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ORIGINAL RESEARCH

Risk Factors For Polycystic Ovarian Syndrome Among Adolescent Girls In Urban Visakhapatnam

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ABSTRACT

Introduction:Polycystic ovary syndrome (PCOS) is the most common endocrine abnormality affecting women of reproductive age, but this condition is still not completely understood. As it is linked with many chronic conditions such as cardiovascular and diabetes, there is need to identify the condition at the earliest.

Methods: A cross-sectional Community-based study was conducted in urban Visakhapatnam in November 2020 among 132 adolescent girls aged between 15 to 19 years to study the prevalence of PCOS among adolescents to identify the risk factors for polycystic ovarian syndrome. Multistage sampling was used to select the study participants from six urban zones, information collected using a PCOS validated questionnaire modified to suit locally. Diagnosis of PCOS was based on Rotterdam/ESHRE criteria examination for obesity, hirsutism, acne and acanthosis.

Results: Six percentof the study subjects were found to have possible diagnosis of PCOS. Family history of risk factors for PCOS such as maternal menstrual irregularities, diabetes and obesity was found in 12.1% of study subjects.Increased BMI was seen in 6.8% girls and 24 .1% had abnormal menstruation.

Conclusion:Family history, increased BMIand presence of clinical findings as abnormal growth of hair and acne are found to be significantly associated.

Keywords: Adolescents,Acne, Hirsutism, PCOS

INTRODUCTION

Polycystic ovary syndrome (PCOS) is the most common endocrine abnormality affecting 10% women of reproductive age and around 12% of adolescent girls (1). PCOS is a disease that often presents during adolescence.The clinical picture is characterised by signs of hyperandrogenism such as acne, excess body hair, male pattern baldness, menstrual irregularities, infertility, obesity, and metabolic alterations with implications on women's health (2)

Diagnosis of the PCOS is made mostly by clinical history, examination findings laboratory investigationsand ultrasonography. Diagnostic criteria for PCOS is based on Rotterdam Consensus 2003: two out of three required 1) clinical and /or biochemical hyperandrogenism, 2) Oligo/amenorrhea, anovulation, Polycystic ovaries appearance on ultrasound.(3)Hirsutism is defined as a score of 8 or more on the modified Ferriman-Gallway index (Ferriman and

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Gallwey, 1961). Oligo/amenorrhea cycles are defined as 8 or less cycles per year and biochemical androgen measurements should be fulfilled in follicular phase in patients with preserved menstrual cycles (4)

PCOS is heterogenous clinically and biochemically because of which it is challenging to diagnose. It has lifelong implications with increased risk for metabolic syndrome, type 2 diabetesand possibly cardiovascular disease and endometrial carcinoma. Early diagnosis in adolescence would allow for early treatment and even prevention of PCO related morbidity. (1,2).

As lab investigations and other diagnostic methods are not be feasible in the community, majority of the cases are diagnosed by a great degree of suspicion from symptoms like irregular menstruation due to anovulation, hirsutism of varied variety, acne, and associated obesity especially in adolescent girls with positive family history. Associated risk factors in overweight or obese adolescent girls are positive family history of mothers with irregular periods, obesity and diabetes. Apart from this, excessive food intake like sweets along with sedentary lifestyle habits plays an important etiological factor.

Lack of awareness about PCOS may lead to morbidity and late sequel affecting adolescent health. Therefore there is need to assess the reproductive health of adolescent girls in an urban setting.

MATERIALS AND METHODS

A cross-sectional community-based study was conducted, in urban Visakhapatnam in November 2020 among adolescent girls aged between15 to 19 years with objectives 1) To study the prevalence of PCOS among adolescent girls in urban Visakhapatnam and to identify the risk factors.

INCLUSION CRITERIA

Girls aged between 15 and 19 years, unmarried, attained menarche 2 years back and are willing to participate.

EXCLUSION CRITERIA

Girls with a history of intake of OCPs or History of intake of medication which may cause hirsutism or obesity or acne.

SAMPLE SIZE

The sample size was calculated considering the prevalence of PCOS as 9.13%. (5)with a confidence level of 95 % and the margin of error of 5% and was found to be 132. The formula used was $n=4pq/L^2$, p=9.13, q=[100-p]90.87, L – absolute precision = 5, confidence interval: 95%, margin of error : 5%. Sample size = 4 x 9.13 x 90.87 =3318/52 = 132.

SAMPLING TECHNIQUE

Multi-stage sampling technique was used. First stage: Urban Visakhapatnam has six zones of which two zones were selected randomly. In the second stage, five electoral wards were selected randomly from each of the selected zones. In the third stage, 13 adolescent girls were included from each of the selected wards until the sample size was achieved. The list of households was collected from the ward secretary of the selected ward. A house to house survey was conducted following the right-hand rule and consecutive houses were visited. Adolescent girls aged between 15-18 years were considered. If more than one adolescent girl as per eligibility were present in a single household, the elder girl was included in the study. For adolescents aged between 15-18 yrs, the accent was taken after taking permission from their parents. Adolescent girls aged above 18 yrs were enrolled after taking informed consent.

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At the time of enrolment, girls were briefed about the purpose of the study, and a participant information sheet in the local language was given.

STUDY TOOL

An interview schedule was prepared based on a validated Adolescent PCOS questionnaire (6) and modified after pretesting. Other equipment such as a flexible stadiometer, weighing machine, measuring tape were used.

VARIABLES

Socio-demographic characteristics like age, education, socioeconomic status, menstrual history, lifestyle [physical activity],eating habits, mood swings, family history of risk factors for PCOS such as maternal menstrual irregularity, diabetes or obesity, examination findingsfor abnormal growth of hair (hirsutism), acne, AcanthosisNigricans, and measurementsfor obesity- waist and hip circumference, weight, height and BMI calculation.

CLINICAL HYPERANDROGENISM

Presence ofHirsutism, Acne, Obesity and/ or Menstrual irregularities, Hirsutism is the presence of excessive terminal hair in androgen-dependent areas of the female body. Hirsutism score was assessed by a Ferryman-Gallwey score of > 8 over 9 body parts.

Diagnostic criteria for PCOS(Probable PCOS): based on Rotterdam / ESHRE criteria (3) (Rotterdam Consensus 2003) : two out of three required

1) Clinical and /or biochemical hyperandogenism2) Oligo/amenorrhea, anovulation 3)Polyscystic ovaries appearance on ultrasound

DATA COLLECTION METHOD

A house to house survey was conducted in the selected urban community taking help of local health worker and relevant information was obtained by interviewing the study participants after taking consent using a validated PCOS questionnaire. Clinical examination was done after ensuring complete privacy.

IEC APPROVAL

The study was carried out after obtaining approval from the Institutional ethics committee. [M180322001]

DATA ANALYSIS

Data analysis was done using Microsoft excel and SPSS 21.0. Categorical data are represented in percentages & proportions and continuous data in mean and SD. Chi squaretest was applied with a 95 % confidence interval and $p < 0.05$ was taken as significant.Analysis of risk factors for PCOS using Chi square test with Yates correction and Multivariate analysis using logistic regression was done.

RESULTS

A total of 132 adolescent girls were included in this study. The age group ranged from 15 years to 19 years. The mean age was found to be 17.6yrs$\pm$2.2 SD. One fourth of the girls were found in 18 years age group representing 25.8% of the total. Most of the study participants (62.5%) were from middle and upper middle socio-economic class.

Table 1: Distribution of subjects as per risk factors for PCOS

1	Age at menarche(in yrs)	Frequency(%)[n=132]
	12	34(25.8)
	13	50 (37.9)

	Variable	Probable PCOS	Total	X^2 test with Yates correction & p value
	14		37(28)	
	15 and above		11 (8.3)	
2	Menstrual irregularities		Frequency(%)[n=132]	
	Oligomenorrhea		17 (12.9)	
	Menorrhagia		15(11.4)	
	Dysmenorrhea		10(7.6)	
	Regular cycles		90(68.1)	
3.	Family h/o risk factors of PCOS			
	Menstrual irregularities		5(3.8)	
	PCOS		0	
	Obesity		6(4.5)	
	Diabetes		5(3.8)	
	No risk factors		116(87.8)	

Table 2: Distribution of subjects as per signs of Hyperandrogenism

1.	**Abnormal growth of hair**	
	Present	91(69)
	Absent	41(31)
2	FerrimannGallway score	
	<8	124(93.9)
	>8	8(6.06)
3	Acne	
	Present	14(10.6)
	Absent	118(89.39)
4	Acanthosis	
	Present	8(6.06)
	Absent	124(93.9)

Table 3:Distribution of subjects as per Risk factors:Waist hip ratio &BMI

1.	**W/H ratio**	**Frequency(%)[n=132]**
	Normal	87 (65.9)
	Abnormal	45 (34.1%)
2,	BMI	
	Normal /Thin	123 (93.2)
	Overweight	4(3.0)
	Obese	5 (3.8)

Table 4: Distribution of subjects as per Abnormal eating habits and mood swings

1.	**Abnormal eating habits**	**Frequency(%)[n=132]**
	Absent	106 (80.3)
	Present	26 (19.6)
2,	**Mood swings**	
	Present	0
	Absent	132 (100)

Table 5: Distribution of subjects as per risk factors and probable PCOS

1	Age at menarche (yrs)	Yes	No		
	< 15	2	104	106	$X^2 = 16.4$
	>15	6	20	26	P < 0.001
2	Menstrual irregularities				
	Present	6	36	42	$X^2 = 5.34$
	Absent	2	88	90	P < 0.05
3	Family H/o of risk factors of PCOS				
	Present	5	11	16	$X^2 = 20.29$
	Absent	3	113	116	P < 0.001
4	Abnormal hair				
	Present	5	21	26	$X^2 = 9.86$
	Absent	3	103	106	P < 0.001
5	Acne				
	Present	4	10	14	$X^2 = 13.93$
	Absent	4	114	118	P < 0.001
6	BMI				
	Present	6	3	9	$X^2 = 51.41$
	Absent	2	121	123	P < 0.001
7	Waist hip ratio				
	Increased	4	41	45	$X^2 = 0.35$
	Normal	4	83	87	P > 0.05
8	Mood swings				
	Present	0	0	0	
	Absent	8	124	132	
9	Abnormal eating habits				
	Present	4	22	26	$X^2 = 0.35$
	Absent	4	102	106	P > 0.05

MULTIVARIATE ANALYSIS OF RISK FACTORS

Multivariate stepwise binary Logistic Regression was performed (using IBM SPSS 25.0) to confirm the influence of selected risk factors viz., Age at Menarche, Menstrual Irregularities, Family h/o of PCOS, abnormal growth of hair, Acne, BMI and W/H ratio on the incidence of PCOS. The outcome variable was the presence of probable PCOS. Table-6 shows the findings. It is seen that only Acne and BMI were the risk factors affecting PCOS. The fitted model is however not statistically significant (Hosmer-Lemeshow test value = 0.059, p = 0.996). Hence the findings are limited to the present sample only and cannot be generalized.

Table-6: Multivariate analysis of risk factors for PCOS.

Variable	B	S.E.	Wald	df	p-val	OR	95% C.I. for OR	
							Lower	Upper
ACNE	-20.806	13312.968	0.000	1	0.999	0.000	0.000	--
BMI- Kg/sq.mt	1.053	0.561	3.521	1	0.061	2.866	0.954	8.608

DISCUSSION

PCOS is the most common endocrine condition affecting adolescent girls and is characterised by clinical findings such as abnormal growth of hair, acne and acanthosisnigricans, increased BMI and waist hip ratio. Various studies havereported risk factors such as early menarche,

irregular menstrual cycles, positive family history of PCOS ethnicity and obesity. (7). The present study was conducted among 132 adolescent girls aged 15 -19 yrs to capture the history of persistence of anovulation for 2-3 yrs following menarche as it is found to be having significant clinical correlation as far as clinical suspicion of the PCOS is concerned. In this study persistence of anovulation was not observed.

Onset of menstruation before the age of 11 years is considered as early menarche and it is one of the risk factors for the development of the future polycystic ovarian syndrome. In this study mean age of menarche was found as13.2 years similar to some studies done in urban setting (Swethabalaji et al(8), Beena Joshi et al (9) and Nitin Joseph et al(10).Family history of irregular menstruation or otherwise maternal PCOS is a risk factor for PCOS in daughters; approximately 25% of females with PCOS have H/o of their mother having PCOS, although estimates vary widely. In this study family history of menstrual irregularities was found in 16% of the families which is similar to Begum et al (11)and Shawna Christensen et al (12). In other studies (9, 13), the rates of PCOS in mothers and sisters of patients with PCOS were 24% and 32%, respectively, although the risk was higher when considering untreated premenopausal women only. In this study both age at menarche and positive family history of PCOS were found to be significantly associated with probable PCOS.

Regarding the menstrual history of the study population, oligomenorrhea and menorrhagia were found in 24.3 % of the girls which was similar to the Beena Joshi et al(9). The presence of irregular periods is a risk factor for the development of future PCOS due to unknown reasons and /or due to insulin resistance in due course of time. Most of the PCOS girls will have anovulation resulting in irregular menstruation like oligomenorrhea and secondary amenorrhea due to altered morphology of ovarian stroma.

Hirsutism is defined clinically as an abnormal amount of sexual hair that appears in a male pattern. It is commonly graded according to the Ferriman-Gallwey system, which quantitates the extent of hair growth in the most androgen-sensitive areas.Androgen excess is often associated with obesity states, at any age of life, because of changes in the pattern of secretion or metabolism of androgens and their actions at the level of target tissues, particularly the adipose tissue. In present study 8% showed abnormal growth of hair. The distribution was wide, overthe upper lip, over the cheek, lower jaw, lower legs, and dorsum of the hands,whereas a study by Nitin Joseph et al (10)reported the abnormal growth of hair among 9.8% of their study population. Various other studies have reported a higher percentage of girls manifesting abnormal growth such as 15 % and above (8,9,11,13).

Based on the presence and distribution of abnormal hair growth on the body, theFerriman-Gallweyhirsutism scoring system is developed to assess the risk of PCOS. Each of the 9 body areas that are most sensitive to androgen is assigned a score from 0 (no hair) to 4 (frankly virile), and these are summed to provide a hormonal hirsutism score. "Focal" hirsutism (score 1 to 7) is a common normal variant, whereas generalized hirsutism (score of 8 or more) is abnormal. The normal score is lower in Asian populations and higher in Mediterranean populations.This study showed Ferriman-GallwayorHirsutism score of more than 8 in 6.1% of girls.A much higher percentage (16%) was found in Begum et al study

Excessive acne vulgaris is an important cutaneous manifestation of hyperandrogenemia in adolescents (21)The degree of acne should be evaluated in the context of the patient's gynaecological age. The possibility of hyperandrogenism is suggested by moderate or severe inflammatory acne (>10 lesions in any area, eg, face, chest, back through the peri-menarchealyears) or acne that is persistent and poorly responsive to topical or oral antibiotic dermatologic therapy. In this study, Acne was found in 10.6 % of girls and was significantly associated with probable PCOS, whereas studies by Beena Joshi et al, Begum et al and Nitin Joseph et al showed it as 11.5%, 12%, and 14% respectively.

Acanthosisnigricans is a velvety thickening of the epidermis that primarily affects the axillae, posterior neck fold, flexor skin surfaces, and umbilicus, and infrequently is diffuse with the involvement of the mucosal surfaces. It is increasingly seen in children and adolescents who are obese and can serve as a cutaneous marker of insulin resistance and malignancy. In our study, the presence of Acanthosisnigricanswas reported by 6 % of the study participants.
The BMI of study participants was calculated and further categorized into normal (BMI 18.6 -24.9 kg/m2), overweight (BMI 25-29.9 kg/m2), and obese (BMI 30- 40 kg/m2) following WHO criteria. This study showed 6.8% of girls were in the overweight and obese category whereas a much higher percentage of girls were found to be overweight and obese categories as reported by other studies.(9,10, 11, 13). BMI was found to be significantly associated with presence of PCOS in the present study.
Although the pathogenesis of PCO syndrome is unknown, it is believed that PCOS is the result of different interactions between genetic and multiple environmental factors. This syndrome is a multi-factorial disease, and the susceptibility of patients is probably determined by several genetic and environmental risk factors as told above (4,13).In the present study, regression analysis shows that only Acne and BMI were the risk factors affecting PCOS.

CONCLUSION

The study concluded that the factors such as family history, increased BMI, presence of clinical findings as abnormal growth of hair and acne are significantly associated with probable diagnosis of PCOS. Awareness creation in general population regarding this disease and associated complication is required which should be followed with proper counseling regarding importance of early diagnosis so that early life style modifications are inculcated and metabolic and reproductive complications of this disease are prevented. Lifestyle modifications for weight reduction and dietary modifications and psychological counseling plays important role in these young girls for preventing long term future complications.

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