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Association of sonographic grading of fatty liver disease with liver function tests and CT hounsfield

Vishalkumar Bhardava
Associate professor, Department of Radiology, 22nd year resident, Department of Radiology, S.B.K.S Medical Institute & Research Centre

Vatsal Agrawal*
2nd year resident, Department of Radiology, Dhiraj hospital, Waghodia, piparia, Vadodara, Gujarat, India
*Corresponding author

Loma Patel
2nd year resident, Department of Radiology, Pramukh Swami medical college, Karamsad, Gujarat, India

Mohik Suri
2nd year resident, Department of Radiology, Dhiraj hospital, Waghodia, piparia, Vadodara, Gujarat, India

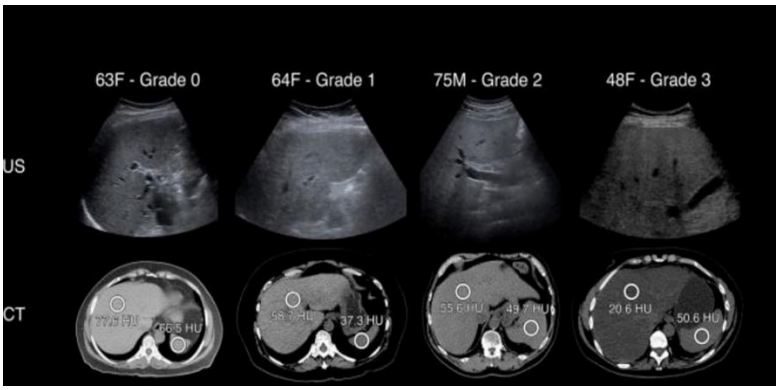
***Abstract*---**Fatty Liver Disease (FLD) is described as the accumulation of triglycerides within cytoplasmic vesicles of hepatocytes exceeding 5 percent of total liver weight. It is generally of two types: Alcoholic or Non-alcoholic FLD (NAFLD). It has a tendency to progress and cause steatohepatitis, brosis, cryptogenic cirrhosis, hepatocellular carcinoma, chronic liver disease, metabolic syndrome, polycystic ovarian syndrome and adenocarcinomas. Objective: To nd association of Sonographic Grading of Fatty Liver Disease with Liver Function Tests and CT Hounseld units. The evaluation of the signicance of Ultrasound and LFTs over Computed Tomography is the aim of this study for the diagnosis of Fatty Liver Disease. Method: patients were undergone CT exams, Ultrasound exams and LFT tests for this this study (mean age: Their hepatic Hounseld units were obtained, Ultrasonographic grades were specied and LFTs were recorded. Results: The sonographic grading of fatty liver is significant/ not, taking HU value as standard. Conclusion: It is concluded that Ultrasound is effective in diagnosing this disease in all grades of FattyLiver Disease along with Liver Function Tests.

Keywords---fatty liver disease, sonographic grading, CT Hounsfield.

Introduction

Hepatic steatosis is a frequently encountered imaging finding that may indicate chronic liver disease, the most common of which is non-alcoholic fatty liver disease.Fatty Liver Disease (FLD) is described as the accumulation of triglycerides within cytoplasmic vesicles of hepatocytes exceeding 5 percent of total liver weight. It is considered to be insignificant clinically in normal circumstances [1], however, it has been described as a silent killer in recent studies [2]. It is generally of two types: Alcoholic or Non- alcoholic fatty liver disease.Non-alcoholic fatty liver disease (NAFLD) which is also known as Metabolic Associated fatty liver disease (MAFLD) [3] and is referred to the condition of triglyceride accumulation on liver when no other causes for secondary hepatic fat accumulation are present such as hypothyroidism or alcohol intake [4]. It is further subdivided into NAFLD in which there is no inflammation of liver and Non-alcoholic steatohepatitis (NASH) in which hepatic inflammation is present [4]. FLD has a tendency to progress and cause steatohepatitis, fibrosis, cryptogenic cirrhosis, hepatocellular carcinoma and may also be the leading cause of chronic liver disease [1,3-5], metabolic syndrome, polycystic ovarian syndrome and certain adenocarcinomas [3]. It is associated with a number of complications or metabolic risk factors such as obesity, diabetes mellitus,high triglycerides and low HDL levels [2,5]. It is generally seemed that men are usually at risk of experiencing NAFLD than women, although, the risk increases with age [2]. Diagnosing this malady, liver biopsy is considered to be a gold standard technique. It has also been observed that the modalities of magnetic resonance imaging, computed tomography (CT) and ultrasonography are generally used for this purpose, however, this study only deals with the comparison of CT and ultrasonography as magnetic resonance imaging is not a common procedure in developing countries as it is expensive [4]. Ultrasonography is done by producing waves with the help of transducer placed against the desired structure of body [6]. Liver ultrasonography is considered to be the 1st-line modality for the diagnosis of NAFLD [7]. Normal parenchyma of liver on ultrasound is isoechoic or slightly more echogenic to kidney and spleen. However, in case of fatty liver, the echogenicity of liver parenchyma is increased prominently. Moreover, the fat does not allow the sound beam to penetrate deeper into the liver tissue, leading to poor visualization of intrahepatic vessels, bile ducts, diaphragm and other pathologies of liver. The sensitivity of ultrasound in detecting mild to moderate FLD is 80-89% and specificity is 87-90%, while it has been seen that ultrasonography remains relatively insensitive in the detection of mild FLD [8]. In addition to that, the severity of the FLDcan also be evaluated with the help of ultrasound based on the degree of attenuation of beam and the loss of echoes from portal vein walls [7,8]. Ultrasonography holds a special significance in the detection of NAFLD as it can diagnose the disease in asymptomatic patients and is relatively simple, cheap and have minimum side effects [9]. CT utilizes X-rays to diagnose pathologies within the patient's body. The interpretation of a CT scan is dependent upon the Hounseld units (HU). Through the use of the attenuation coefficients of water and air, different body parts have been assigned their CT numbers on the basis of their density [11]. This way, CT can represent liver fat content by measuring Liver attenuation [12]. Normally,the comparison of

hepatic and splenic attenuation is done for the accuracy of measurement. The attenuation of spleen is 8-10 HUs less than liver in normal people. In a patient of FLD, an unenhanced CT would demonstrate liver with the attenuation of less than 40 HUs or when compared with the spleen, there would be a difference of greater than 10 HUs. In recent studies, CT is considered useful in diagnosing FLD of greater than 30% with the help of liver to spleen attenuation ratios, with a sensitivity of 73-100% and a specificity of 95-100% [13]. CT scan is considered to be 100% specific in diagnosing moderate to severe FLD, when liver to spleen attenuation ratio is less than 0.8 [12]. However, Unenhanced CT scan does not hold significance if the degree of fatty liver is low. This is because a considerable amount of overlap of Hounseld units of normal and abnormal liver is seen, thus, representing that the density measured by CT may not be sensitive enough to predict fat content of liver [14]. In simple words, the Hounseld unit attenuation of liver is usually higher than spleen on CT scans but when this ratio is reversed, it connotes the presence of a fatty liver [15]. LFTs usually include alanine aminotransferase (ALT), alkaline phosphatase (ALP), aspartate aminotransferase (AST) and bilirubin. ALT and AST are generally the indicators of an injury to hepatic cells on a molecular level. ALP, however, is associated with hepatocellular injury, as well as biliary movements and any obstruction in the pathway of bile may lead to an increase in the levels of ALP. Bilirubin, on the other hand, is important in distinguishing the causes of Jaundice, precisely differentiate the causes of pre- hepatic, hepatic and post-hepatic jaundice on the basis of conjugated and unconjugated bilirubin [16]. NAFLD is usually associated with metabolic syndrome and, therefore, clinicians recommend LFTs and Liver fat scores for the calculation of non-invasive scores. Although LFTs are normal in almost 50 percent of NAFLD cases, but there is a great risk of LFTs, especially ALT to derail towards the upper levels from the normal range due to this disease. The screening of the liver has a marked significance in the diagnosis of NAFLD [17]. By screening, patients with NAFLD are often identified by asymptomatic elevation of liver enzymes, most frequently ALT which has been used as a substitute marker for NAFLD [18]. Although CT has obliged clinicians and radiologists to understand the human body better and diagnose the maladies, it could also prove to be fatal due to ionizing radiation. On the other hand, ultrasonography does not use such radiations, thus it is justifiable to use ultrasonography. It should be necessary for the clinicians to seek help through LFTs.



Methods

A total of 50 patients were included in this study (mean age: 38 years), 28 patients were female and 32 patients were male. Siemens 16 slice dual CT scan source in Dhiraj General Hospital to scan patients in supine position. Sonography machine used was GE LOGIQ P9 with 3.5 MHz probe . Unenhanced CT scan with 80 to 140 kV and100 to 300 mAs was done and the 5 mm thickness slices were taken. The random selection points were taken in Liver and Spleen to calculate the Hounseld units. Ultrasound was done by different physicians and patients were scanned in supine decubitus positions. The grades of Fatty Liver were specified by the physicians.

Results

In a total of 50 patients, the mean value of 'total bilirubin' calculated among total patients of FLD was 0.90 with a standard deviation of 1.82. Specically, the mean value in 31 patients with Grade I FLD came out to be 0.72 with a standard deviation of 1.41, mean value in 15 patients with Grade II FLD came out to be 1.15 with a standard deviation of 2.45 and the mean value in 3 patients with Grade III FLD came out to be 0.97 with a standard deviation of 0.36 (Table 1). The mean value of 'ALT' calculated was 42.79 with a standard deviation of 27.76 9 (Table 2). Specically, the mean value in 31 patients with Grade I FLD came out to be 27.15 with a standard deviation of 12.14, mean value in 15 patients with Grade II FLD came out to be 53.71 with a standard deviation of 10.43 and the mean value in 3 patients with Grade III FLD came out to be 104.37 with a standard deviation of 50.63. The mean value of AST calculated was 46.46 with a standard deviation of 31.22. Specically, the mean value in 31 patients with Grade I FLD came out to be 30.63 with a standard deviation of 13.49, mean value in 15 patients with Grade II FLD came out to be 54.78 with a standard deviation of 17.80 and the mean value in 3 patients with Grade III FLD came out to be 121.6 with a standard deviation of 47.7. The mean value of Alkaline Phosphatase was 193.97 with a standard deviation of 248.01. Specically, the mean value in 31 patients with Grade I FLD came out to be 122.22 with a standard deviation of 51.11, mean value in 15 patients with Grade II FLD came out to be 288.31 with a standard deviation of 365.08 and the mean value in 3 patients with Grade III FLD came out to be 266.00 with a standard deviation of 287.03 9 (Table 3). The means of total bilirubin in three groups of FAD (Grade I, Grade II, Grade III) are statistically insignificant as the p- value = 0.523 (> a = 0.05). The means of ALT, AST and Alkaline Phosphatase in three groups of FLD (Grade I, Grade II, Grade III) are statistically significant as the p-value obtained was 0.00, 0.00 and 0.03 (> a = 0.05), respectively (Table 4).

TABLE 1- Crosstabulation Between Liver lobes Hounseld Units and Fatty Liver Grades

CT HU value	Fatty liver Grade I	Fatty liver Grade II	Fatty liver Grade III	Total
Right lobe <25	0	2	2	4

CT HU value	Fatty liver Grade I	Fatty liver Grade II	Fatty liver Grade III	Total
25-39	9	13	0	22
>39	21	3	0	24
Total	30	18	2	50
Left lobe <20	0	2	3	5
20-39	6	11	0	17
>39	26	2	0	28
Total	32	15	3	50

Table 2: Crosstabulation between values of SGPT (ALT), SGOT (AST), ALP and Fatty Liver Grades

	FATTY LIVER GRADE I	FATTY LIVER GRADE II	FATTY LIVER GRADE III	TOTAL
SGPT(ALT) <40	21	9	2	32
40-65	7	8	0	15
>65	2	1	0	3
TOTAL	30	18	2	50
SGOT(AST). <45	24	12	1	37
45-80	5	5	1	11
>80	1	1	0	2
TOTAL	30	18	2	50
Alkaline Phosphatase <200	18	12	1	31
200-900	11	3	1	15
>900	1	3	0	4
TOTAL	30	18	2	50

Table 3: Crosstabulation between values of SGPT (ALT), SGOT (AST), ALP values and Liver Lobes Hounseld Units

	RIGHT LOBE					LEFT LOBE				
	<25	25-39	>39	TOTAL		<20	20-39	>39	TOTAL	
SGPT (ALT)										
<40	2	16	14	32		3	11	18	32	
40-65	1	4	10	15		2	4	9	15	
>65	1	2	0	3		0	2	1	3	
TOTAL	4	22	24	50		5	17	28	50	
SGOT (AST)										
<45	2	14	21	37		3	11	23	37	
45-80	1	7	3	11		1	5	5	11	
>80	1	1	0	2		1	1	0	2	
TOTAL	4	22	24	50		5	17	28	50	
ALP <200	1	16	14	31		4	9	18	31	
200-900	2	4	9	15		1	6	8	15	
>900	1	2	1	4		0	2	2	4	
TOTAL	4	22	24	50		5	17	28	50	

Discussion

CT HU value	Fatty liver Grade I	Fatty liver Grade II	Fatty liver Grade III
Mean HU acc to 2019, Muhammad Yousaf study	42	24	3
Mean HU Acc to our study	32	15	3

The abnormal accumulation of triglycerides within cytoplasmic vesicles of hepatocytes is identified as FLD. There are two major types, Alcoholic and NAFLD.

Non- alcoholic is further classified as Non-alcoholic Fatty Liver (NAFL) and Non-alcoholic steatohepatitis (NASH) on the basis of hepatic inflammation. Imaging techniques especially ultrasonography and Computed tomography has been given considerate significance in diagnosing NAFLD in recent studies. The 1st study regrading grading of FLD through the use of Ultrasonography and CT was presented by John CS et al. in the year 1985. They found the accuracy of Ultrasonography 85%, sensitivity 100% and specificity 56%. The relationship of Ultrasonography and CT for the diagnosis of FLD, especially Grade I and Grade II FLD, came out to be significantly productive similar to our study [18]. Cody J. Boyce et al. investigated the incidence of FLD in asymptomatic patients in 2010 by the use of Hounseld numbers of CT. They inducted 3,357 patients out of which 45.9% (1,542) patients were suffering from mild FLD and 6.2% (208) patients were diagnosed with moderate-to- severe FLD. They concluded that unenhanced CT examination worked as a reliable and non-invasive procedure for the detection and study the progression of asymptomatic FLD [1]. However, in our study, simple Ultrasonography also proved to be beneficial enough for the accurate diagnosis of FLD. Another study concluded the same results as our study was brought out by Rehman J. et al [20]. in 2015 which employed 30 patients for each group based on grades of FLD that were obtained through Ultrasonography. They calculated CT Hounseld units of Liver and Spleen and found a significant difference for each grade of FLD and between Liver and Spleen. They concluded that Ultrasound was a reliable as the fi1st imaging modality for the diagnosis of Fatty Liver. In 2019, Muhammad Yousaf et al [12]. conducted a cross-sectional analytical study on 227 subjects and compared Ultrasonography grades of FLD with CT Hounseld numbers. They reported significant p-values when CT Hounseld units were compared with all three grades of Fatty Liver obtained through Ultrasonography. They concluded that Ultrasonography came out to be well- grounded and dependable modality for the diagnosis of NAFLD. Some studies have also compared the Liver profile with the FLD and acknowledged high ALT and AST levels in patients with FLD and but they did not specify the grades of FLD. Our study is the 1st to acknowledge Ultrasound grades, CT Hounseld units in Right Lobe of Liver, Left Lobe of Liver and Spleen and Liver Function Tests and their comparison in a single patient criterion.

Conclusion

Computed tomography is considered as the necessary requirement for the accurate diagnosis of this disease. However, in reference to this study, it is concluded that Ultrasound is effective in diagnosing this disease in all grades along with Liver Function Tests as it is non-invasive, easily and widely available and have no detrimental effects in long term.

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