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Orignal Article

Sonographic Correlation of Caudate Lobe and Liver Size Among Hepatitis C Virus Patients

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ABSTRACT

Hepatitis C virus (HCV) is a leading cause of liver disease in the world. Ultrasound is considered to be the first choice to diagnose hepatomegaly and caudate lobe enlargement in HCV patients by measuring the liver and Caudate lobe size **Objective:** To assess the sonographic correlation of caudate lobe size with liver size among hepatitis C virus patients **Methods:** The cross-sectional analytical study was conducted in the Department of Radiology at Sabiry Surgical Hospital, Faisalabad, Pakistan. A total of 68 patients (33 males and 35 females) with the HCV from March 2021 to November 2021 were included in this study. The craniocaudal length of the liver and vertical diameter of the caudate lobe was measured and compared in a ratio by using ultrasonography. **Results:** In total patients, the minimum age was 22 years and the maximum age was 70 years with an average age of 41.76 (SD=12.46) years. The mean liver size was 171.34 (SD=12.96) mm and the mean caudate lobe size was 61.06 mm (SD=12.96). The percentage between the normal and enlarged caudate lobe was 10.3% and 89.7% respectively. In total there were 60 patients with the present while 8 with absent hepatomegaly and 7 with normal and 61 with enlarged caudate lobe size the p-value is 0.021 which was significant because it was <0.05 **Conclusions:** The caudate lobe size measurement by ultrasonography is a strong reliable parameter for early assessment and early possible treatment of the HCV in patients.

INTRODUCTION

The Hepatitis C Virus (HCV) is prevalent across the world, with a significant degree of geographical variation in its distribution. Africa and Asia have the maximum documented rates of infection, while Northern and Western Europe, and Australia have the lowest. Germany (6%), Canada (8%), France (11%), and Australia (11%) are populous developing-world nations with comparatively low rates of HCV seroprevalence. In the United States (18%), Japan (15–23%), and Italy (22%), small but somewhat higher seroprevalence rates have been recorded [1]. The liver is the body's second-largest organ, accounting for about 2-3% of total body weight [2]. It is one of the most essential metabolic organs in vertebrates, performing a wide range of functions [3]. Many liver diseases are characterized by immune-mediated pathogenesis, and immune systems change with age, influencing the clinical picture of liver disorders [4]. The inflammation of the liver is known as hepatitis. Hepatitis can be caused by several factors, including drugs, although "viruses" are the most common cause of inflammation globally. HCV is a hepatotropic RNA virus that causes liver damage over time, potentially leading to cirrhosis and hepatocellular cancer [5]. In regions where the HCV is prevalent, unsterile surgical techniques and inappropriate injectable drug usage are key risk factors for infection with this blood-borne virus [5,6]. Hepatic fibrosis, which can progress to cirrhosis,

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hepatocellular insufficiency, portal hypertension, and an increased risk of hepatocellular malignancy, is caused by chronic viral hepatitis [7,8].Ultrasound signs of acute hepatitis include hepatomegaly, periportal lymphadenopathy, splenomegaly, increased gallbladder wall thickness, decreased or increased liver echogenicity, and increased echogenicity of portal walls [9]. Chronic hepatitis was shown to have a decrease in the brightness and number of portal vein radicle walls, as well as an increase in liver echogenicity overall. Furthermore, the pathogenic severity closely matched these ultrasound patterns; a prospective investigation verified the same acute hepatitis ultrasonography findings with a strong connection to clinical severity. Hepatomegaly is a term used to describe a liver that is larger than normal [10]. Hepatomegaly is not a disorder in and of itself, but rather a symptom of an underlying disease mechanism [11]. Ultrasound or CT scans are widely used to determine the size of the liver. Gross Hepatomegaly, on the other hand, can be visible on an abdominal radiograph. The midclavicular line in the adult liver averages 100-125 mm in craniocaudal length; a liver that is greater than 155-160 mm in the midclavicular line is considered enlarged. The caudate and right lobes are regions of the liver that vary in size depending on the individual [12]. Spiegel's lobe, the caudate process, and the paracaval section, which is anterior to the inferior vena cava, comprise the caudate lobe [13]. The caudate lobe of the liver looks disconnected and less echogenic in ultrasonography than the right lobe of the liver. The ventral contours of the caudate and right lobes of the liver were smooth to slightly curved, with sharp edges and prolonged dorsal contours. The echo patterns are subtle and uniform [11]. The normal vertical diameter of the caudate lobe varied from 15-50 mm when the caudate lobe size increases from 50 mm it is termed caudate lobe hypertrophy [14]. Various liver inflammatory disorders cause an increase in the caudate lobe and liver size. It indicates reduced liver functioning; therefore, direct measurement & assessment of caudate lobe and liver size may be a strong indicator of the HCV. This research will help in the diagnostic field of liver evaluation because early malformation of the liver is necessary for treatment because, in the later stages, there is a significant disruption of the liver parenchyma, which leads to early fibrotic changes and potentially complete fibrosis, for which the only treatment is a liver transplant. Current study sonographically correlates the caudate lobe and liver size in HCV patients for early diagnosis & early possible treatments.

METHODS

The Cross-sectional analytical study was conducted in the Department of Radiology at Sabiry Surgical Hospital, Faisalabad, Pakistan, after the approval from the institutional ethical committee. The Pearson correlation coefficient was used to analyze the relationship between liver size and caudate lobe size. The study duration was 9 months. Patients of both gender with age groups 20-70yrs and liver and caudate lobe size (confirmed on USG) along with confirmed reports of HCV. All inflammatory conditions except HCV, known patients having benign and malignant tumors, and Diabetics were excluded from the research. Ultrasound was performed by using Aplio 500 Platinum & Toshiba Nemio XG Premium compact Ultrasound with a convex probe having a frequency of 3 to 7.5-MHz. Purposive sampling was conducted. Ultrasound evaluation of the liver is critical and helpful in assessing its size. We positioned the patient supine and utilized a convex transducer to access the liver. To scan the liver, we employed three approaches: subcoastal, intercoastal, and subxiphoid. Both subcostal and intercostal techniques were used to scan the right hemiliver. Intercostal scans were successful with the patient supine, and this offers the greatest findings during normal breathing when the right lung base and accompanying shadowing are not covering the superior portions of the liver. Subcostal scanning was performed when the patient was in a left lateral decubitus or left posterior oblique position, causing the liver to shift somewhat medial and inferior. Imaging during deep breathing resulted in more inferior liver displacement and improved subcoastal and subxiphoid scanning. After that, the transducer was angled superiorly while scanning from a subcostal approach, allowing us to observe the dome of the liver. The liver was measured from the dome of the diaphragm towards the midclavicular line as shown in Figures 1. In a sagittal plane, the caudate lobe was seen as a midline wedge, with its tip reaching the cephalad up to the entry of the left and middle hepatic veins into the IVC and its base facing the IVC. After identifying the left lobe of the liver from an open position to the left, a clockwise rotation aid in the identification of the ligamentum venosum. The caudate lobe's vertical diameter was measured as shown in Figure 1. Clinical complaints, caudate lobe enlargement, and hepatomegaly results on ultrasonography were all reported. The data obtained were evaluated.

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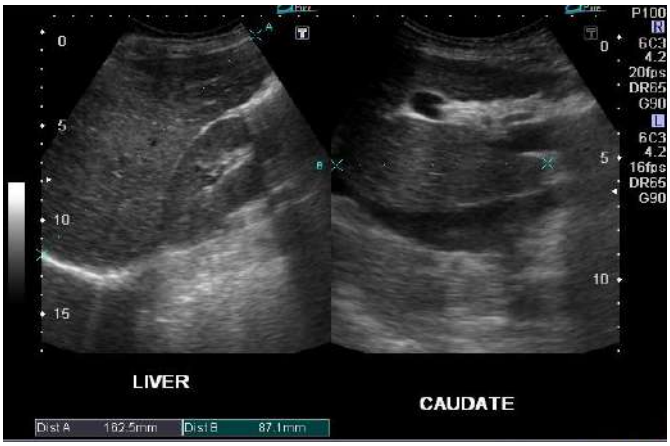

Figure 1: Depicts hepatomegaly with a liver size of 162.5mm along with an enlarged caudate lobe measuring 87.1mm.

RESULTS

The research included 68 people infected with HCV. The total number of females and males was 35 and 33 respectively and the age range was 20-70 years. The average age of 35 females was 42.31 years (SD=12.48) with a minimum age of 22 years and a maximum age of 70 years. While the minimum age among 33 men was 22 years and the maximum age was 67 years, the mean age was 41.18 years (SD= 12.60). All calculations were done on SPSS software.

Gender	Hepatomegaly	Caudate lobe Enlarged /normal		Liver size in mm	Caudate lobe size in mm
Female	Absent	Enlarged	N	6	6
			Mean	152.8500	57.3167
			Std. Deviation	6.53842	4.84125
			Minimum	142.50	51.80
			Maximum	159.40	63.80
		Normal	N	1	1
			Value	150.0000	38.3000
	Present	Enlarged	N	27	27
			Mean	176.6333	63.8593
			Std. Deviation	11.93721	9.25856
			Minimum	161.60	52.90
			Maximum	216.70	87.10
		Normal	N	1	1
			Value	184.2000	43.2000
	Total	Enlarged	Mean	172.2727	62.6687
			N	33	33
			Std. Deviation	14.51548	8.83740
			Minimum	142.50	51.80
			Maximum	216.70	87.10
		Normal	Mean	167.1000	40.7500
			N	2	2
			Std. Deviation	24.18305	3.46482
			Minimum	150.00	38.30
			Maximum	184.20	43.20
		Total	Mean	171.9771	61.4171
			N	35	35
			Std. Deviation	14.73058	10.10840
			Minimum	142.50	38.30
			Maximum	216.70	87.10
Male	Absent	Enlarged	N	1	1
			Value	135.4000	57.2000
	Present	Enlarged	N	27	27
			Mean	173.5259	63.6185
			Std. Deviation	8.85545	7.73981
			Minimum	162.30	51.00
			Maximum	199.90	85.90
		Normal	N	5	5
			Mean	162.2800	45.5000
			Std. Deviation	.66106	2.42487
			Minimum	161.10	41.30
			Maximum	162.60	46.90
	Total	Enlarged	N	28	28
			Mean	172.1643	63.3893
			Std. Deviation	11.28841	7.69138
			Minimum	135.40	51.00
			Maximum	199.90	85.90
		Normal	N	5	5
			Mean	162.2800	45.5000
			Std. Deviation	.66106	2.42487
			Minimum	161.10	41.30
			Maximum	162.60	46.90
		Total	N	33	33
			Mean	170.6667	60.6788
			Std. Deviation	10.97838	9.64763
			Minimum	135.40	41.30
			Maximum	199.90	85.90
Total	Absent	Enlarged	N	7	7
			Mean	150.1857	57.3000
			Std. Deviation	8.83939	4.41965
			Minimum	135.40	51.60
			Maximum	159.40	63.80
		Normal	N	1	1
			Value	150.0000	38.3000
	Present	Enlarged	N	54	54
			Mean	175.0796	63.7389
			Std. Deviation	10.52774	8.45303
			Minimum	161.60	51.00
			Maximum	216.70	87.10
		Normal	Mean	165.9333	45.1167
			N	6	6
			Std. Deviation	8.96831	2.36340
			Minimum	161.10	41.30
			Maximum	184.20	46.90
	Total	Enlarged	N	61	61
			Mean	172.2230	63.0000
			Std. Deviation	13.02762	8.32782
			Minimum	135.40	51.00
			Maximum	216.70	87.10

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		Normal	N	7	7
			Mean	183.8571	44.1429
			Std. Deviation	10.16331	3.36048
			Minimum	150.00	38.30
			Maximum	184.20	46.90
		Total	N	68	68
			Mean	171.3412	61.0588
			Std. Deviation	12.98587	9.82085
			Minimum	135.40	38.30
			Maximum	216.70	87.10

Table 1: Relationship between Qualitative and Quantitative Variables of this Study

Table 1 reveals that the minimum liver size was 135.40mm and the greatest liver size was 216.70mm in a total of 68 individuals (including males and females), with the mean liver size being 171.3412 (SD=12.96587). In females, the minimum caudate lobe size was 38.30mm and the maximum caudate lobe size was 87.10mm with the mean for caudate lobe size was 61.05mm (SD= 10.11) while in males the minimum caudate lobe size was 41.30mm and maximum caudate lobe size was 85.90mm with the mean for caudate lobe size was 60.67mm (SD= 9.65). iN total 35 female patients with HCV, hepatomegaly was absent in 6 patients that has enlarged caudate lobe size and in 1 patient that has normal caudate lobe size. While with hepatomegaly present, 27 patients have enlarged caudate lobe size, and only 1 patient with normal caudate lobe size. In 33 male patients with HCV, there was only 1 patient that has enlarged caudate lobe size with absent hepatomegaly. While in patients with hepatomegaly present, 27 patients have enlarged caudate lobe size and 5 with normal caudate lobe size. So, the results that we get from table 1 is that from the total of 68 HCV patients there are 60 patients (both males and females) with present hepatomegaly and 8 HCV patients with absent hepatomegaly, and 61 HCV patients with enlarged caudate lobe and only 7 HCV patients with normal caudate lobe size.

		Liver size in mm	Caudate lobe size in mm
Liver size in mm	Pearson Correlation	1	.279*
	Sig. (2-tailed)		.021
	N	68	68
Caudate lobe size in mm	Pearson Correlation	.279*	1
	Sig. (2-tailed)	.021	
	N	68	68

Table 2: Correlation of Caudate lobe and Liver size in HCV patients

There is a substantial link between liver size and caudate lobe size, as seen in Table 2 ($p<0.05$). Here 0.279 shows the strength of the relationship between given variables, there is a positive correlation between liver and caudate lobe size, meaning that as liver size increases, so does caudate lobe size, and vice versa. Figure 2 shows that the data points make a straight line going from the origin out to high X and Y values, so we can access that the variables have a positive correlation which means that with the increase in liver size caudate lobe size also increases.

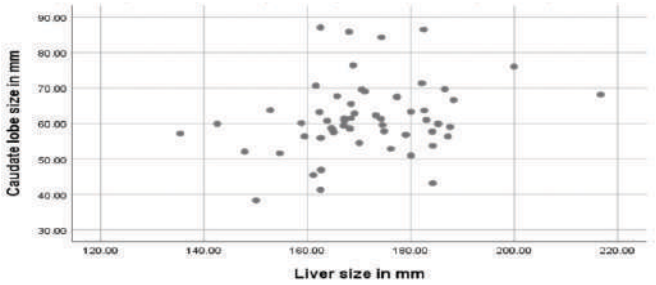

Figure 2: Graph shows a positive correlation between liver and caudate lobe size in mm

DISCUSSION

HCV is the leading cause of liver disease worldwide, impacting 130-170 million people [15]. When the patient was examined using ultrasound, we discovered that the mean liver size was 171.34mm and the mean caudate lobe size was 61.06mm, indicating that there is a positive correlation between liver and caudate lobe size, clearly showing that the size of the caudate lobe gradually increases as the size of the liver increases with the development of the HCV as compared to earlier work done by Muhammad Ahsan Javed and colleagues where the association between the size of the right liver lobe and the caudate lobe in patients with normal and chronic liver disease was investigated using ultrasonography [16]. Furthermore, the results suggested that the mean caudate to right lobe ratio in chronic liver disease patients was greater than 0.68, whereas the mean caudate to right lobe ratio in normal individuals was 0.38. They suggested that the caudate to right lobe ratio will be a useful measure for diagnosing chronic liver disease like my research findings in which I observed that in HCV patients the caudate lobe size increases with the increase in liver size which would be a good parameter to early diagnose HCV. During research, it was observed that in the stage of acute hepatitis the echogenicity of the liver decreases, and its echogenicity becomes equal to right kidney parenchyma but its echogenicity decreases from the pancreas and there is a starry sky appearance of the liver parenchyma along with periportal edema and there is the presence of gallbladder wall thickness in these patients while in chronic HCV the echogenicity of liver parenchyma increases and surface become nodular and there is no periportal edema. These findings were compared with a study reported in 2020 to

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determine the function of ultrasonography in the diagnosis of liver cirrhosis and its consequences [17]. 114 individuals were suspected of having liver cirrhosis based on clinical and laboratory evidence. Ultrasounds were performed. The bulk of cases (56%) were of alcoholic cirrhosis, with post necrotic cirrhosis accounting for 37%. Raised echogenicity, surface nodularity, and a course echo pattern were all common indications. The most common consequences were ascites and gallbladder problems. These findings suggest that on ultrasound these changes were apparent and must be noted to early diagnose liver diseases. According to JB Contractor and colleagues, liver cirrhosis is end-stage liver fibrosis that develops as a result of normal wound healing in the presence of continuous liver injury [18].The study aimed to evaluate the morphometric measures of the right lobe and determine the C/RL in the human cadaveric liver, as well as to compare the C/RL ratio results to previously recorded studies in an attempt to give baseline data. They found that the transverse diameter of the caudate lobe averaged 78.22 ± 12.17 mm, with values ranging from 55.06–98.30 mm, and the longitudinal diameter of the right lobe averaged 126.31 ± 20.24 with values ranging from 90.54–172.18 mm. Harbin's Index was calculated as the ratio of the CT to the right lobe, i.e., (CT/RT), and averaged 0.38 ± 0.12 with values ranging from 0.17–0.61 the average caudate lobe size in my research was 61.0588 with values ranging at 38.30- 87.10 and the average liver size was 171.3412 with a value ranging at 135.40-216.70 mm. These measurements are per my findings, showed that the progression of liver disease causes a change in its normal measurements. They also suggest that although liver parenchyma may be difficult to detect on ultrasonography and any irregularity of the liver surface may be visible only with large nodules or ascitic effusion, caudate lobe hypertrophy is a consistent finding with liver cirrhosis or similar chronic liver illness like HCV. The normal liver size ranges between 13-16cm, and liver sizes greater than 16cm are considered enlarged. These findings are consistent with Monika Patzak et al., findings on Liver Size Assessment by Ultrasonography, in which they determined liver span sonographically in a randomly selected population sample and identified variables that influence liver size [19]. A total of 1,789 patients had their livers sonographically evaluated at the midclavicular line. Furthermore, they discovered that the average liver span (SD) at the midclavicular line for the entire group was 15.0 (1.5) cm, with females having a mean (SD) of 14.9(1.6) cm and males having a mean (SD) of 15.1(1.5) cm. In 24.3 percent of the individuals, the liver spread was greater than 16 cm. The multivariate analysis revealed that the factors potentially impacting liver span, gender, age, BMI, height, fatty liver (P.0001), waist-to-hip ratio (P =.015), and metabolic syndrome (P =.032) are all significant.

CONCLUSION

The caudate lobe size measurement by ultrasonography is a strong reliable parameter for early assessment and early possible treatment of the HCV in patients. The subjects with infectious, neoplastic, toxic, metabolic, and miscellaneous causes may present with hepatomegaly while the caudate lobe enlargement does not always occur in these conditions. The results of this research showed that the caudate lobe size increases with the progression of inflammatory condition like the HCV. Therefore, we concluded that measuring the caudate lobe size by ultrasound along with the liver size was the best strategy for early diagnosis of the HCV by using Ultrasound.

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