Original Research Article

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20210812

An observational study on prevalence and determinants of PCOS in women presenting with acne vulgaris to a tertiary care hospital in North India

Mini Chandra¹, Palak Garg², Koshinder Vats¹, Abhishek O. Tibrewal³*

Received: 04 December 2020 **Accepted:** 03 February 2021

*Correspondence:

Dr. Abhishek O. Tibrewal,

E-mail: dr.abhishek08@hotmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Acne vulgaris is an inflammatory disease of pilosebaceous gland that usually affects people from puberty to young adulthood. Apart from being a dermatological condition, acne is now recognised to be related to a plethora of systemic disorders, notably endocrinal abnormalities, like Polycystic Ovarian Syndrome (PCOS). We conducted this study with the aim of finding the prevalence and determinants of PCOS among patients presenting with acne vulgaris.

Methods: In this prospective observational study, 100 women were selected who presented with acne, to the outpatient dermatology department of our hospital. The study subjects were 14 to 36 years old, non-pregnant females, who agreed to be a part of the study. PCOS was diagnosed using Rotterdam criteria. Statistical software (SPSS version 22) was used for the statistical analyses.

Results: Out of the 100 study subjects, 81 (81%) had PCOS and 19 (19%) did not. The subjects who had PCOS were older (Median of 22 years vs 20 years), higher FSH levels (Median of 5.8 vs 3.2), higher LH/FSH ratio (Median of 0.7 vs 0.6), and higher DHEA levels (Median of 285.5 vs 160.3), though these differences were not statistically significant. The PCOS group was more likely to be suffering from irregular menses (OR, 1.51; 95% CI: 0.5-4.5, p value 0.46), weight gain (OR, 1.02; 95% CI: 0.37-2.7, p value 0.97), and hirsutism (OR, 1.17; 95% CI: 0.43 - 3.24), as compared to the non-PCOS group. However, PCOS was not significantly associated with age, duration of acne, fasting blood sugar levels, HOMA-IR, or levels of hormones like FSH, LH, Testosterone, DHEA, and Insulin.

Conclusions: The study concludes a high prevalence of PCOS among acne patients. All women with acne should be considered for underlying PCOS and asked about their menstrual patterns and examined for other sign of hyperandrogenism.

Keywords: Acne vulgaris, Endocrinal disorder, Observational study, PCOS

INTRODUCTION

Acne vulgaris is an inflammatory disease of pilosebaceous gland that usually affects people from puberty to young adulthood. As per Global Burden of

Disease Study 2010, acne vulgaris is the 8th most common skin disease, and is accounted to affect 80% individuals in the age group of 11-30 years. The severity of skin involvement varies from minimal involvement to disfiguring and highly inflammatory presentations, along

¹Department of Dermatology, Venerology and Leprology, Muzaffarnagar Medical College, Uttar Pradesh, India

²Department of Dermatology, Venerology and Leprology, National Institute of Medical Sciences and Research, Jaipur, Rajasthan, India

³Epidemiologist and Biostatistician, Independent Consultant, Gurugram, India

with common complications such as hyperpigmentation, scarring, and negative psychosocial effects.² Apart from being a dermatological condition, acne is now recognised to be related to a plethora of systemic disorders, notably endocrinal abnormalities, like Polycystic Ovarian Syndrome (PCOS).³⁻⁵

PCOS is a common endocrine disorder among women who are of reproductive age. The pathogenesis involves several associated hormonal pathways that culminate in metabolic, reproductive and cardiovascular effects. The hallmark features of PCOS are hyperandrogenism and hyperinsulinemia, which have systemic long term implications.⁶ High level of androgens not only enlarge the sebaceous glands and increase sebum production, but also cause abnormal desquamation of follicular epithelial cells, and this in combination with the colonization of the follicle by Propionibacterium acnes, result inflammation and progressive development of papules, pustules, nodules, cysts and scars (characteristics of acne vulgaris).7 PCOS is one of the commonly reported systemic endocrine disorder associated with acne.8 However, the number of studies done on this subject among Indian population is scarce. Hence, we conducted this study with the aim of finding the prevalence and determinants of PCOS among patients presenting with acne vulgaris.

METHODS

The present study was a prospective observational study conducted among 100 patients of acne vulgaris, who presented to the out-patient department of the dermatology and venerology department of our hospital. The study duration was 14 months, starting from December 2018 till January 2020. The inclusion criteria were study subjects aged 14 to 36 years old, non-pregnant females, who agreed to be a part of the study. The exclusion criteria were patients who were smokers, pregnant or lactating, taking hormonal therapy like hormonal contraceptive and antiandrogen therapy, and suffering from any chronic disease, like hypertension, diabetes mellitus, vascular disorder, and systemic inflammatory disorder, were excluded from the study.

The operational terms and definitions were as follows: Acne: a chronic inflammatory disease of pilosebaceous follicles characterized by comedone, papules, pustules, nodules and often scars. Acne vulgaris was graded based on the severity of acne vulgaris using grading based on clinical examination, lesion counting, and those that require instruments such as photography, fluorescent photography, polarized light photography, video microscopy and measurement of sebum production. The two commonly used measures are grading and lesion counting. Acne vulgaris was graded by Indian authors, using a simple grading system, which classifies acne vulgaris into four grades. Menstrual history and irregularity — we enquired about the cycle lengths, irregularities, duration of bleeding, number of sanitary

pads used in each cycle, and presence of cramps. Menstrual irregularities were defined as Fewer than 9 periods a year or periods longer than 40 days apart. Hormonal essays—The serum concentration of hormones like testosterone, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) were estimated with the help of radioimmunoassay. PCOS was diagnosed using the ESHRE/ ASRM (Rotterdam), 2003 diagnostic criteria. 12,13

According to these criteria, PCOS is confirmed if two of the following conditions are present, in addition to exclusion of related disorders: a) Oligo- or anovulation, Clinical and/or biochemical signs hyperandrogenism, c) Polycystic ovaries. Polycystic ovaries were diagnosed using pelvic ultrasonogram (USG), using either a 3.5 MHz transabdominal (full bladder technique) or a 5 MHz transvaginal probe. Polycystic ovary diagnosis was based upon the presence of multiple small subcapsular cysts (diameter 2-8 mm) with dense echogenic stroma. Polycystic ovary was not diagnosed in cases with multiple small cysts scattered throughout the ovary without dense echogenic cores.

The study was prior approved by the ethical committee of the hospital. All the study subjects were explained in detail about the study in the language of their understanding and their informed consent was taken in writing. Confidentiality of the patients was maintained throughout the study.

All the variables were recorded in Microsoft excel. Statistical software (SPSS version 22) was used for the statistical analyses. All the variables were tested for normality using Kolmogorov-Smirnov test. The categorical variables were summarized as frequencies and percentages, while continuous variables as medians and interquartile range (IQR; 25th to 75th percentiles), since most of the variables were observed to be non-normally distributed. The association of variables with the outcome (PCOD) was assessed using the chi-square statistic or Fischer exact test for categorical variables and Mann-Whitney U test for the continuous variables. The association of different categorical variables with the outcome was assessed using an odds ratio with a 95% Confidence Interval (CI). The correlation of different continuous variables was assessed using Spearman's correlation test. All tests were 2-sided and p<0.05 was considered statistically significant.

RESULTS

All the study subjects (n=100) were females who presented with acne vulgaris. Out of them, 81 (81%) had PCOS and 19 (19%) did not. The subjects who had PCOS were older (Median of 22 years vs 20 years), higher FSH levels (Median of 5.8 vs 3.2), higher LH/FSH ratio (Median of 0.7 vs 0.6), and higher DHEA levels (Median of 285.5 vs 160.3), though these differences were not statistically significant. The details of other variables

have been given in Table 1. The association of various categorical variables with PCOS among acne vulgaris patients has been depicted in Table 2. The most common sites of acne in both the groups were cheeks and chin (38.3% in PCOS group and 52.6% in non-PCOS group, p=0.34). The PCOS group had 22 (27.2%) subjects suffering from severe acne, 35 (43.2%) from moderate acne, and 24 (29.6%) from mild acne. The non-PCOS group had 2 (10.5%), 12 (63.2%) and 5 (26.3%) subjects suffering from severe, moderate and mild acne, respectively. The PCOS group was 1.5 times more likely to be suffering from irregular menses as compared to the

non-PCOS group (OR, 1.51; 95% CI: 0.5-4.5, p value-0.46). The weight gain was almost identical in the two groups as 53.1% and 52.6% subjects reported weight gain in the PCOS and non-PCOS groups, respectively (OR, 1.02; 95% CI: 0.37-2.7, p value-0.97). Hirsutism was more commonly seen among patients with PCOS (50, 61.7%) as compared to patients without PCOS (11, 57.9%), but the difference is not statistically significant (p value=0.76). Hair fall and seborrhoea were also more common among patients with PCOD, though the difference wasn't statistically significant (p value, 0.68 and 0.88, respectively).

Table 1: Association of different continuous variables with PCOS among acne vulgaris patients (n=100).

	PCOD	Daniles.		
Variables	Yes (n=81)	No (n=19)	P value	
	Median (IQR)	Median (IQR)		
Age (years)	22 (19-23)	20 (18-30)	0.979	
Duration of acne (years)	8 (7-9)	9 (7-10)	0.535	
FSH	5.8 (3-6.8)	3.2 (2.1-6.3)	0.241	
LH	3.1 (1.7-5.2)	3.1 (1-3.2)	0.306	
LH/FSH ratio	0.7 (0.5-1)	0.6 (0.5-1)	0.738	
DHEA	285.5 (117.2-459.7)	160.3 (116.8-379.3)	0.332	
Testosterone	53.3 (37.7-70)	55.9 (31.6-62.3)	0.302	
Insulin	10.5 (8.4-18.5)	13.5 (10.3-21.7)	0.106	
Fasting blood sugar	82 (73.2-90)	83 (72-96)	0.867	
HOMA-IR	2 (1.7-3.9)	2.6 (1.9-4.7)	0.231	

FSH: follicle stimulating hormone; LH: luteinizing hormone; DHEA: dehydro-epiandrosterone; HOMA-IR: Homeostatic Model Assessment of Insulin Resistance; IQR: Interquartile range; PCOD: polycystic ovarian syndrome / disease

Table 2: Association of different categorical variables with PCOS among acne vulgaris patients (n=100)

Variables		PCOS		P value	Odds ratio	
		Yes (%) (n=81)	No (%) (n=19)	r value	Odus ratio	
	Cheeks	20 (24.7)	6 (31.6)	_		
	Chin	13 (16)	0 (0)		NA	
	Full face	8 (9.9)	0 (0)	_		
Acne site	Cheeks, chin	31 (38.3)	10 (52.6)	0.34		
	Cheeks, forehead	6 (7.4)	2 (10.5)	_		
	Chin, forehead	1 (1.2)	0 (0)			
	Cheek, forehead, chin	2 (2.5)	1 (5.3)			
Acne severity	Mild	24 (29.6)	5 (26.3)			
	Moderate	35 (43.2)	12 (63.2)	0.21	NA	
	Severe	22 (27.2)	2 (10.5)			
Menstrual history	Irregular	62 (76.5)	13 (68.4)	0.46	1.51 (0.5-4.5)	
	Regular	19 (23.5)	6 (31.6)	0.40	Reference	
Weight gain	Yes	43 (53.1)	10 (52.6)	0.97	1.02 (0.37-2.77)	
	No	38 (46.9)	9 (47.4)	0.97	Reference	
Hirsutism	Yes	50 (61.7)	11 (57.9)	0.76	1.17 (0.43-3.24)	
	No	31 (38.3)	8 (42.1)	0.76	Reference	
Hair fall	Yes	51 (63)	11 (57.9)	0.69	1.24 (0.45-3.42)	
	No	30 (37)	8 (42.1)	0.68	Reference	
Seborrhoea	Yes	61 (75.3)	14 (73.7)	0.88	1.09 (0.35-3.4)	
	No	20 (24.7)	5 (26.3)	0.88	Reference	
Acanthosis	Yes	22 (27.2)	6 (31.6)	0.7	0.81 (0.27-2.39)	
nigricans	No	59 (72.8)	13 (68.4)	0.7	Reference	

PCOD: polycystic ovarian syndrome / disease; NA: Not applicable; CI: Confidence Interval

Table 3: Correlation of different variables among acne vulgaris patients with PCOS (n=81).

Variables		FSH	LH	LH/FSH ratio	DHEA	Testo-sterone	Insulin	HOMA-IR
FSH	ρ	1	0.744	-0.03	0.235	0.239	-0.263	-0.259
	p		< 0.001	0.793	0.035	0.031	0.018	0.02
LH	ρ	0.744	1	0.560	0.198	0.05	-0.271	-0.283
	p	< 0.001		< 0.001	0.077	0.655	0.014	0.01
LH/FSH ratio	ρ	-0	0.560	1	0.109	-0.135	-0.089	-0.095
	p	0.79	< 0.001		0.333	0.229	0.431	0.399
DHEA	ρ	0.235	0.198	0.109	1	0.299	-0.18	-0.18
	p	0.04	0.077	0.333		0.007	0.107	0.108
Testo-sterone	ρ	0.239	0.05	-0.135	0.299	1	-0.029	-0.031
	p	0.03	0.655	0.229	0.007		0.799	0.786
Insulin	ρ	-0.263	-0.271	-0.089	-0.18	-0.029	1	0.870
	p	0.02	0.014	0.431	0.107	0.799		< 0.001
Fasting blood sugar	ρ	0.11	0.091	0.038	0.053	-0.054	-0.233*	0.203
	p	0.31	0.417	0.737	0.639	0.631	0.037	0.069
HOMA-IR	ρ	-0.259	-0.283	-0.095	-0.18	-0.031	0.870	1
	p	0.02	0.01	0.399	0.108	0.786	< 0.001	

ρ: Spearman's correlation coefficient; Bold are significant values (p<0.05); FSH: follicle stimulating hormone; LH: luteinizing hormone; DHEA: dehydro-epiandrosterone; HOMA-IR: Homeostatic Model Assessment of Insulin Resistance.

The only condition that was more common in patients without PCOS (6, 31.6%) as compared to patients with PCOS (22, 27.2%) was acanthosis nigricans (p value=0.7). The correlation of different variables among acne vulgaris patients with PCOS has been reported in Table 3.FSH levels were significantly correlated with duration of PCOS (r=-0.24, p=0.03), LH levels (r=0.74, p<0.001), DHEA levels (r=0.23, p=0.03), testosterone levels (r=0.24, p=0.03), Insulin level (r= -0.26, p=0.02), and HOMAIR (r=-0.26, p=0.02). LH levels were significantly correlated with FSH level (r=0.74, p<0.001), LH/FSH ratio (r=0.56, p<0.001), Insulin level (r= -0.27, p=0.01), and HOMAIR (r= -0.28, p=0.01). LH/FSH ratio had a significant correlation with only LH levels (r=0.56, p<0.001). DHEA levels were significantly correlated with age (r= -0.25, p=0.04), FSH level (r=0.23, p=0.04), and testosterone level (r=0.29, p=0.007). Testosterone levels were significantly associated with FSH level (r=0.24, p=0.03) and DHEA level (r=0.29, p=0.007). Significant correlation of insulin level was seen with FSH level (r=-0.26, p=0.02), LH level (r=-0.27, p=0.014), and HOMAIR (r=0.87, p<0.001). Fasting blood sugar was seen to be significantly correlated with Insulin level (r=-0.23, p=0.037). HOMAIR was significantly correlated with FSH level (r=-0.26, p=0.02), LH level (r=-0.28, p=0.01), and Insulin level (r=0.087, p<0.001).

DISCUSSION

Vulgaris is an inflammatory disease of pilosebaceous gland that usually affects people from puberty to young adulthood. The lesions are located predominantly on the face, neck, chest and back, places with more follicles. 14 The main pathogenic factors of acne are high sebaceous gland secretion, follicular hyperproliferation, high androgen effects, Propionibacterium acnes colonization and inflammation.¹⁵ The most common cause of hyperandrogenism among women is PCOS. The present study was done to determine the prevalence and determinants of PCOS among women presenting with acne.

The present study includes 100 women from 19 to 30 years of age. Other studies have reported women of similar age reporting with acne and PCOS. ^{16,17} It has been reported that prevalence of polycystic ovaries is more common among women younger than 35 years. ¹⁸

Majority of women in the present study had moderate severity of acne (47%), irregular menses (75%), hirsutism (61%), hair fall (62%) and seborrhoea (75%). Another study done by Begum et al also reported higher prevalence of irregular menses and hirsutism among patients of acne. 16 Another study reported the similar prevalence of hirsutism as reported in our study (54%).¹⁸ Women suffering from a plethora of complaints are more likely to visit hospital and thus such a high proportion of women from our study have symptoms hyperandrogenism.

In the present study, 81% women had PCOS. The prevalence of PCOS among women with acne vary widely in the literature. The reported prevalence of PCOS among acne patients in other studies is 26.9%, 28.8%, 30.0%, 48.3%, 51.2%, 52.2%, and 70%. 8.18-23 The high proportion of women suffering from PCOS in the present study might be due to the difference in the ethnic background of subjects and diagnostic criteria used.

The women who had PCOS in the current study, were older (Median of 22 years vs 20 years), higher FSH levels (Median of 5.8 vs 3.2), higher LH/FSH ratio (Median of 0.7 vs 0.6), and higher DHEA levels (Median of 285.5 Vs

160.3), though these differences were not statistically significant. In the present study, PCOS was not significantly associated with age, duration of acne, fasting blood sugar levels, HOMA-IR, or levels of hormones like FSH, LH, Testosterone, DHEA, and Insulin. Another study has reported no statistically significant relation between PCOS and hormone levels. ¹⁶ The limitations of the hormone assays are due to differences and variation in the assay techniques. Even in typical PCOS cases, the LH to FSH ratio might not be higher than usual. ²⁴

We also noted that PCOS was not significantly associated with severity of acne, irregularity of menses, weight gain, hirsutism, hair fall, seborrhea, or acanthosis nigricans. Raja et al have also reported that in their study, PCOS was not significantly associated with age or menstrual irregularity, but hirsutism was seen to be significantly associated with PCOS.⁸ Other studies have also mentioned hirsutism as a significant association with PCOS among acne patients.^{25,26} The substantial heterogeneity of results of women of the current study as compared to other studies might not just be due to the different kind materials and methods used, but can also be attributed to the varied ethnic background and age groups of the women.²⁷

The presence of markers of hyperandrogenism among acne patients should raise a strong suspicion of PCOS. Such patients should be diagnosed timely and should be treated comprehensively. Often such patients have other underlying hormonal abnormalities that can hamper health and productivity. Hormonal profile determination as well as pelvic ultrasonography for ovarian visualization should be performed to confirm the diagnosis of PCOS in female acne patients who have menstrual disturbances.

The small sample size of the present study is a limitation. Apart from that it is a hospital-based study, thus only serious patients would be visiting the hospital and milder cases of acne would have been ignored. Thus, a strong selection bias could have occurred in the study. In addition, PCOS is associated with several other dermatological conditions like presence of facial hair and thus these patients are more likely to visit hospital as compared to non- PCOS patients and thus the prevalence of PCOS might have been over estimated.

CONCLUSION

The study concludes a high prevalence of PCOS among acne patients. All women with acne should be considered for underlying PCOS and asked about their menstrual patterns and examined for other sign of hyperandrogenism.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- 1. Lyon CC. Acne: Diagnosis and Management. JR Soc Med. 2001;94(12):652.
- Sutaria AH, Masood S, Schlessinger J. Acne Vulgaris. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2020 January. Available at https://www.ncbi.nlm.nih.gov/books/NBK459173/ Accessed on 12 September.
- 3. Zouboulis CC. Acne as a chronic systemic disease. Clin Dermatol. 2014;32(3):389-96.
- 4. Ozdemir S, Ozdemir M, Gorkemli H, Kiyici A, Bodur S. Specific dermatologic features of the polycystic ovary syndrome and its association with biochemical markers of the metabolic syndrome and hyperandrogenism. Acta Obstet Gynecol Scand. 2010;89(2):199-204.
- 5. Alan S, Cenesizoglu E. Effects of hyperandrogenism and high body mass index on acne severity in women. Saudi Med J. 2014:35(8):886-9.
- 6. O'Connell K. Pharmacology of hormonal contraceptives and acne. Cutis. 2008;81:8-12.
- 7. Chen W, Thiboutot D, Zouboulis CC. Cutaneous androgen metabolism: basic research and clinical perspectives. J Invest Dermatol. 2002;119(5):992-1007.
- 8. Raja SA, Prasad PVS, Kaviarasan PK. Prevalence and pattern of PCOS in women presenting with acne, a hospital based prospective observational study. Int J Res Med Sci. 2018;6:899-903.
- 9. Zaenglien AL, Graber EM, Thiboutet DM, Strauss JS. In: Wolff K, Goldsmith LA, Katz SI et al., editors. Fitzpatrck's Dermatology in General Medicine. 7 th ed. USA: McGraw Hill; 2008. Chapter 80: Acne vulgaris and acne form eruptions. 690-730.
- 10. Jacob R. Prevalence of acne among women with polycystic ovarian syndrome-a clinical study.SIRJ-HMS. 2014;1(1):7-11.
- 11. James WD, Berger TG, Elston DM, editors. Andrew's Disease of the Skin. 10th ed. Philadelphia: Saunders Company; 2006.
- 12. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. Fertil Steril. 2004;81:19-25.
- 13. Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). Hum Reprod. 2004;19:41-7.
- 14. Batista, FAS, Paula A. Types of Acne and associated therapy. Am Research J. 2006;15:257–66.
- 15. Emiroğlu N, Cengiz FP, Kemeriz F. Insulin resistance in severe acne vulgaris. Postepy Dermatol Alergol. 2015;32(4):281-5.

- 16. Begum S, Hossain MZ, Rahman MF, Banu LA. Polycystic ovarian syndrome in women with acne. J Pak Association Dermatol. 2012;22(1):24-9.
- 17. Fraser IS, Kovacs G. Current recommendations for the diagnostic evaluation and follow-up of patients presenting with symptomatic polycystic ovary syndrome. Best Pract Res Clin Obstet Gynaecol. 2004;18:813-23.
- 18. Zandi S, Farajzadeh S, Safari H. Prevalence of polycystic ovary syndrome in women with acne: hormone profiles and clinical findings. J Am Acad Dermatol. 2016;20(4):194-8.
- 19. Kelekci KH, Kelekci S, Incki K, Ozdemir O, Yilmaz B. Ovarian morphology and prevalence of polycystic ovary syndrome in reproductive aged women with or without mild acne. Int J Dermatol. 2010;49(7):775-9.
- 20. Abdullah Z, Masood Q, Hassan I, Kirmani O. Hormonal profile and polycystic ovaries in women with acne vulgaris. Ind J Dermatol Venereol Leprol. 2013;79(3):422-4.
- 21. Maluki AH. The frequency of polycystic ovary syndrome in females with resistant acne vulgaris. J Cosmet Dermatol. 2010;9(2):142-8.
- 22. Betti R, Bencini PL, Lodi A, Urbani CE, Chiarelli G, Crosti C. Incidence of polycystic ovaries in patients with late-onset or persistent acne: hormonal reports. Dermatologica. 1990;181(2):109-11.

- 23. Tehrani M, Parvizi M, Moghadam AS, Heshmat R, Khas SNZ, Golchin M. The prevalence of polycystic ovary syndrome in Iranian women with gestational diabetes: a pilot study. Iranian J Diab Lipid Disorders. 2009:57-64.
- 24. Timpatanapong P, Rojanasakul A. Hormonal profiles and prevalence of polycystic ovary syndrome in women with acne. J Dermatol. 1997;24:223-9.
- 25. Falsetti L, Gambera A, Andrico S, Sartori E. Acne and hirsutism in polycystic ovary syndrome: clinical, endocrine-metabolic and ultrasonographic differences. Gynecol Endocrinol. 2002;16(4):275-84.
- 26. Lee AT, Zane LT. Dermatologic manifestations of polycystic ovary syndrome. Am J Clin Dermatol. 2007;8(4):201-19.
- 27. Yu NE, Ho PC. Polycystic ovary syndrome in Asian women. Semin Reprod Med. 2008;26:14-21.

Cite this article as: Chandra M, Garg P, Vats K, Tibrewal A. An observational study on prevalence and determinants of PCOS in women presenting with acne vulgaris to a tertiary care hospital in North India. Int J Community Med Public Health 2021;8:1270-5.