ve sol hepatik kanal çapı (LHD-D) ve ductus choledochus kanal çapı (CBD-D) arasında anlamlı bir korelasyon bulundu. Sadece erkekler arasında yapılan korelasyon analizinde RHDCD-A ile sağ hepatik kanal – sol hepatik kanal açısı (RLHD-A), RHDCD-A ve ductus hepaticus communis kanal çapı (CHD-D) parametreleri arasında anlamlı bir korelasyon bulundu. Sadece kadınlarda yapılan korelasyon analizinde yaş ile RHD-D, LHD-D, CHD-D, CBD-D arasında, RHDCD-A ile sistik kanal – safra kesesi açısı (CDG-A), RHD-D arasında ve CHD-D

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cystic duct – gallbladder angle (CDG-A), RHD-D, and between CHD-D and cystic duct diameter (CD-D).
Conclusion: This study will contribute to literature by revealing the morphometric characteristics and radio-anatomic information of the hepatobiliary systems of both patients with cholelithiasis and healthy individuals.
Keywords:. Cholelithiasis, gallstone, hepatobiliary duct system, magnetic resonance cholangiopancreatography

and cystic duct diameter (CD-D) arasında anlamlı bir ilişki bulunmuştur.
Sonuç: Bu çalışmanın hem kolelitiazisli hastaların hem de sağlıklı bireylerin hepatobiliyer kanal sistemlerinin morfometrik özelliklerini ve radyoanatomik bilgilerini ortaya koyarak literatüre katkı sağlayacağına inanıyoruz.
Anahtar kelimeler: Kolelitiazis, safra taşı, hepatobilier kanal sistemi, manyetik rezonans kolanjiyopankreatografi

INTRODUCTION

Gall bladder is an important, oval-shaped, digestive system organ located in the lower part of the liver; it stores approximately 30-50 ml of bile concentrates, and transports to the second part of duodenum through its channels. The obstruction that occurs during this transportation causes infection in the ducts and gallbladder and this condition called cholelithiasis occurs as a disease with low mortality, but high morbidity[1].

In studies conducted on cholelithiasis in the United States of America (USA), Europe and Asia, its prevalence is reported to be between 5.9% and 21.9%[2]. Although cholelithiasis formation is multifactorial, the most important factor is known as gallstones. Gallstone is a gastrointestinal disease that has an incidence between 10 and 15% and it requires a high cost for treatment[3]. Its pathogenesis is affected by factors such as gender (higher in females), age (higher in old patients), diet rich in terms of obesity (high carbohydrate and lipid), genetic factors (lack of ABCB4), pregnancy, diabetes mellitus, alcohol consumption, hemolytic diseases, race and increase in cholesterol in the blood. The primary pathophysiological factor among these factors is the increase in cholesterol in the blood[1,4-8]. The reason can be the fact that 37-86% of gallstones are formed by stones rich in cholesterol[9].

Patients with cholelithiasis gallstone have symptoms of pain in the right upper quadrant (RUQ), dark-colored urine, hepatitis, fever, nausea, vomiting, itching, RUQ sensitivity on palpation, loss of appetite and acholic stools[4,9,10]. However, in 40-60% of the patients, no symptoms are seen in the first stage of the disease[11].

Since it may be confused with many diseases in terms of symptoms, the diagnosis should be supported with liver function tests, white blood cell count and radiological imaging methods[9,12]. Mainly radiological imaging methods such as RUQ ultrasonography (USG), computed tomography (CT), Magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP), and endoscopic ultrasound (EUS) are used in the diagnosis[4,9]. Although USG imaging method replaced MRCP imaging method recently, MRCP provides better imaging in pregnant patients and complicated ductal diseases[6,13].

Today, serious technological developments have occurred in the treatment of gallstones with the developments in technology[6]. These are invasive laparoscopic cholecystectomy, open surgical cholecystectomy and small incision cholecystectomy methods for the treatment of symptomatic gallstones. Micro radio-anatomic information is very important to perform these surgical techniques most accurately. There were no studies in literature review in which hepatobiliary canal system and morphometric parameters in patients with cholelithiasis and healthy individuals were examined.

In this study, which is based on the hypothesis of investigating the hepatobiliary duct system in cholelithiasis and healthy individuals, it aims to increase the level of microanatomical knowledge by comparing the radio-anatomical features of the hepatobiliary duct system in cholelithiasis patients and healthy individuals with MRCP. We believe that increasing the level of knowledge about the hepatobiliary duct system will lead to anatomical studies, internal and surgical interventions.

MATERIALS AND METHODS

Study population

The study was started in İnönü University Radiology Department with the decision of İnönü University Local Clinical Research Ethics Committee numbered 2021/1547. The study was carried out in İnönü University training and research hospital with the permission of the local ethics committee. The applications were carried out by radiologists specialized in the field for at least 5 years. The study

was conducted by retrospectively scanning the MRCP images of 113 patients with cholelithiasis (58 female, 55 male) and 87 healthy individuals (39 female, 48 male) (those who had various indications but not cholelithiasis) who were recruited in accordance with the inclusion criteria from the hospital archive system. Images of patients with cholelithiasis who were between 20 and 65 years of age, who did not have an invasive procedure in their gall bladder and who did not have a history of liver, and pancreatic diseases were included in the study. The images of healthy individuals were obtained from who were between 20 and 65 years of age, who did not have a history of liver and pancreatic diseases, who did not have an abdominal surgery history, and who did not have a cholelithiasis diagnosis.

MRPC protocol

The images were obtained from 1,5 Tesla (Intera, Master Gyroscan Philips Medical Systems, The Netherlands) and 3 Tesla (Magnetom Skyra Version E11: Siemens Healthcare, Erlangen, Germany) devices. Images were taken in the axial plane without using contrast material, with a slice thickness 1 mm by using standard body coil.

Image analysis

The images were obtained in three planes (axial, sagittal, and coronal) by using maximum intensity projection (MIP) console and length and diameter measurements were made on these images to the parameters determined (Table 1), (Figure 1, 2).

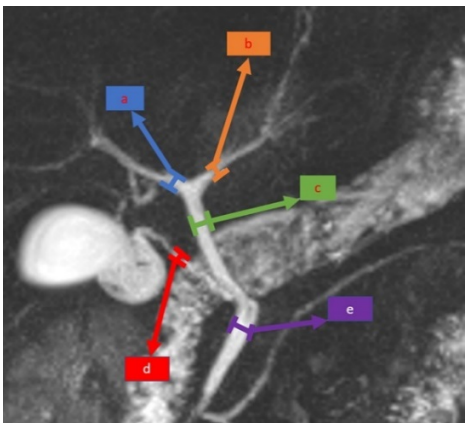

Figure 1. Demonstration of diameters (a; RHD-D, b; LHD-D, c; CHD-D, d; CD-D, e; CBD-D)

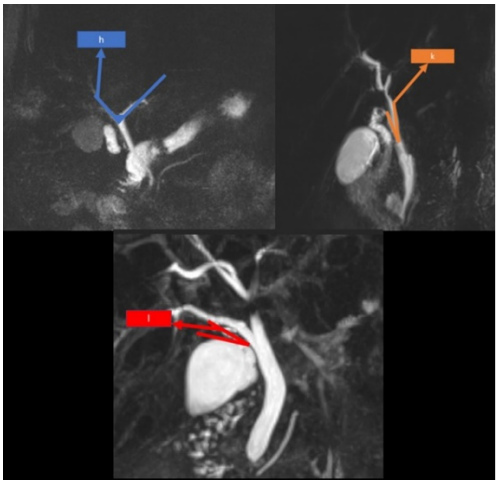

Figure 2. Demonstration of angles (h; RLHD-A, k; RHDCD-A, l; CDG-A).

Table 1. Diameter and angle measurements.

Measurement Parameters	
Diameter Measurements	**Angle Measurements**
Cystic duct – Gallbladder angle (CDG-A)	Right hepatic duct – Left hepatic duct angle (RLHD-A)
Right hepatic duct diameter (RHD-D)	
Left hepatic duct diameter (LHD-D)	
Common hepatic duct diameter (CHD-D)	Right hepatic duct – Cystic duct angle (RHDCD-A)
Cystic duct diameter (CD-D)	
Common bile duct diameter (CBD-D)	

Statistical analysis

Normality distribution of the data was examined with Kolmogorov Smirnov test and it was found that the data were not normally distributed. Median, minimum (minimum) and maximum values were included in descriptive statistics. Mann Whitney-U test was used for paired comparisons. Spearman Rho correlation analysis applied to nonparametric data was used to determine the relationship between groups and the degree of the relationship and correlation coefficient and p value were obtained. While a correlation coefficient close to 1 indicates a strong relationship, a correlation coefficient close to 0 indicates a weak relationship. A correlation coefficient with "-" sign indicates a negative relationship, while "+" sign indicates a positive relationship. $p<0.05$ value was considered as

significant in statistical analyses and IBM SPSS Statistics 22.0 for Windows package program was used. Power analysis was performed using G*Power 3.1.9.4 program.

RESULTS

The study was carried out on 113 healthy individuals with cholelithiasis. Other hepatobiliary duct system diseases, except cholelithiasis, were determined as exclusion criteria in the cholelithiasis group, and all hepatobiliary duct system diseases, including cholelithiasis, in the healthy group. Power analysis was performed using a 95% confidence interval and an effect value of 0.5, and the sample size was found to be 174 in total. In the cholelithiasis group, median age of the 58 female patients was found as 56 years, while median age of the 55 male patients was found as 54 years. In the healthy group, median age of the 39 female individuals was found as 52 years, while median age of the 48 male individuals was found as 48.5 years. Median (min-max) values of the ages of the patients with cholelithiasis and healthy group and Mann Whitney-U analysis results are shown in Table 2. According to the analysis results, no statistically significant difference was found between the ages of male and female patients with cholelithiasis and those of the healthy male and female individuals ($p>0.05$), (Table 2). In addition, no statistically significant difference was found between healthy females and females with cholelithiasis and between healthy male and males with cholelithiasis in terms of age ($p>0.05$), (Table 2).

Table 2. Median (min-max) values of the ages of the patients with cholelithiasis and healthy individuals (Mann Whitney-U analysis results).

Group	Female Age (years) Median (Min-Max)	Male Age (years) Median (Min-Max)	p
Cholelithiasis	56 (22-65)	54 (26-65)	.935
Healthy	52 (22-65)	48.5 (22-65)	.572
p	.306	.095	

Median (min-max) values of the parameters obtained from the MRCP images of patients with cholelithiasis and Mann Whitney-U test analysis results are shown in Table 3. According to the analysis results, no statistically significant difference was found between the measurements taken from female and male patients with cholelithiasis ($p>0.05$).

Table 3. Median (min-max) values of parameters obtained from male and female patients with cholelithiasis and Mann Whitney-U test analysis results.

Parameters *	Female Median (Min-Max)	Male Median (Min-Max)	p
RLHD-A (°)	75.6 (26.9-143.8)	78.6 (26.2-143.1)	.587
RHDCD-A (°)	22.1 (9-86.8)	22 (6-62.4)	.934
CDG-A (°)	56.7 (6.2-138.3)	63.4 (5.1-150.2)	.203
RHD-D (mm)	3.3 (1.3-8.5)	3.4 (1.2-11)	.984
LHD-D (mm)	4.1 (1.9-10.3)	3.9 (1.9-13.6)	.966
CHD-D (mm)	5.2 (2.5-11.6)	4.9 (2.2-27.5)	.829
CD-D (mm)	1.9 (1.1-6.2)	2.1 (0.9-9.5)	.175
CBD-D (mm)	6 (2.4-12.6)	5.3 (1.9-14.9)	.298

*RLHD-A: Right hepatic duct – Left hepatic duct angle, RHDCD-A: Right hepatic duct – Cystic duct angle, CDG-A:Cystic duct – Gallbladder angle, RHD-D: Right hepatic duct diameter, LHD-D: Left hepatic duct diameter, CHD-D: Common hepatic duct diameter, CD-D: Cystic duct diameter, CBD-D: Common bile duct diameter.

Median (min-max) values of the parameters obtained from the MRCP images of healthy individuals and Mann Whitney-U test analysis results are shown in Table 4. According to the analysis results, statistically significant difference was found between healthy female and male individuals in terms of RHD-D and LHD-D measurements ($p<0.05$).

Table 4. Median (min-max) values of the measurements taken from healthy females and males and Mann Whitney-U test analysis results.

Parameters	Female Median (Min-Max)	Male Median (Min-Max)	p
RLHD-A (°)	78.4 (34.2-178.8)	73.1 (24.5-178.8)	.739
RHDCD-A (°)	21.8 (9.6-65.8)	28.3 (6-121.1)	.062
CDG-A (°)	53.7 (7.9-137.5)	64.3 (7.8-141.1)	.701
RHD-D (mm)	3.6 (2.1-10.2)	3 (1.5-7.8)	**.022**
LHD-D (mm)	3.8 (2.4-14.6)	3.1 (1.5-7.8)	**.033**
CHD-D (mm)	5 (2.6-19.7)	4.1 (1.7-10.7)	.099
CD-D (mm)	2.2 (1.3-4.4)	2 (1.1-3.3)	.223
CBD-D (mm)	6 (1.8-15.4)	4.9 (2.3-11.3)	.074

*RLHD-A: Right hepatic duct – Left hepatic duct angle, RHDCD-A: Right hepatic duct – Cystic duct angle, CDG-A: Cystic duct – Gallbladder angle, RHD-D: Right hepatic duct diameter, LHD-D: Left hepatic duct diameter, CHD-D: Common hepatic duct diameter, CD-D: Cystic duct diameter, CBD-D: Common bile duct diameter.

As a result of the comparison of cholelithiasis patients and healthy individuals, regardless of gender, with the Mann Whitney-U test, no significant relationship was found between the two groups ($p>0.05$) (Table 5).

Table 5. Comparison of patients with cholelithiasis and healthy individuals regardless of gender

Parameters	p
RLHD-A (°)	.635
RHDCD-A (°)	.138
CDG-A (°)	.932
RHD-D (mm)	.656
LHD-D (mm)	.088
CHD-D (mm)	.094
CD-D (mm)	.441
CBD-D (mm)	.184

*RLHD-A: Right hepatic duct – Left hepatic duct angle, RHDCD-A: Right hepatic duct – Cystic duct angle, CDG-A: Cystic duct – Gallbladder angle, RHD-D: Right hepatic duct diameter, LHD-D: Left hepatic duct diameter, CHD-D: Common hepatic duct diameter, CD-D: Cystic duct diameter, CBD-D: Common bile duct diameter.

According to Spearman rho correlation analysis performed between patients with cholelithiasis and healthy individuals regardless of gender, a positive correlation was found between RHD-D and RHDCD-A parameters, and a negative, very weak correlation between LHD-D and CBD-D parameters ($p<0.05$) (Tablo 6).

According to the Spearman correlation test performed between healthy male individuals and male patients with cholelithiasis, a moderate, positive and significant correlation was found between RLHD-A parameter and RHDCD-A parameter, weak between RHDCD-A parameters, and weak, positive and significant correlation between CHD-D parameters ($p<0, 05$) (Table 7).

Table 6. Relationship between patients with cholelithiasis and healthy individuals regardless of gender

Parameters	Test	Age**	RLHD-A**	RHDCD-A**	CDG-A**	RHD-D**	LHD-D**	CHD-D**	CD-D**	CBD-D**
Age *	r	-.122	.043	-.022	-.002	-.002	.028	.021	-.142	.020
	p	.260	.693	.839	.982	.989	.798	.844	.190	.855
RLHD-A*	r	-.042	-.045	-.004	-.002	.090	.122	.093	.004	-.026
	p	.700	.681	.971	.987	.405	.261	.392	.972	.808
RHDCD-A*	r	-.150	-.077	.143	.077	-.029	-.004	-.028	-.026	-.137
	p	.165	.477	.187	.476	.792	.968	.798	.815	.205
CDG-A*	r	-.111	.091	-.021	.132	-.004	-.038	-.032	-.104	-.062
	p	.305	.401	.844	.224	.969	.725	.771	.339	.569
RHD-D*	r	-.079	.145	.220	.157	-.117	-.034	-.054	-.031	-.196
	p	.465	.182	**.040**	.145	.279	.757	.618	.766	.069
LHD-D*	r	-.110	.022	.149	.129	-.052	-.082	-.057	-.082	-.254
	p	.310	.836	.169	.233	.631	.451	.599	.450	**.018**
CHD-D*	r	-.057	.075	-.082	-.012	-.133	-.143	-.052	-.063	-.129
	p	.598	.489	.449	.913	.218	.185	.633	.560	.233
CD-D*	r	-.177	.036	.020	.140	-.069	-.016	-.011	.169	.024
	p	.101	.743	.857	.196	.522	.885	.918	.117	.823
CBD-D*	r	-.131	.082	-.035	-.029	-.196	-.175	-.108	.006	-.124
	p	.277	.451	.749	.792	.069	.105	.318	.952	.252

RLHD-A: Right hepatic duct – Left hepatic duct angle, RHDCD-A: Right hepatic duct – Cystic duct angle, CDG-A: Cystic duct – Gallbladder angle, RHD-D: Right hepatic duct diameter, LHD-D: Left hepatic duct diameter, CHD-D: Common hepatic duct diameter, CD-D: Cystic duct diameter, CBD-D: Common bile duct diameter, * Patient group with cholelithiasis, ** Healthy group of individuals.

Table 7. The relationship between male cholelithiasis patients and male healthy individuals

Parameters	Test	Age**	RLHD-A**	RHDCD-A**	CDG-A**	RHD-D**	LHD-D**	CHD-D**	CD-D**	CBD-D**
Age *	r	-.034	.167	.028	.076	-.026	-.125	-.025	.091	.181
	p	.835	.311	.865	.647	.873	.447	.879	.581	.271
RLHD-A*	r	.171	-.018	.514	-.088	-.025	.119	.114	-.104	.174
	p	.298	.913	**.001**	.596	.880	.471	.490	.527	.289
RHDCD-A*	r	-.162	.091	.368	-.070	-.102	.027	-.100	.020	-.047
	p	.325	.580	**.021**	.672	.538	.869	.546	.906	.777
CDG-A*	r	.202	.225	.220	.022	.075	.001	.048	.038	.078
	p	.218	.168	.179	.896	.650	.994	.774	.820	.637
RHD-D*	r	-.008	-.307	.048	.067	.138	.103	.081	.006	.178
	p	.959	.057	.772	.686	.404	.534	.624	.972	.279
LHD-D*	r	.142	-.214	.081	.071	.027	.061	.147	-.092	.245
	p	.388	.191	.624	.669	.871	.712	.371	.576	.133
CHD-D*	r	.152	-.192	-.034	.029	.156	.252	.324	-.091	.138
	p	.357	.243	.838	.860	.342	.122	**.044**	.580	.404
CD-D*	r	.130	-.068	.195	.069	.052	.005	-.065	-.011	.079
	p	.431	.682	.234	.675	.753	.978	.696	.949	.631
CBD-D*	r	.061	-.052	-.033	.112	.121	.218	.278	.007	.071
	p	.711	.754	.841	.498	.464	.182	.087	.967	.668

RLHD-A: Right hepatic duct – Left hepatic duct angle, RHDCD-A: Right hepatic duct – Cystic duct angle, CDG-A: Cystic duct – Gallbladder angle, RHD-D: Right hepatic duct diameter, LHD-D: Left hepatic duct diameter, CHD-D: Common hepatic duct diameter, CD-D: Cystic duct diameter, CBD-D: Common bile duct diameter, * Patient group with cholelithiasis, ** Healthy group of individuals.

According to the Spearman correlation test performed between healthy female individuals and female patients with cholelithiasis, the correlation between age and RHD-D, CHD-D, CBD-D parameters was weak, between age and LHD-D parameter was moderate, RHDCD-A parameter was

with CDG-A, RHD-D parameters. A weak correlation was found between the D parameters and a weak correlation between the CHD-D parameter and the CD-D parameter ($p<0.05$) (Table 8).

Tablo 8. The relationship between female cholelithiasis patients and female healthy individuals

Parameters	Test	Age**	RLHD-A**	RHDCD-A**	CDG-A**	RHD-D**	LHD-D**	CHD-D**	CD-D**	CBD-D**
Age *	r	.110	-.027	-.075	.027	.153	.199	.159	.032	.122
	p	.455	.855	.615	.856	.229	.174	.280	.832	.409
RLHD-A*	r	.055	.110	.066	.008	-.090	-.234	-.118	-.112	-.129
	p	.710	.456	.657	.959	.541	.109	.424	.450	.381
RHDCD-A*	r	-.230	-.262	.089	.315	-.350	-.096	-.077	-.040	-.133
	p	.116	.072	.547	**.029**	**.015**	.515	.601	.788	.369
CDG-A*	r	-.004	.033	.098	.117	-.100	.090	.078	-.060	-.050
	p	.979	.822	.506	.427	.501	.545	.599	.686	.737
RHD-D*	r	.381	.092	-.178	.266	.098	.046	.134	.270	.124
	p	**.008**	.536	.226	.067	.506	.755	.363	.063	.400
LHD-D*	r	.485	.088	-.111	.197	.035	.043	.167	.268	.169
	p	**.000**	.553	.454	.179	.814	.771	.256	.065	.252
CHD-D*	r	.397	.009	-.242	.084	-.095	-.102	-.030	.300	.001
	p	**.005**	.949	.097	.570	.520	.490	.837	**.038**	.994
CD-D*	r	.184	-.109	-.008	.229	-.147	.004	.051	.247	.069
	p	.211	.461	.955	.117	.318	.980	.730	.091	.639
CBD-D*	r	.330	.053	-.238	.077	-.223	-.148	-.030	.207	-.062
	p	**.022**	.723	.103	.601	.127	.317	.842	.159	.675

RLHD-A: Right hepatic duct – Left hepatic duct angle, RHDCD-A: Right hepatic duct – Cystic duct angle, CDG-A: Cystic duct – Gallbladder angle, RHD-D: Right hepatic duct diameter, LHD-D: Left hepatic duct diameter, CHD-D: Common hepatic duct diameter, CD-D: Cystic duct diameter, CBD-D: Common bile duct diameter, * Patient group with cholelithiasis, ** Healthy group of individuals.

DISCUSSION

In this study, we aimed to compare the hepatobiliary ducts of patients with cholelithiasis and healthy individuals radioanatomically. As a result of the study, a statistically significant difference was found for both groups in the comparison of LCH-D and CHD-D parameters in male patients with cholelithiasis and healthy male subjects ($p<0.05$). In addition, between RHD-D and RHDCD-A, between LHD-D and CBD-D, according to the Spearman correlation test performed regardless of gender, between RHDCD-A and RLHD-A, RHDCD-A and CHD-D parameters according to the analysis performed only among men. According to the analysis performed only among women, there is a significant relationship between age and RHD-D, LHD-D, CHD-D, CBD-D, between RHDCD-A and CDG-A, RHD-D, and between CHD-D and CD-D. found ($p<0.05$).

Although cholelithiasis has different pathogeneses, the most important is gallstones. Gallstone is a polygenic disease with a high incidence and costly diagnosis and treatment. According to the literature, 12% of the individuals in the USA have gallstones and 2.5% of these individuals have cholecystectomy surgery. The annual cost of these individuals to USA is 10 billion dollars[3,14-16]. In addition, the fact that approximately one third of gallstones has asymptomatic course prevents the determination of the exact number. In most of the diagnosed patients, gallstones generally have symptomatic course or they are revealed during radiological imaging requested due to another disorder in the gastrointestinal region[3,5,9].

The prevalence of gallstone is affected by age, gender, body mass index, daily dietary intake, blood cholesterol rate, pregnancy, genetic disposition and some metabolic diseases[1,4-7]. The prevalence of gallstone advances in direct proportion to age and this increase reaches its peak between the ages of 50 and 65. In addition, its prevalence is two times higher in women when compared with men[3,15-17]. While its prevalence is between 5-20% in young female patients, this rate increases to 25-80% in adult female

patients[15]. In parallel with the literature, it was found in our study that female patients had a median age of 56, while male patients had a median age of 54. In addition, 51.3% of the patients in the cholelithiasis group were female, while 48.7% were male.

There are a large number of radiological imaging methods for gallstones. Although USG is considered as the gold standard for gallstones, MRCP has recently started to be popular with its advantages. The most important of these advantages is the fact that it allows clear and objective imaging of more complicated bile ducts. In addition, MRCP is considered to be the most accurate non-invasive imaging method with a high sensitivity and specificity[4,9,10,18,19]. The most important reason for this can be the fact that the gall includes high amount of water.

In surgeries such as laparoscopic cholecystectomy or living donor liver transplantation in this region, the most common situation is encounter a hepatobiliary duct system different from classical anatomy knowledge. There is an agreement in literature that there is a variation of up to 40% in individuals[20]. It is important to know the anatomy of the region in detail since unpredictable anatomical differences during the surgery increase the risk of damage to the bile ducts and therefore complication[21]. At this point, although there are frequent studies on devices to be used in diagnosis and anomalies or variations of the hepatobiliary system[20,21], no studies were found in which detailed morphometric information about this region was provided. Although this is a limitation for the discussion, we believe that our study will form a basis for new studies.

Valkovic et al.[22] evaluated CBD-D parameter preoperatively and postoperatively in a study they conducted on 102 patients who were planned to have cholecystectomy. However, since this structure is not seen clearly with USG, they examined it in three parts as proximal, middle and distal and they found proximal part as 2.27±0.18 mm, middle part as 3.49±0.23 mm, distal part as 4.31±0.30 mm preoperatively. In this study, we took images of patients with cholelithiasis with MRCP imaging method and we found that the median value of CBD-D parameter as 6 (1.8-15.4) mm in female patients with cholelithiasis and as 4.9 (2.3-11.3) mm in male patients with cholelithiasis.

In another study, CHD-D parameter of diabetic and non-diabetic individuals evaluated with USG was measured as 2.8 (1.5-4.5) mm in non-diabetic male individuals and as 2.9 (1.6-5.5) mm in non-diabetic female individuals and the reason for the difference with our study can be the difference between the measurement tools used[23].

There are some limitations of this study. Since the study was conducted retrospectively, detailed demographic information of the patients was not reached. The fact that there were no studies that provided detailed morphometric information about the region although there are studies about the anomalies or variations of the hepatobiliary system limited the possibility of comparing the measurements of our study with previously conducted studies. By increasing the number of samples in future studies, more meaningful results can be obtained between and within groups of individuals with cholelithiasis and healthy individuals.

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