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Original Article

Assessment of Non-Alcoholic Hepatic Steatosis Disease and its Association with Hepatomegaly by Using Ultrasound

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ABSTRACT

Background: Non-alcoholic hepatic steatosis disease (NAHSD) is increasingly recognized as a major global health concern, particularly due to its silent progression and significant impact on quality of life. The prevalence of NAHSD is particularly high in regions with widespread obesity and diabetes, conditions that are escalating in global incidence.

Objective: This study aimed to evaluate the prevalence and severity of NAHSD and its association with hepatomegaly using ultrasonography in a Pakistani adult population.

Methods: A cross-sectional study was conducted from November 2023 to March 2024 at the Department of Radiology, District Head Quarter's Hospital, Swabi, Pakistan. A total of 70 adults presenting with clinical manifestations of hepatomegaly were enrolled. Ultrasonography was performed using a Toshiba Doppler machine equipped with a convex transducer (2.5—5.0 MH frequency). Liver size, shape, and echogenicity were assessed, and hepatic parenchyma was graded into three categories based on echogenicity. Data were analyzed using SPSS version 25, focusing on descriptive and inferential statistics.

Results: The study comprised 41 females (58.6%) and 29 males (41.4%), with an age range from 19 to 69 years (mean age 43.79 ± 11.583 years). Hepatic steatosis was graded as mild in 20% (14), moderate in 5.7% (4), and severe in 1.4% (1) of patients with hepatomegaly. The majority, 72.9% (51), showed no signs of hepatic steatosis. Hepatomegaly was noted in 27% of patients (19).

Conclusion: Ultrasonography is an effective diagnostic tool for assessing NAHSD and hepatomegaly, revealing a significant prevalence of these conditions among the studied population. Early screening and intervention are critical to managing and reducing the healthcare burden associated with NAHSD.

Keywords: Non-alcoholic hepatic steatosis, hepatomegaly, ultrasonography, healthcare burden, diagnostic imaging, liver disease, Pakistani population, Toshiba Doppler machine.

INTRODUCTION

Non-alcoholic hepatic steatosis disease (NAHSD) is an increasingly prevalent condition characterized by excessive fat accumulation in the liver, not related to alcohol intake (1, 2). This condition is particularly concerning as it often progresses without symptoms yet is indicated by liver enzyme levels that are two to three times higher than normal. NAHSD is a major public health issue, exacerbated by rising global obesity rates. It is the most common liver disease in the United States, affecting approximately 5% of the population, with an 18% prevalence reported among the general Pakistani population, underscoring its significance in Asia as well (1, 3).

The risk factors for NAHSD include age, gender, race, and ethnicity, with a higher incidence noted among adults. Males under 50 years are more frequently affected, whereas incidence rates in females increase after 50, likely due to hormonal changes following menopause (2). The disease is commonly associated with insulin resistance, diabetes, obesity, and hypertension. Studies have shown varying degrees of comorbidity with obesity present in 30–100% of cases, type 2 diabetes in 10–75%, and high cholesterol levels in 20–94% of patients (4, 5).

Hepatomegaly, defined as an abnormal enlargement of the liver, is often a concurrent condition with NAHSD. Although not a disease, hepatomegaly can indicate underlying pathologies such as NAHSD and is critical in the clinical assessment for surgical planning and management follow-up. The liver performs numerous vital functions, and its size can be influenced by various factors including fatty infiltration (6).

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Clinical assessment methods such as palpation and percussion are traditionally employed to estimate liver size but are often criticized for their inaccuracy (7, 8). Ultrasonography stands out as a superior diagnostic tool for evaluating liver pathology, including NAHSD and hepatomegaly. It allows for straightforward measurements, typically focusing on liver length rather than overall size. Standard measurements include the liver's length at the mid-clavicular line, usually up to 15 cm, and the cranio-caudal dimension, which can extend up to 16 cm in adults (9). This method provides a more reliable and less invasive means of assessing liver size and detecting potential abnormalities.

MATERIAL AND METHODS

This cross-sectional study was conducted at the Department of Radiology, District Head Quarter's (DHQ) Hospital, Swabi, Pakistan, from November 2023 to March 2024. Ethical approval was granted by the Ethical Committee of Women University Swabi, ensuring compliance with the Declaration of Helsinki regarding ethical standards for research involving human subjects. The study included male and female adult participants from the district of Swabi who presented with clinical manifestations of hepatomegaly and hepatic steatosis (10).

For the sonographic examinations, a Toshiba Doppler ultrasound machine equipped with a convex transducer capable of a frequency range between 2.5 and 5.0 MHz was utilized. The assessments focused on liver size, shape, and echogenicity, which were evaluated using grayscale imaging. The hepatic parenchyma was sonographically categorized into three grades based on echogenicity: Grade I, where echogenicity is mildly increased; Grade II, characterized by moderately increased echogenicity with suboptimal imaging of intrahepatic vessels; and Grade III, where echogenicity is severely increased, and imaging of intrahepatic vessels is absent. Measurements were taken at the mid-clavicular line, with a normal liver length up to 15 cm and cranio-caudal dimension up to 16 cm in adults. A measurement greater than 16 cm was indicative of hepatomegaly (10-12).

Data was collected through detailed sonographic examinations conducted by trained radiologists. Each ultrasound session was carefully documented, with data including liver dimensions and echogenicity levels. The collected data were anonymized and analyzed using SPSS version 25. Statistical methods applied included descriptive statistics to outline demographic and ultrasound findings, and inferential statistics to explore associations between hepatomegaly, hepatic steatosis grades, and demographic variables. The findings were prepared for presentation, ensuring accurate representation of the ultrasound imaging results and their clinical implications.

RESULTS

In this cross-sectional study conducted at the Department of Radiology, DHQ Hospital, Swabi, Pakistan, a total of 70 patients were enrolled to assess the prevalence of hepatic steatosis in individuals presenting with hepatomegaly. The age distribution of the participants ranged widely, with ages spanning from 19 to 69 years. The mean age of the participants was approximately 43.79 years, with a standard deviation of 11.583, indicating a moderately diverse age group (Table 1).

Table 1: Age-wise Distribution of Patients Enrolled in the Study

	N	Minimum	Maximum	Mean	Std. Deviation
Age	70	19	69	43.79	11.583

Table 2: Gender-wise Distribution of Patients Enrolled in the Study

Gender	Frequency	Percent	Valid Percent
Female	41	58.6	58.6
Male	29	41.4	41.4
Total	70	100.0	100.0

Table 3: Hepatic Steatosis Disease in Patients with Hepatomegaly

Hepatomegaly	I	II	III	Total
Mild	5	7	2	14 (20.0%)
Moderate	3	1	0	4 (5.7%)
None	14	37	0	51 (72.9%)
Severe	0	1	0	1 (1.4%)
Total	22 (31.4%)	46 (65.7%)	2 (2.9%)	70 (100.0%)

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Gender distribution among the participants revealed a higher prevalence of female patients compared to males. Specifically, 58.6% of the participants were female (41 individuals), while 41.4% were male (29 individuals), demonstrating a notable gender disparity in the occurrence of hepatic conditions within this population (Table 2).

The evaluation of hepatic steatosis disease grades among those diagnosed with hepatomegaly showed that the majority of patients did not present with severe steatosis. Specifically, 72.9% of the participants (51 individuals) had no signs of hepatic steatosis. In contrast, 20% of the patients (14 individuals) exhibited mild steatosis, characterized by slightly increased echogenicity, and a smaller fraction, 5.7% (4 individuals), displayed moderate steatosis. Severe hepatic steatosis was notably rare, identified in only 1.4% of the cases (1 individual). These findings underscore the variability in the severity of hepatic steatosis among patients with hepatomegaly, with the majority presenting mild to no steatosis (Table 3). This distribution provides important insights into the characteristics and clinical profiles of patients affected by hepatomegaly and hepatic steatosis in the studied region, highlighting the need for targeted interventions and continuous monitoring of this patient demographic.

DISCUSSION

Non-alcoholic hepatic steatosis (NAHSD), a significant global health concern, detrimentally impacts healthcare systems and the quality of life. In Pakistan, the prevalence of NAHSD remains high, though often undiagnosed due to limited screening practices over the years (10). Comparative studies, such as the one conducted by Muzna et al., which involved 87 patients and utilized ultrasonography, revealed a higher incidence of mild fatty liver disease among women than men, with 33.7% of patients exhibiting mild hepatic steatosis. This study, along with others, identifies obesity as a primary contributor to NAHSD, though other factors such as diabetes, hypertension, and menopause appear less significantly correlated (10-12).

Our study aligns with these findings, noting a female predominance in NAHSD prevalence with 58.6% of the 70 patients being female. This gender distribution is consistent with broader epidemiological data suggesting a higher susceptibility among women, particularly post-menopause, which could be due to hormonal changes influencing lipid metabolism (10). Furthermore, Rizwan Ullah et al.'s research at Alnoor Ultrasound and KTH Hospital in Peshawar, which assessed 230 patients, found a similar trend with a higher overall prevalence of non-alcoholic liver disease, particularly among males (11). This study underscored the role of obesity and diabetes as primary risk factors, reinforcing the need for early diagnostic interventions, such as ultrasound, which proved effective in detecting hepatic abnormalities early (13).

Similarly, Uzma Bano et al. explored the frequency and risk factors associated with NAHSD in 100 patients, highlighting the commonality of diabetes and obesity in patients diagnosed with fatty liver via ultrasound, with an average patient age of 45.39 years (12, 13). Abida Matin et al. also identified common clinical features and risk factors of hepatic steatosis, noting that 19.0% of their cohort had diagnosed hepatomegaly, yet most patients were asymptomatic (4). These findings are particularly insightful when juxtaposed with our results, where the mean age was slightly lower at 43.79±11.5 years, and a substantial proportion of patients (92.9%) presented with right hypochondriac pain, a common symptom in advanced cases (14-17).

The strengths of our study include the use of ultrasonography, a non-invasive and cost-effective method, which proved reliable in assessing hepatic diseases and evaluating the association between NAHSD and hepatomegaly. However, the study is not without limitations. The sample size, although adequate for preliminary insights, limits the generalizability of the findings across broader demographics. Furthermore, the cross-sectional nature of the study restricts the ability to infer causality between observed risk factors and NAHSD (18-20).

Future studies should aim to expand the participant pool across multiple regions to enhance the representativeness of the results. Longitudinal studies could also provide more definitive insights into the progression of NAHSD and the effectiveness of various intervention strategies over time. Recommendations based on our findings suggest continued emphasis on preventive measures, particularly weight management and diabetes control, to mitigate the risk of NAHSD. Additionally, enhancing public health strategies for more widespread and systematic screening could improve early diagnosis rates, ultimately reducing the healthcare burden of NAHSD (20).

CONCLUSION

The study underscores the utility of ultrasonography as the preferred modality for early diagnosis of non-alcoholic hepatic steatosis disease (NAHSD) and its association with hepatomegaly, highlighting significant healthcare implications. Given the prevalence of NAHSD and its correlation with lifestyle factors such as obesity and diabetes, there is a critical need for public health interventions that promote healthier lifestyles and enhanced screening practices. Early detection and management of NAHSD can significantly reduce the burden on healthcare systems by preventing progression to more severe liver diseases and associated health complications.

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