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ORIGINAL ARTICLE

Role of Ultrasound in the Diagnosis of Non-Alcoholic Fatty Liver Disease (NAFLD)

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ABSTRACT

Background: The most prevalent liver illness, nonalcoholic fatty liver disease (NAFLD), is characterized by abnormal fat buildup in the hepatocytes without a substantial alcohol consumption history or secondary causes of fatty liver disease.

Aim: This study aims to assess ultrasound's diagnostic utility in NAFLD.

Material and Method: In the Hayatabad Medical Complex (HMC) in Peshawar, Pakistan, a cross sectional study with convenient sampling technique was conducted over six-month. This study received permission from the Institutional Research and Ethical Review Board (IREB) of HMC Hospital, and Open-Epi determined the sample size of 250 patients with a 95% confidence interval and a 5% margin of error. A certified sinologist conducted the abdominal ultrasound. The right arm was extended to its maximum abduction while the participants were positioned in the dorsal decubitus position. Using a right intercostal technique, the right liver lobe was seen, and a representative parenchymal region was identified without compromising the main vascular. The data were gathered through Questionnaire and analyzed using SPSS version 26.

Results: There were 250 participants, with 55.4% men and 44.2% women. Patients between 40 and 49 accounted for 38.4% of the affected population. The most common conditions among patients with NAFLD were mild severity (49%) and abdominal discomfort (47.4%). Only (8%) of participants had liver cirrhosis before NAFLD while (91.6%) of patients lacked liver cirrhosis before NAFLD. When treating suspected NAFLD, 83.3 percent of patients preferred the Ultrasound modality initially, and more patients received a primary ultrasound diagnosis.

Practical Implication: Ultrasound is the most commonly used modality because of their availability and low cost but its role in NAFLD is not fully diagnosed and evaluated. This study aims to evaluate the proper use of the Ultrasound modality in NAFLD for the benefits of patients to be diagnosed initially with Ultrasound so that it may not lead to a serious problem.

Conclusion: A valuable non-invasive imaging technique for the diagnosis of non-alcoholic fatty liver disease (NAFLD) is ultrasound. Most patients first favor ultrasound, which is considered the leading imaging modality for NAFLD suspicion. The majority of NAFLD patients were middle-aged and male.

Keywords: Abdominal pain, Fatigue, Liver cirrhosis, Non- Alcoholic Fatty Liver Disease, Ultrasound

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) also called “silent liver disease” [1] is termed as the accumulation of abnormal fat (>5%) in the hepatocytes without significant use of alcohol (>30 g/d in men, >20 g/d in women or ≥14 drinks/week for men or ≥7 drinks/week for women) and absence of secondary causes of fatty liver disease like hepatitis C or Wilson disease [2]. The global prevalence of NAFLD is 25% [3] with the highest prevalence noted in the Middle East (31.8%), then Asia (27.4%), the USA (24.1%), Europe (23.7%), and the lowest is in Africa (13.5%) [4] while Pakistan has a 14% prevalence of NAFLD[5]. In the United States, NAFLD is also considered the most common liver disorder with an affected prevalence of 30% [6].

In Western countries, chronic liver disease is most commonly caused by NAFLD [7]. Non-Alcoholic Fatty Liver Disease was cited for the first time in 1980 [8] and was also initially described in 1980 by Ludwig et al in which twenty individual histological discoveries were captured for the most obese affected with NAFLD [9]. NAFLD is of two types, simple fatty liver and nonalcoholic steatohepatitis (NASH) [10]. NAFLD affected 20-30% of cases progress to NASH [11]. Malaise, fatigue, and uncomfortableness in the right upper abdomen are the common symptoms of NAFLD [12]. The spectrum of conditions included by NAFLD ranges from hepatic steatosis to fibrosis and has also been related to endothelial dysfunction, metabolic syndrome, insulin resistance, type 2 diabetes, dyslipidemia, and independent cardiovascular events [13]. Cardiovascular disease is the most common cause of death in NAFLD patients. Hepatocellular carcinoma’s third most common cause is NAFLD while Cryptogenic cirrhosis’s hidden cause can be “Burned out” NAFLD [14]. Chronic liver disease is the most commonly considered NAFLD characterized by excess triglyceride (TG) accumulation within hepatocytes[15]. High liver function test (LFT) results in patients up to 90% are believed to be NAFLD[16]. After diagnosis with NAFLD during 10-20 years less than 10% of patients progressed towards cirrhotic complications and hepatocellular carcinoma [17].

NAFLD-related recent pathogenesis is most likely a high-calorie diet, excess fats, carbohydrates, sugar-sweetened beverages, and high fructose intake. In 7% of normal-weight (lean) individuals most commonly in females at a younger age and with normal liver enzymes, NAFLD is present [18]. Patients with NAFLD have approximately 50% hypertension, 50-90% hyperlipidemia, 30-50% T2DM, and 80-90% obesity while 62% have high triglyceride levels and 54% have reduced high-density lipoprotein cholesterol (HDL-C) levels [19]. Principal factors related to NAFLD are Diabetes mellitus type 2 (DM-2) and obesity [20]. A study in Korea shows that in euglycemic patients, NAFLD was strongly related to an elevated risk of type 2 diabetes mellitus [21]. In total 924 types 2 diabetic patients, Kalra et al. identified 522 (56.5%) cases of NAFLD with elevated prevalence in females (60%) than in males (54.3%) [22]. NAFLD diagnosis remains under-recognized as most patients are without symptoms until the late stages of the disease [23]. Early detection and treatment of NAFLD may reverse and save its progression [24]. For the past 50 years, diagnostic Ultrasound is a common method for the diagnosis of fatty liver disease [25]. The most widely available modality for the initial evaluation of suspected fatty liver disease is Ultrasound. Like an MRI [26], it is

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noninvasive, inexpensive, easily performed, does not contain any ionizing radiation, incidental focal lesions are detected easily and the upper abdomen can be easy to examine. Unenhanced helical CT was initially described by Smith et al. in 1995 [27] but the radiation dose is now one of the biggest disadvantages of CT [28]. The fatty liver shows increased echogenicity "bright liver" on Ultrasound due to increased interfaces created by fats within hepatocytes, which leads to more echoes returning back to the transducer [29]. Parenchymal brightness, liver-to-kidney contrast, deep beam attenuation, bright vessel walls, and gallbladder wall definition are the Ultrasound parameters used for the diagnosis of fatty liver disease [30]. When more than 20% of hepatocytes contain histologically visible fat droplets, then it can be detectable by the US with a reported sensitivity of 79.7% and specificity of 86.2% [31]. Ultrasound has several limitations that elevate the concern, like operator dependency, subjective evaluation, and limited ability to quantify the amount of fatty infiltration [32]. Generally, Ultrasound is the most commonly used modality because of their availability and low cost but its role in NAFLD is not fully diagnosed and evaluated which is very necessary for the proper use of the modality and for the benefits of patients to be diagnosed initially with Ultrasound. Most patients have fatty liver but lack of knowledge and unavailability of diagnostic facilities, the ratio of the effected individuals increases day by day and may lead to a serious problem. The purpose of conducting this study in Hayatabad Medical Complex (HMC) Peshawar, Pakistan is to evaluate the diagnostic role of Ultrasound in NAFLD.

MATERIAL AND METHODS

This cross-sectional study with consecutive sampling technique was conducted at the Radiology Department of Hayatabad Medical Complex (HMC), Mardan, Pakistan. All enrolled patients at the Hayatabad Medical Complex (HMC) Radiology Department in Peshawar, Pakistan, were included in the study population. The patients underwent an extensive clinical evaluation and a close examination. Along with the referring radiologist, an in-depth investigation of the medical records was conducted. This was done to compensate for any bias and influencers in the study's findings. Using the Open Epi sample size calculator, the sample size of 250 patients was determined by taking a 14% prevalence with a 5% margin of error and a 95% confidence range. Patients who were willing to give consent, suspected of having non-alcoholic fatty liver disease (NAFLD), and of any gender between the ages of 20 and 60 met the inclusion criteria. Patients having a history of alcohol or drug use that results in fatty liver, pregnant patients, and those with documented chronic liver disease were excluded.

The Hayatabad Medical Complex (HMC), in Peshawar, Pakistan, ethics and review committee gave its clearance before the study could begin. At the ultrasound room, individuals were gathered, and a signed consent form was acquired. Biodata, clinical information, and the degree of physical activity were gathered and documented. A certified sonologist conducted the abdominal ultrasound on each patient, utilizing a Toshiba Xario-Prime (TUS-660) ultrasound machine to prevent instrumental bias. The right arm was extended to its maximum abduction while the participants were positioned in the dorsal decubitus position. Using a right intercostal technique, the right liver lobe was seen, and a representative parenchymal region was identified without compromising the main vascular. For each participant, the doctor made adjustments to the transmit focal range and time gain compensation (TGC) while adjusting other settings. When the subject was performing a breath hold in shallow expiration, ten consecutive RF frames were collected at a rate of ten frames per second. Every frame measured 10 cm in depth and included 560 lateral lines. The transmit focal range and TGC settings were automatically recorded by the equipment. The ultrasonography of the liver revealed a higher echotexture and deep attenuation when compared to the kidneys. The fatty liver is classified into three grades based on its echogenicity: Grade I fatty liver is defined as having increased hepatic echogenicity with visible periportal and diaphragmatic echogenicity; Grade II fatty liver is identified as having increased hepatic echogenicity with imperceptible periportal echogenicity without diaphragmatic obscuration; Grade III fatty liver is stated as having both imperceptible periportal echogenicity and diaphragmatic obscuration. With extensive knowledge of ultrasound, two consultant radiologists generated and reviewed the ultrasound reports. Any disagreement is resolved by consensus. Every patient with NAFLD who had an abdominal ultrasound had data collected using a data collecting form. Every study data form was routinely reviewed for correctness, uniformity, and comprehensiveness, and any mistakes found were immediately fixed. Every form containing completed data was organized and given a distinctive study ID by coding. SPSS version 26.0 was used to store and analyze all of the data. With regard to quantitative data, mean + SD was computed. For categorical variables, percentages and frequencies were determined. P values less than 0.05 for the Chi square test were considered significant. Tables and graphs were used to display all of the results.

RESULTS

The overall number of participants in the study was 250, with 139 males (55.4% of the total) and 111 females (44.2% of the total) participating. In order of age, the following categories were included: 20–29, 30-39, 40–49, and 50–60. The age group that was most affected was those between the ages of 40 and 49 (38.2%), followed by those between the ages of 50 and 60 (25.9%), and then 30-39 (22.3%). As can be seen in Figure 1, the age group that was affected the least was the 20–29-year-olds (13.1%).

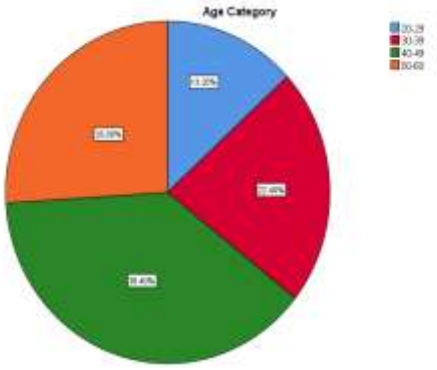

Fig. 1: Age categories of the participants

On the other hand, just 11.6% and 8.4% of the participants had completed their college or university educations, while the bulk of participants (23.5%) had no formal education. The most common symptom among those diagnosed with non-alcoholic fatty liver disease (NAFLD) was pain on the right side of the abdomen (47.4%), followed by weariness (31.1%). Patients diagnosed with non-alcoholic fatty liver disease who reported with weight loss had the lowest proportion of symptoms (1.6%). Seventy-two percent of the people have a family history of nonalcoholic fatty liver disease (NAFLD), while seventy-two percent of the people do not have such a history. A total of 123 people, or 49%, have mild nonalcoholic fatty liver disease (NAFLD), followed by moderate NAFLD in 106 people, or 42.2%, and severe NAFLD in 21 people, or 8.4%. Cirrhosis of the liver was present in only 20 (8%) of the 230 individuals (91.6%) who were diagnosed with non-alcoholic fatty liver disease (NAFLD) prior to receiving the diagnosis. One hundred and twenty-one (80.1%) of those who have NAFLD do not take any medication, while only forty-nine (19.5%) don't. A total of 95 individuals, or 37.8%, had previously received instruction regarding NAFLD, whereas 155 persons, or 61.8 percent, had not received such knowledge. The ultrasound modality was utilised by twenty-nine (83.3%) of the participants in order to diagnose non-

alcoholic fatty liver disease (NAFLD). The remaining 31 (12.4%) and ten (4%) individuals utilised the CT scan and MRI, respectively, as shown in Table 1.

Table 1: Characteristic-wise distribution of variables.

Variables	Frequency	Percentage
Gender		
Male	139	55.4%
Female	111	44.2%
Symptoms of NAFLD		
Abdominal pain on Right side	119	47.4%
Fatigue	78	31.1%
Jaundice	18	7.2%
Extreme Tiredness	16	6.4%
Weight loss	4	1.6%
Weakness	15	6.0%
NAFLD Severity		
Mild	123	49.0%
Moderate	106	42.2%
Severe	21	8.4%
Liver Cirrhosis before NAFLD		
Yes	20	8.0%
No	230	91.6%
Imaging Test before NAFLD		
Ultrasound	209	83.3%
CT scan	31	12.4%
MRI	10	4.0%

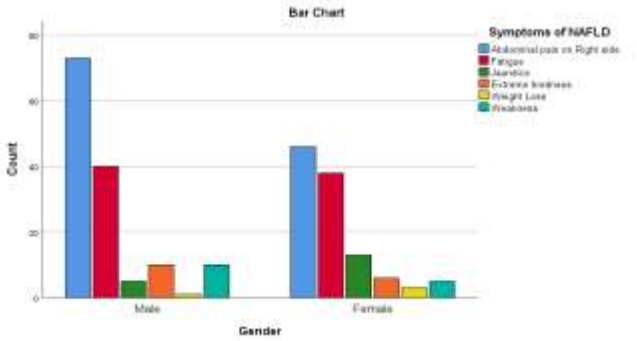

Fig. 2: Gender wise distribution of patients and Symptoms of NAFLD

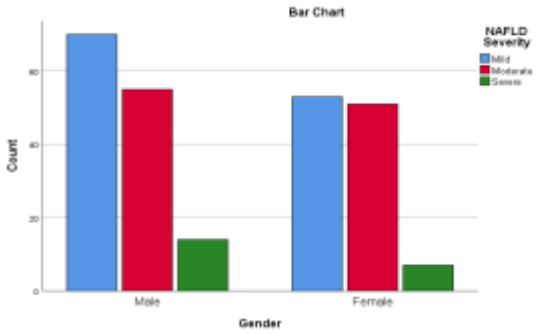

Fig. 3: Gender wise distribution of patients and NAFLD Severity

DISCUSSION

In this particular situation, the role of ultrasonography, which is the most common non-invasive diagnostic tool for non-alcoholic fatty liver disease (NAFLD), is investigated. We recruited a total of 250 patients for our study, and the majority of those affected were males rather than females. This was a finding that was also noticed in a number of other research publications that were published in the past [1,9].

One of the key symptoms that affected the participants in our study the most was right-sided abdominal pain, which was followed by exhaustion, which affected a greater percentage of the participants. Prior to receiving their diagnosis of non-alcoholic fatty liver disease (NAFLD), almost all of the patients did not have any liver cirrhosis, and the majority of patients had a mild form of the disease when it was initially discovered using sonography. In the beginning, the majority of patients favored having an ultrasound performed since it did not pose any radiation risk, it was non-invasive, it was inexpensive, and it was easily accessible. Additionally, the majority of the patients were first diagnosed with non-alcoholic fatty liver disease (NAFLD) that was related to ultrasound. Among the imaging tests that are conducted for NAFLD, ultrasound is the most popular option. The rate of diagnosis of non-alcoholic fatty liver disease (NAFLD) was around 83.3% of the participants, which is higher than the diagnoses given in the other research publications by Shobha Luxmi et al. [6] and Mubashir Dilawar et al. [12], which indicate rates of 60.8% and 78%, respectively.

It was found that patients between the ages of 40 and 49 were the most affected age group. This is due to the fact that the majority of patients in this age range are afflicted. As shown in Figures 2 and 3, both male and female patients experienced an increase in the number of mild cases of nonalcoholic fatty liver disease (NAFLD), followed by moderate and severe cases. When it came to symptoms, abdominal discomfort was the most prevalent, followed by weariness.

Limitation: This study was conducted at a single centre and had a small sample size.
Recommendation: It would be beneficial to do a multi-centered study with a larger sample size in order to further investigate the diagnostic role of ultrasound and also to determine the phases of non-alcoholic fatty liver disease (NAFLD).

CONCLUSION

Ultrasound is the major imaging modality that is used in the diagnosis of non-alcoholic fatty liver disease (NAFLD). To begin with, the majority of patients prefer ultrasound for suspected non-alcoholic fatty liver disease (NAFLD) because ultrasound is non-invasive and does not involve radiation. Men were more likely to be affected by nonalcoholic fatty liver disease (NAFLD) than women, and patients in the middle age range were more likely to be impacted by the condition than patients in any other age group. The most common symptoms of nonalcoholic fatty liver disease (NAFLD) in both male and female patients were abdominal discomfort, followed by exhaustion, and a modest severity of the condition.
Conflict of Interest and Ethical issues: The work was approved by the Institutional Research and Ethical Review Board (IREB) of the Hayatabad Medical Complex (HMC) in Peshawar, Pakistan. The authors have stated that they do not have any conflicts of interest in relation to the work.
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