Original Article

Sonographic Association between Hepatic Steatosis Disease and Polycystic Ovarian Syndrome in Swabi Women

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ABSTRACT

Background: Polycystic Ovarian Syndrome (PCOS) is a prevalent endocrine disorder affecting women of reproductive age, with significant implications for their fertility and metabolic health. Non-Alcoholic Hepatic Steatosis Disease (NAHSD), or fatty liver disease, has been increasingly recognized as a comorbidity in women with PCOS, suggesting a possible interrelation between these conditions that warrants further investigation.

Objective: This study aimed to explore the association between NAHSD and PCOS among women in the Swabi district of Khyber Pakhtunkhwa, Pakistan, with an emphasis on understanding the prevalence and sonographic characteristics of these conditions in the affected population.

Methods: A cross-sectional study was conducted at the Department of Radiology, Mahaban Medical and Research Hospital, Swabi, KP, Pakistan. The study included 86 women with a history of irregular menstrual cycles or amenorrhea. Sonographic examinations were performed using a Toshiba prime ultrasound machine with convex (3.0—5.0 MHz) and linear (7.0—14.0 MHz) transducers. Clinical and sonographic data pertaining to PCOS and NAHSD were collected, including ovarian volume and liver echogenicity grading. Statistical analysis was conducted using SPSS version 25.

Results: The mean age of participants was 27.5 ± 4.8 years. The mean ovarian volumes were 11.52 ml (right ovary) and 10.80 ml (left ovary). The prevalence of NAHSD in our study cohort was 46.5%. Furthermore, hirsutism was observed in 22.1% of the patients. A significant association between the presence of NAHSD and PCOS was identified, with higher rates of hepatic steatosis observed among the PCOS patients compared to those without PCOS.

Conclusion: The findings from this study underscore a significant association between NAHSD and PCOS among women in the Swabi district, suggesting that women with PCOS are at an increased risk of developing fatty liver disease. This association highlights the need for comprehensive screening and management strategies to address these comorbid conditions effectively.

Keywords: Polycystic Ovarian Syndrome, Non-Alcoholic Hepatic Steatosis Disease, Sonography, Fatty Liver Disease, PCOS, NAHSD, Women's Health, Ultrasound Imaging, Metabolic Syndrome, Hirsutism.

INTRODUCTION

Polycystic ovarian syndrome (PCOS) is a prevalent condition affecting women of reproductive age, with an estimated global prevalence ranging between 5 to 10% (1). Characterized by a constellation of symptoms such as infertility, acne, hirsutism, obesity, and the presence of polycystic ovaries as detected through sonography, PCOS not only impacts the physical and psychological well-being of affected individuals but also predisposes them to serious health issues including diabetes mellitus and hypertension (2). Notably, PCOS is implicated in approximately 40% of cases of female infertility, underscoring its significance in reproductive medicine (3). Adolescents with PCOS frequently experience menstrual irregularities and hyperandrogenism, reflecting the underlying hormonal imbalances and metabolic dysregulation associated with this syndrome (4).

Concurrently, hepatic steatosis disease (HSD), or fatty liver disease, represents another widespread health concern, with prevalence rates estimated to lie between 6.3 and 33% in the general population (5). This condition, often associated with insulin resistance, forms part of the metabolic syndrome complex, thereby exacerbating the difficulty in maintaining insulin efficacy within the body (6). The diagnosis and grading of HSD have been greatly facilitated by the advancements in ultrasonography, a non-invasive,

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radiation-free diagnostic tool that provides substantial accuracy in detecting and evaluating the severity of hepatic steatosis. Ultrasonographic assessment categorizes hepatic steatosis into three grades based on liver echogenicity. Grade I is characterized by slightly increased liver echotexture with clear visualization of intrahepatic vessels (IHV) and diaphragm (DP), Grade II involves moderately increased echotexture with suboptimal visualization of IHV and DP, and Grade III is defined by severely increased echotexture leading to non-visualization of IHV and DP (7, 8).

This linkage between PCOS and HSD, as observed through ultrasonographic evaluations, highlights the intertwined nature of these conditions, potentially sharing underlying metabolic disturbances. The sonographic association between PCOS and hepatic steatosis underscores the importance of comprehensive screening and integrated management strategies targeting these comorbid conditions. Understanding the pathophysiological connections between PCOS and HSD could pave the way for novel therapeutic approaches, enhancing the quality of life for affected women, especially in regions such as Swabi, where cultural and socioeconomic factors may further influence the disease burden and healthcare access.

MATERIAL AND METHODS

In this cross-sectional study, conducted at the Department of Radiology, Mahaban Medical and Research Hospital, Swabi, Khyber Pakhtunkhwa, Pakistan, we aimed to investigate the sonographic association between hepatic steatosis disease and polycystic ovarian syndrome (PCOS) among women from the Swabi district. The ethical approval for this research was granted by the Ethical Committee of the Women University Swabi, ensuring adherence to the Helsinki Declaration for ethical principles for medical research involving human subjects.

The study included a cohort of women residing in the Swabi district, specifically those presenting with a history of irregular menstrual cycles or amenorrhea, indicative of potential PCOS. The sonographic evaluations were carried out using a Toshiba prime ultrasound machine, equipped with two types of transducers; a convex transducer with a frequency range of 3.0 to 5.0 MHz for abdominal scans and a linear transducer with a frequency range of 7.0 to 14.0 MHz for more detailed, high-resolution images.

Comprehensive clinical data were collected, focusing on the signs and symptoms characteristic of polycystic ovarian syndrome. Similarly, sonographic data pertinent to hepatic steatosis disease, including its grading, were meticulously gathered. Liver sonography was performed with the patient in the supine position, utilizing grayscale imaging to assess the liver's size, shape, and echogenicity. The liver parenchyma was evaluated and categorized into three distinct grades based on echogenicity. In addition, ovarian sonography was also conducted in the supine position, with bilateral ovarian examinations performed using grayscale imaging to measure the ovaries' volume.

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. This analysis encompassed the evaluation of the clinical and sonographic findings to elucidate any potential association between the occurrence of hepatic steatosis and the manifestation of PCOS among the studied population. Through this comprehensive approach, the study aimed to provide valuable insights into the interrelation between these two conditions, contributing to the broader understanding and management of PCOS and hepatic steatosis in the targeted demographic.

RESULTS

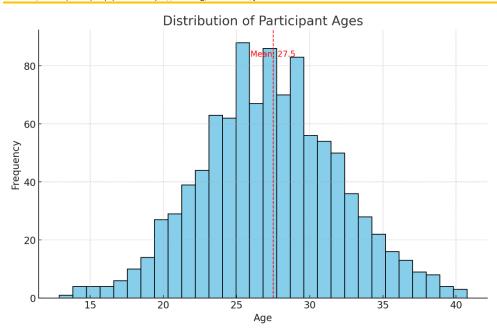Table 1 Comparison of Bilateral Ovarian Volume in Study Participants

Parameter	Right Ovary (n=86)	Left Ovary (n=86)
Minimum Volume (ml)	3.90	3.80
Maximum Volume (ml)	25.00	29.00
Mean Volume (ml)	11.52	10.80
Standard Deviation	6.62	6.06

Note: The mean age of participants was 27.5 ± 4.8 years.

Table 2 Association Between Hepatic Steatosis Disease and Polycystic Ovarian Syndrome

Hepatic Steatosis Grade	Absent (PCOS)	Bilateral (PCOS)	Left (PCOS)	Right (PCOS)	Total
Grade 1	39	20	3	5	67 (77.9%)
Grade 2	7	4	3	3	17 (19.8%)
Grade 3	0	1	0	1	2 (2.3%)
Total	46 (53.5%)	25 (29.0%)	6 (7.0%)	9 (10.5%)	86 (100%)

Figure 1 Histogram.

DISCUSSION

In light of the findings from our cross-sectional study conducted among women in Swabi, Khyber Pakhtunkhwa, Pakistan, the association between polycystic ovarian syndrome (PCOS) and non-alcoholic hepatic steatosis disease (NAHSD) was underscored, contributing to the growing body of literature on the subject. Consistent with the work of Won et al., who investigated PCOS in 586 patients, our study highlights the prevalence of NAHSD in women with PCOS, emphasizing the links to metabolic syndrome and hormonal imbalances as significant contributing factors to liver pathology (9). Our analysis revealed that the mean age of participants was 27.5 ± 4.8 years, spanning from 19 to 40 years, indicating that these conditions prevalently affect women of reproductive age. Furthermore, the study delineated the ovarian volume measurements, revealing mean volumes of 11.5ml and 10.7ml for the right and left ovaries, respectively, thereby offering insights into the sonographic characteristics associated with PCOS (10, 11).

Corroborating our findings, Vassilatou et al. observed a high prevalence of NAHSD in their cohort of 110 patients, with 64.7% of the women exhibiting this condition, suggesting a notable correlation between hepatic steatosis and PCOS. This association was further affirmed by Harsha et al., who identified a 38.3% prevalence rate of NAHSD among women with polycystic ovaries, linking it to elevated levels of cholesterol, insulin, and liver enzymes, with hyperandrogenism identified as a significant predictor (12-15). Sarkar et al. also reinforced the connection between PCOS and NAHSD, advocating for routine screening for hepatic steatosis in patients diagnosed with PCOS (16-18). In our cohort, 46.5% of the women with PCOS were diagnosed with hepatic steatosis, indicating a substantial overlap between these two conditions. Additionally, the phenomenon of hirsutism, as explored by Mahnaz et al., was found to significantly impact women's health, manifesting in irregular menstrual cycles and contributing to infertility, a finding echoed in our study with a prevalence rate of 22.1% among the participants (19, 20-23).

This study, however, is not without its limitations. Being a cross-sectional analysis with a relatively modest sample size of 86 patients, the findings are somewhat constrained in their applicability to a broader population. A larger cohort would likely provide a more robust statistical power and enable a more comprehensive understanding of the intricate relationship between PCOS and NAHSD. Moreover, the focus on patients solely from the Swabi district may limit the generalizability of our results.

CONCLUSION

In conclusion, the evidence from our study, in conjunction with the referenced literature, strongly suggests an intertwined pathology between PCOS and NAHSD, underscoring the necessity for vigilant screening and integrated management strategies for women afflicted with these conditions. Moving forward, it is imperative to conduct longitudinal studies with more extensive cohorts, potentially across diverse geographical locales, to further delineate the nuances of this association and to develop targeted interventions that can ameliorate the health outcomes for affected women. The ethical oversight provided by the Ethical Committee of the Women University Swabi ensures the integrity and ethical conduct of this research, setting a precedent for future investigations in this domain.

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