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Original Research Article

Sonographic Correlation of Polycystic Ovarian Syndrome with Suprapubic Subcutaneous Fat

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Abstract

Polycystic ovarian syndrome is most common heterogeneous problem affecting seriously women's lives in their fertile age group. Obesity, infertility, insulin resistance, increased type 2 diabetes mellitus and cardiovascular disease (CVD) are risk factors frequently present with PCOS. Among these, anovulation infertility is one of the most alarming situation. Obesity also stands out as it has reached its epidemic proportions. ***Objective:*** The objective of this study was sonographic correlation of PCOS with obesity by measuring subcutaneous fat at suprapubic region. ***Material and methods:*** A total 138 sample size was selected according to Prevalence of PCOS based on AE- PCOS Society. Both 69 Patients with PCOS and 69 without PCOS were included. Toshiba Xario machine was used at Gosh-e-Shifa hospital, Lahore. Both transvaginal and transabdominal (linear and convex) were used. Specific scanning protocols were used. ***Results:*** The 69 (50%), individuals who were diagnosed with PCOS, few of them had previous history of PCOS. Total 10 (14.4%) patients out of 69 patients had prior history of PCOS. The other 69 (50%) patients are normal. The clinical symptoms of patients and sonographic criteria for PCO collectively used to diagnose PCOS and normal patients. Then suprapubic subcutaneous fat was measured. The mean of measurements was taken and correlated the both type of individuals with their corresponding fat thickness. The result showed that the patients with PCOS had more subcutaneous fat thickness comparatively to subcutaneous fat thickness of normal patients. This study showed that the obesity is major consequence of PCOS and increased subcutaneous fat thickness at suprapubic region is correlated with PCOS.

Keywords: PCOS, Patients with PCOS, Patient without PCOS, Obesity, Suprapubic Subcutaneous fat.

INTRODUCTION

Polycystic ovarian syndrome is the most common endocrine problem occurring in fertile age women consequences of reproductive (infertility, hyperandrogenism, hirsutism), metabolic (insulin resistance, impaired glucose tolerance, type II diabetes mellitus, cardiovascular) and physiological features; symptoms including the menstrual cycle irregularity, anovulation, excessive hair growth, acne and polycystic ovarian morphology [1]. Obesity, infertility, insulin resistance, increased type 2 diabetes mellitus and cardiovascular disease (CVD) are risk factors frequently present with PCOS [2, 3]. Among these, anovulation infertility is one of the most alarming associated morbidities, as it currently affects approximately 48.5 million women aged 20–44 years [4].

Stein and Leventhal two American gynecologist, firstly diagnosed and described the PCOS in 1935.Therefore, the polycystic ovarian syndrome is also called Stein and Leventhal syndrome. They described the PCOS as constellation of (1) amenorrhea (2) hirsutism (3) polycystic ovaries [5]. Three different groups offered the diagnostic criteria for PCOS: National Institute of Health (NIH), Androgen Excess and PCOS Society and Rotterdam Criteria [6, 7]. At present, the Rotterdam criteria is most commonly used. Two out of the three criteria required are oligo-anovulation, hyperandrogenism and polycystic ovarian morphology [8]. Worldwide prevalence of PCOS varies from 2.2% to 26% [9]. Prevalence of PCOS may be varied with the use of different diagnostic criteria ranging from 5% to 15% [10].

Hyperandrogenism is the main feature of PCOS and insulin resistance plays a critical role in its pathophysiology. The overproduction of androgen hormone causing many metabolic problems as obesity, hypertension, and type 2 diabetes mellitus in patients

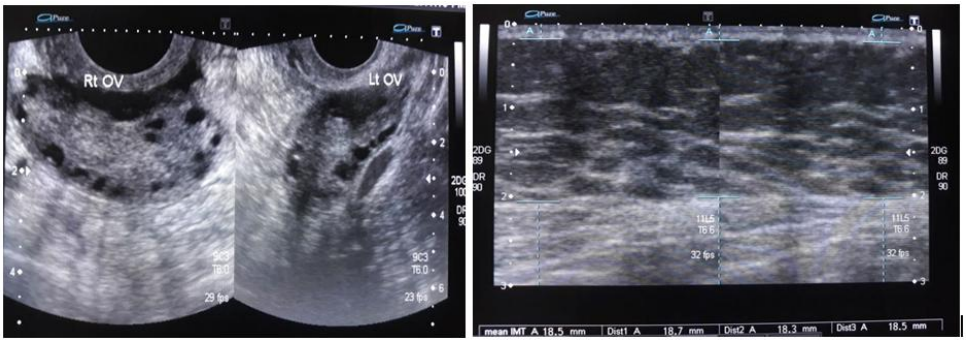
with PCOS [11, 12]. Amongst the complications previously mentioned, obesity stands out as it has reached epidemic proportions [13], with a worldwide prevalence of 35% in females [14]. The adiponectin and leptin hormones involving in regulating the glucose level and fatty acid breakdown which are reduced in obese patients. Over-production of androgen hormones through insulin resistance cause reduction of the adipose tissue hormones and increasing body fat in PCOS patients. This is how PCOS correlates with obesity [15]. Many studies are done before this to correlate PCOS with obesity. The impact of obesity on PCOS and PCOS on obesity is complicated. Despite the fact that PCOS happens in obese and lean women, a systematic review and meta-analysis was done in 2012 concluded that obesity was more prevalent in women with PCOS than in women without PCOS. A higher occurrence of PCOS was seen among the individuals who were obese [16]. A case-control study was conducted by Karabulut *et al.*, for comparing the body fat distribution in PCOS. The results of this study also showed that fat accumulation was significantly high in patients with PCOS [17]. A prospective cohort study was conducted in normal weight PCOS women by Daniel A. Dumesic *et al.*, They concluded that intra-abdominal fat deposition and subcutaneous abdominal adipose storage was increased even in normal weight PCOS due to hyperandrogenism [18].

Different parameters used for obesity are Body mass index (BMI), waist circumference (WC), waist to hip ratio (WHR) and lipid parameters. Different diagnostic modalities as Ultrasound, Dual Energy X-ray Absorptiometry, CT and MRI are also used to measure adipose tissues by adiposity indices as visceral adipose tissue (VAT) and subcutaneous adipose tissue (SAT). In our study, we prefer ultrasonography for measuring body fat thickness by adiposity parameter as compared to other diagnostic modalities which are invasive, ionizing and expensive [19]. Despite many decades since the first publication of ultrasound being used to measure adipose tissue, this technology is often ignored by clinicians and researchers. However, ultrasound is a reliable, reproducible, accurate, fast, noninvasive and non-ionizing modality to measure subcutaneous and visceral fat [20]. In our study we used only one adiposity indices i.e. subcutaneous fat at suprapubic region to describe correlation of PCOS with obesity.

METHODOLOGY

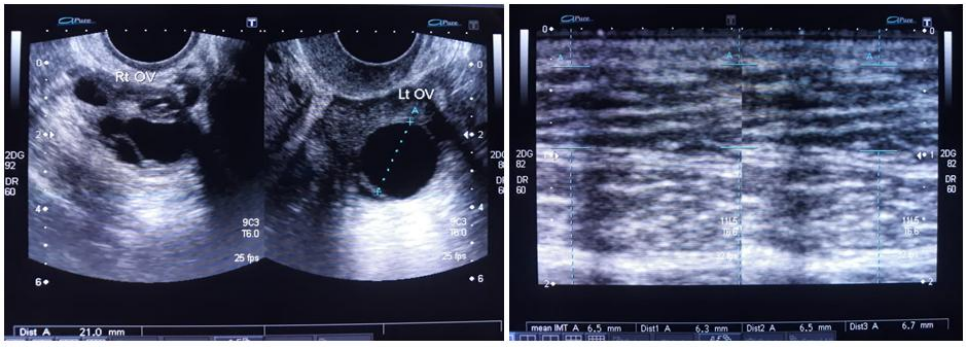
A cross sectional analytical study of three months was conducted at Gosh-e-Shifa hospital Lahore. Our sample size was 138 according to the prevalence of polycystic ovarian syndrome-10% (According to Androgen Excess and PCOS Society (AE-PCOS) [21]. A Convenient sampling technique was used. Independent T test sampling method was done on SPSS software version 21. We took 69 individuals with PCOS and 69 normal individuals at fertile age group, both married and unmarried. We considered patients with PCOS in their fertile age group who had history of menstrual irregularity, infertility, previous history of PCOS, weight gain, facial acne, hirsutism and sonographic appearance of multiple immature periphery or randomly arranged follicles 2-10mm in thickness and thick stroma in the ovaries with >10ml volume on ultrasound in fertile age group at 12th to 14th day of menses. Normal individuals from the same population and same group at 12th to 14th day of menstrual cycle were taken. We excluded all the women with any other pelvic pathologies. Toshiba Xario was used with transvaginal (5.0 - 11MHz) and transabdominal transducers (convex 2.0 – 5.0MHz and linear 5.0 - 11.0MHz). For PCOS, transvaginal transducer was used with empty bladder for married patients. Patient was laid in supine position with flexed knee and slightly outward. An elevation was used so that transducer could easily tilted downward. Transabdominal convex transducer was used for unwilling and unmarried patients with adequately filled bladder. For suprapubic subcutaneous fat, transabdominal linear transducer was used with patient lying in supine position. Three measurements were taken without graded compression at suprapubic region with inter-distance of 1cm. The mean of three measurements was taken with standard deviation.

Measurements



(A) **(B)**

Fig-1: The transvaginal ultrasound image gives the sonographic appearance of PCOS. The transabdominal ultrasound image shows the measurement of subcutaneous fat thickness at suprapubic region. (Married, age 19years)



(A) **(B)**

Fig-2: The transvaginal ultrasound image shows normal appearance of both ovaries, Left ovary shows a mature follicle of 20mm. The transabdominal ultrasound image shows subcutaneous fat thickness at suprapubic region. (Married, age 33years)

RESULTS

In this cross sectional analytical study 138 individuals were taken. 69(50%) individuals with age ranging from 14-36years were diagnosed with PCOS. The rest 69 (50%) individuals with age ranging from 14-40years were normal Table-1.

In 138 patients 69 (50%), individuals who were diagnosed with PCOS, few of them had previous history of PCOS. Total 10 patients out of 69 patients had previous history of PCOS. The Patient who were diagnosed PCOS had family history too.

The patients with PCOS had complaints of menstrual irregularity, amenorrhea, facial acne, hirsutism, weight gain and infertility (primary/secondary). We included criteria for the sonographic findings of PCOS i.e. ovarian volume, follicles sizes and follicles arrangement in both ovaries. The volume of both ovaries in patients with PCOS was >10ml. The follicles size at 12th-14th day in both ovaries was up to 10mm.Follicles arrangement was seen both periphery and mosaic pattern.

The rest 69 (50%) out of 138 patients had no previous history of PCOS, no family history, no weight gain, facial acne, and hirsutism was seen in those individuals. Both ovaries of normal individuals show normal ovarian volume up to 10ml, normal follicles arrangement and good follicles size at 12th-14th day i.e. >10mm.

Subcutaneous fat measurements were taken at suprapubic region in 138 patients. Their mean were taken with standard deviation. Suprapubic Subcutaneous fat was measured at suprapubic region of each patient with PCOS ranging from 8-32.8mm in thickness with mean value of 18.7 ± 5.3mm.

Subcutaneous fat measurement were also taken in normal individuals at suprapubic region. Fat thickness was ranging from 2.2mm-24.8 with mean value of 10.6 ± 5.2mm.

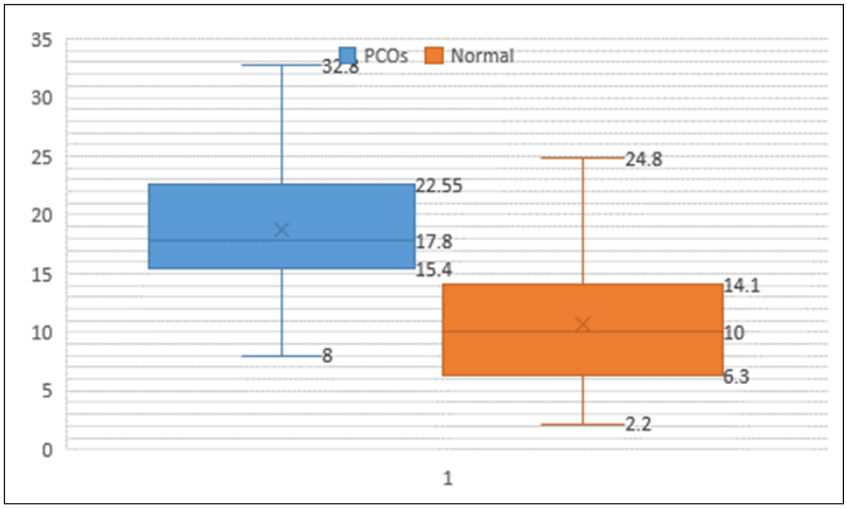
The overall results of this study were concluded that subcutaneous fat thickness was increased in patients with PCOS as compared to normal individuals as described in Table-2 and Graph-1.

Table-1: Descriptive statistics of 138 (100%) patients, 69(50%) patients were normal. And rest 69(50%) were diagnosed with PCOS

PCOS		Frequency	Percent
Valid	No	69	50.0
	Yes	69	50.0
	Total	138	100.0

Table-2: Descriptive statistics showed the mean values of suprapubic subcutaneous fat thickness with standard deviation in patient with PCOS and in patients without PCOS

Group Statistics					
	Ovary Status	N	Mean	Std. Deviation	Std. Error Mean
Subcutaneous Fat	PCOS	69	18.7580	5.35231	.64434
	Normal	69	10.6870	5.24909	.63192



Graph-1: Correlation of suprapubic subcutaneous fat with PCOS patients and normal patients described by Box and Whisker plot

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Subcutaneous Fat	Equal variances assumed	.031	.860	8.943	136	.000	8.07101	.90249	6.28628	9.85575

DISCUSSION

A significant correlation of subcutaneous fat at suprapubic region with PCOS was seen. Result showed increased fat thickness in patients with PCOS than in normal patients. Increased fat thickness in patient with PCOS showed the relation of PCOS with obesity. As obesity is one of its major consequences [13, 15]. PCOS also causes anovulation infertility in patients in their fertile age group [22]. Many studies uses both VAT (visceral adipose tissue) and SAT (subcutaneous adipose tissue) adiposity indices to measures body fat. In our study we relied only on subcutaneous fat to correlate obesity with PCOS. A case control study was conducted in 46 women with PCOS and 43 age matched controls by Karabulut *et al*., for comparing the body fat distribution in PCOS patients. Body fats are measured from four different region with other metabolic and circulatory hormones evaluation. Body fats was compared between different groups. The results of this study also showed that fat accumulation is significantly high in patient with PCOS [17]. A recent study is conducted by Debarchan *et al*., in eastern part of India for comparing the visceral adipose tissue and subcutaneous adipose tissue between patient with PCOS and healthy patients. The study demonstrated that PCOS patients had higher level of subcutaneous and visceral adipose tissues than healthy controls [15]. A systematic review is done on 106 studies with meta-analysis included 35 studies. It concluded that women with PCOS had increased prevalence and risk of overweighting, obesity and central obesity. This systematic review showed that women with PCOS had a greater prevalence of overweight and obesity, compared with women without PCOS. Clinical prevention and treatment of obesity is necessary for management of PCOS [23]. Ultrasound is reliable, non-invasive, less cost, non-ionizing modality to diagnose PCOS as well as measuring subcutaneous fat [20].

CONCLUSION

PCOS is a heterogeneous disorder affect women in their fertile age through many consequences. One of major consequence of PCOS is obesity.

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