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A STUDY TO EVALUATE THE HEARING THRESHOLD IN PATIENTS WITH POLYCYSTIC OVARIAN SYNDROME

ENT

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ABSTRACT

Aim: To evaluate the hearing threshold in patients diagnosed with PCOS, **Methodology:** A cross - sectional study to evaluate hearing threshold was conducted on 30 patients within the age group of 18-35 years who were diagnosed with PCOS, meeting inclusion and exclusion criteria and who were willing to give written informed consent for the study were considered. Thorough history and otological examination was done and these patients were subjected to pure tone audiometry with and without masking for hearing evaluation. They were compared with 30 normal individuals who underwent similar evaluation to compare their audiology profile. **Results:** Higher frequency hearing loss specifically at was significantly more prevalent in 53.3% of PCOS cases when compared to the normal patients. **Conclusion:** The study concluded that higher frequencies (2000 Hz – 8000 Hz), specifically at 4000 Hz and 8000 Hz were more sensitive to the effects of insulin resistance, hyperandrogenism and chronic inflammation which contributed to the pathology of PCOS and those patients diagnosed with PCOS should be advised periodical audiological evaluation.

KEYWORDS

PCOS, Hyperandrogenism, Sensorineural hearing loss, Insulin Resistance

INTRODUCTION:

PCOS is a prevailing endocrine condition that affects 5–20% of women of reproductive age. It is distinguished by polycystic ovaries, hyperandrogenism, and ovulatory dysfunction.[1] PCOS is a chronic condition beginning most commonly in adolescence.

The pathophysiological mechanisms underlying the association between PCOS and hearing loss are not fully understood, but theories include the role of insulin resistance, hyperandrogenism, and chronic low-grade inflammation.[3]

Recent studies suggest a potential link between PCOS and sensorineural hearing loss, especially in the high-frequency range.[2] This study aims to evaluate hearing loss in patients diagnosed with PCOS and compare their audiological profile with healthy controls to better understand the relationship between PCOS and auditory function.

OBJECTIVES:

1. To evaluate the hearing threshold in patients diagnosed with polycystic ovary syndrome (PCOS) compared to healthy controls using pure tone audiometry.

MATERIALS AND METHODS:

With our institutional scientific and ethics board approval, a cross-sectional study was carried out on 30 patients of age group 18 – 35 years, for a duration of 6 months from February 2024 to August 2024, who were willing to give written informed consent and were clinically confirmed cases of Polycystic Ovarian Syndrome (PCOS), referred to ENT OPD at KVG Medical College and Hospital, Sullia, Dakshina Kannada, Karnataka. The clinical findings of the PCOS patients were compared to 30 normal patients of the same age group.

Sample size calculation:

Based on the ENT OPD records of our hospital, the proportion of cases with PCOS in OBG Department, KVG MCH, Sullia, referred to Ent Department, accounted for 2% over the last 2 years. Using this as 'p', sample size was calculated using the formula, $\frac{z^2pq(1-p)}{d^2}$, where z = 1.96, p=2, q=(1-p) = 100-2 = 98, d (allowable error) =5, $\frac{1.96^2 \times 2 \times 98}{5^2} = \frac{3.30 \times 2 \times 98}{25} = 30$ i.e. 30 PCOS patients and 30 normal individuals.

Inclusion criteria:

- Patients of age range 18-35 years.
- Patients who were diagnosed with PCOS in the department of OBG following criteria for PCOS as per Rotterdam criteria: menstrual irregularities, features of hyperandrogenism, and/or polycystic ovaries on ultrasound.
- Patients who were willing to undergo USG and Pure tone audiometry.
- Patients who were willing to give informed consent.

Exclusion criteria:

- Patients who were not willing to undergo USG.
- PCOS and controls taking medications for at least 3 months prior to study, such as oral contraceptives, glucocorticoids, ovulation induction agents, antidiabetic, antiobesity, oestrogenic, antiandrogenic, antihypertensive, and ototoxic drugs.
- Patients with previous otologic issues such as tympanic membrane perforation, chronic otorrhea, chronic tinnitus, otosclerosis, or neurologic diseases.
- Women having medical histories that might have impacted their ability to hear were excluded from this study.
- Patients displaying a family history of cardiovascular disease, hypertension, chronic liver disease, endocrinopathies, such as diabetes, Cushing's syndrome, androgen-secreting tumours, non-classical 21-hydroxylase deficiency, thyroid dysfunction, hyperprolactinemia, smoking, alcohol use, and use of any medications that are known to affect the secretion or action of insulin or sex hormones.
- Patients who have undergone otologic surgery and those who wear hearing aids

Detailed history of the patient was taken with respect to age, gender, presenting complaints with duration, associated complaints, past history, family history and personal history and detailed clinical examination was done where all participants underwent a physical examination to assess for clinical signs of PCOS, including hirsutism, acne, acanthosis nigricans and alopecia and Random blood sugar levels. Patients referred to ENT Department further underwent a thorough otological examination and were subjected to pure tone audiometry with and without masking for hearing evaluation. They were compared with 30 normal individuals who underwent similar evaluation to compare their audiological profile. Data was analyzed using statistical methods, results presented, and chi-square test was used for categorical variables ($p < 0.05$ considered significant).

RESULTS:

Table 1: Participant Demographics and Baseline Characteristics

Characteristics	PCOS Group (n=30)	Control Group (n=30)	p-value
Age (years)	27.5 ± 4.8	26.9 ± 5.1	0.64
Hirsutism (%)	60.0%	13.3%	<0.001
Acne (%)	53.3%	20.0%	0.007
Acanthosis nigricans (%)	30.0%	6.7%	0.02
Alopecia (%)	26.7%	3.3%	0.01

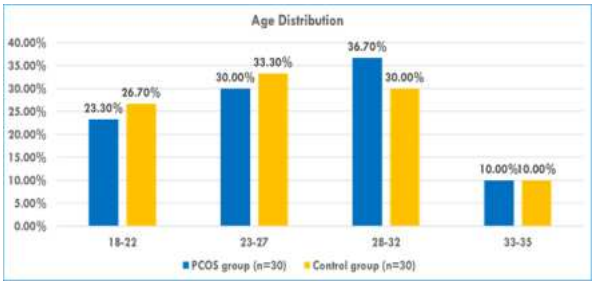


Figure 1: Age distribution of study population

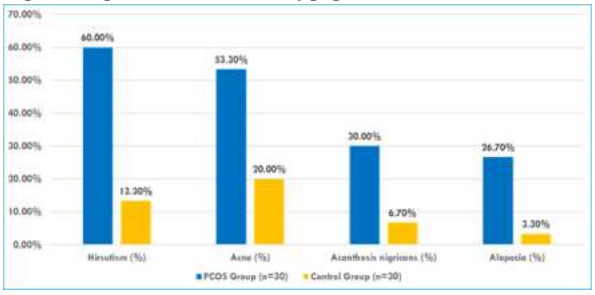


Figure 2: Percentage of Baseline characteristics

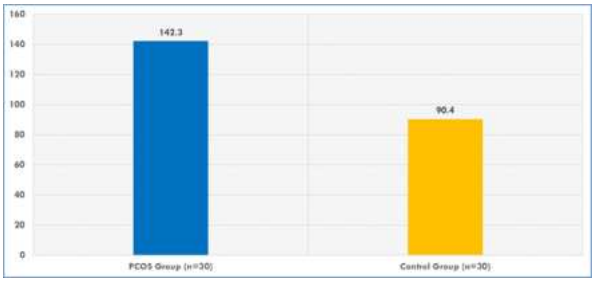


Figure 3: Average of the Random blood sugar levels

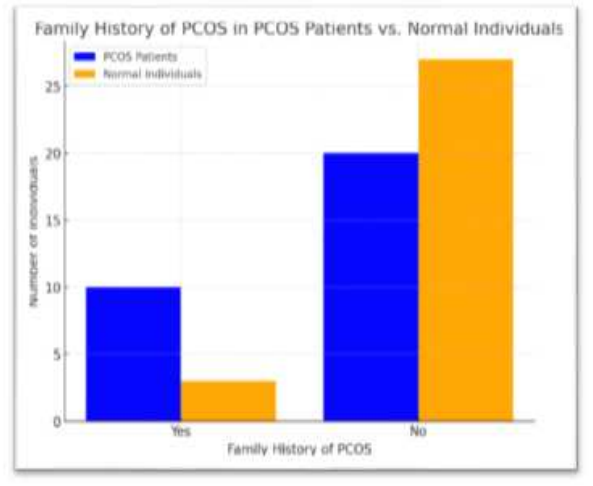


Figure 4: Depiction of family history of PCOS in PCOS and Normal groups

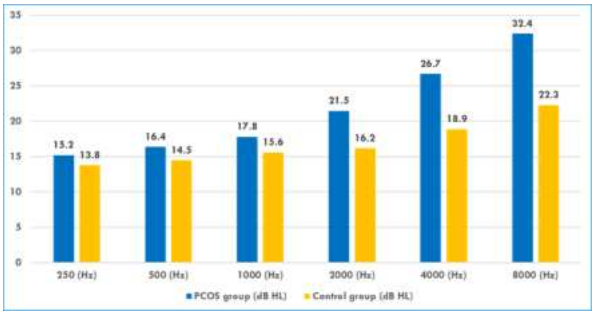
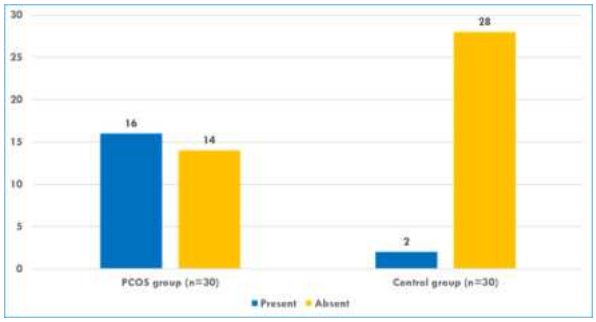


Figure 5: Depiction of hearing threshold at various frequencies in PCOS and control groups

Table 2: Depicts the p value of hearing threshold of each frequency

Frequency (Hz)	p-value
250 (Hz)	0.31
500 (Hz)	0.2
1000 (Hz)	0.18
2000 (Hz)	0.004
4000 (Hz)	<0.001
8000 (Hz)	<0.001



Odds ratio (95% CI)	p-value
32.73 (4.00-268.04)	<0.001

Figure 6: Association between PCOS and hearing loss

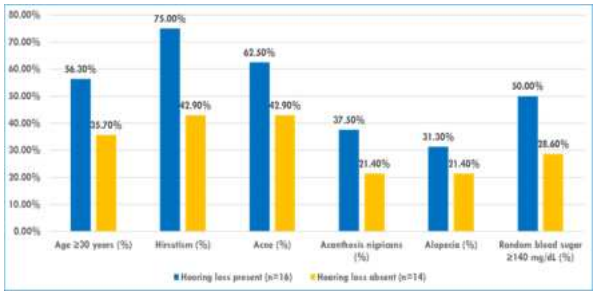


Figure 7: Subgroup analysis

DISCUSSION:

Polycystic ovary syndrome (PCOS) is a heterogeneous endocrine disorder, affecting 7% of reproductive age women [9]. It causes anovulation and infertility in women of reproductive age and many other health risks are associated with it.[10]

Insulin resistance, hyperinsulinemia, and chronic low-grade inflammation associated with PCOS may contribute to cochlear dysfunction and subsequent hearing loss.[3] In women with PCOS, basal insulin secretion rates are increased, although insulin secretory responses to a glucose load are generally inadequate.[4] Women with PCOS also demonstrate decreased hepatic extraction of insulin, which contributes to their hyperinsulinaemia leading to endothelial damage.[5]

In PCOS, increased ovarian androgen production results from enhanced androgen synthesis by follicular theca cells, which exhibit higher expression of steroidogenic enzymes. This may contribute to altered cochlear fluid levels and increased carotid intima-media thickness (IMT), potentially leading to hearing loss.[6] Women with PCOS had substantially worse pure-tone thresholds than women without PCOS, according to high-frequency audiometry.[7]

Inflammatory cytokines (such as tumour necrosis factor and IL6) suppress insulin mediated glucose transport more in adipocytes derived from patients with PCOS than in adipocytes derived from matched controls. [8] Inflammatory cytokines also suppress adiponectin secretion to a greater degree in adipocytes derived from patients with PCOS than in matched controls, favoring the development of a more proinflammatory, insulin resistant environment. [8]

The present study found a significantly higher prevalence of hearing loss in higher frequencies in PCOS patients (53.3%) compared to controls (3.3%), with an odds ratio of 32.73 (95% CI: 4.00-268.04, p<0.001), consistent with previous studies which is in line with studies by Kucur C, et.al[3]

The most affected frequencies in PCOS patients were 2000-8000 Hz, in line with the findings of Oghan and Coksuer (2012). However, some

studies found no significant difference at conventional frequencies (250-8000 Hz).[2]

The PCOS group had a significantly higher mean random blood sugar level (142.3 mg/dL) compared to controls (90.4 mg/dL) (p=0.007), consistent with the increased prevalence of insulin resistance in PCOS patients as in line with the study conducted by O'meara NM, et.al.[4]

CONCLUSION:

In conclusion, this study demonstrates a significantly higher prevalence (53.3%) of hearing loss in PCOS patients compared to normal individuals, particularly at higher frequencies. Since the hearing loss is present at higher frequencies (2000Hz – 8000Hz) specifically at 4000 Hz and 8000 Hz, it often goes unnoticed by the patient and hence fail to be diagnosed and treated. The findings in this study highlight the importance of regular audiological evaluations in PCOS patients. Future research should focus on elucidating the underlying pathophysiological mechanisms and the long-term impact of PCOS on auditory function.

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