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Review Article

PCOS and Acne a Systematic Review

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Abstract

Polycystic ovary syndrome is a common endocrine disorder that affects up to 10% of women of reproductive age. It is characterized by hyperandrogenism, insulin resistance, and ovulatory dysfunction. Acne is one of the most common skin conditions in women, affecting up to 50% of adult women. PCOS and acne are known to be interrelated, with many women with PCOS experiencing acne. This literature review aims to summarize the current understanding of the relationship between PCOS and acne based on recent studies and literature published between 2016 and 2022.

A systematic review of the literature was conducted using the databases PubMed, Google Scholar, and Web of Science. Analyzed papers included individual studies, systematic reviews, meta-analysis, and abstracts published in scientific literature. Peer-reviewed studies evaluating adult acne vulgaris published through 2016 were reviewed.

We reviewed 18 studies and throughout the studies, a common connection between PCOS and increasing occurrence of acne in women was evident. In a meta-analysis of 60 studies one study found a 1.6-fold increase in the prevalence of acne among PCOS patients in comparison to healthy controls. That same study also revealed that the prevalence of acne among adult PCOS patients was 42%, while in adolescent patients it was higher at 59%. Both rates were significantly higher than the rates observed in non-PCOS patients. Other articles found that insulin resistance was significantly associated with the development of acne in women with PCOS. Furthermore, studies that dove into the pathophysiology of PCOS found that androgen receptors were more abundant in the adipose tissue of women with PCOS and that this may contribute to the development of acne in these women. These articles suggest that there is a strong correlation between PCOS and acne, and that individuals with PCOS are more likely to suffer from acne than those without the condition.

Keywords: PCOS and Acne Prevalence; Systematic Review; Hormonal Imbalances; Insulin Resistance; Acne Pathophysiology; Treatment Strategies

Background

Polycystic Ovary Syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age, with an estimated prevalence of 5%-19% worldwide depending on which criteria are used [1]. The Rotterdam criteria has been endorsed as a tool to diagnose PCOS based on oligo-anovulation, androgen excess, and ovarian morphology [1]. PCOS is characterized by hyperandrogenism, ovulatory dysfunction, and polycystic ovaries, which can lead to a variety of clinical manifestations, including acne as well as hirsutism, androgenetic alopecia, and acanthosis nigricans [2]. The pathology of PCOS is not clearly understood and has been known to be a multifactorial genetic disorder [1]. Acne is a common skin condition affecting up to 80% of adolescents and young adults, with women being more likely to experience persistent acne into adulthood [4]. The association between PCOS and acne has been the subject of numerous studies, but the exact nature of this relationship remains unclear. This review aims to summarize the current literature on the relationship between PCOS and acne.

Results

Studies were done to establish a connection between PCOS and the prevalence of acne. In a meta-analysis of 60 studies, one study found that almost half of the patients with PCOS suffered from acne, significantly 1.6-fold higher than the non-PCOS women [1]. In individuals with PCOS and who were over the age of 19, acne was reported at a rate of 42% whereas in adults over 19 without PCOS, acne was reported at a rate of 17%. In adolescents (under the age of 19) acne in individuals with PCOs was reported at a rate of 59% whereas acne was seen in adolescents without PCOS at 39% [5]. Both of these results show a significant increase in the prevalence of acne

in those with PCOS. Moreover, acne prevalence in women of reproductive age with PCOS and without PCOS was shown to be 40% and 19% respectively [5]. In addition, the study also compared the prevalence of acne in those with and without PCOS in different geographical regions. It was determined that in Europe, adult women with PCOS reported acne at a rate of 29% vs. 21% in those without PCOS. In West Asia it was 42% vs 19% and in South Asia it was 23% vs 9% [5].

Another trial was conducted at a dermatology center for one year from 2012-2013 [1]. This study included 100 women who were diagnosed with PCOS. The results of this study showed that the prevalence of acne was 48% in their PCOS patient population [6]. Further evidence showes the high association of acne in those diagnosed with PCOS. Similar results were found in a study of 401 women who were suspected to have PCOS. In this study, the women that met the criteria for PCOS diagnosis had a 61.2% higher rate of acne than those not diagnosed with PCOS [1]. This study performed a comprehensive skin examination to conclude their results [7]. Acne severity was quantified by the global acne grading system in a retrospective study including 133 patients with PCOS [1]. This system divided the face, chest, and back into areas and each acne lesion is scored on a basis of severity from absence of lesions to nodules. This study also found that in those with PCOS, the global acne grading score was higher in younger patients [8].

Much research has been done on the dermatological manifestations of PCOS. To understand the connection between PCOS and acne, we must first understand the pathophysiology of acne in the context of insulin resistance and hyperinsulinemia. PCOS leads to increased levels of LH, and in response to these heightened levels, there is an increase in androgen production. Elevated LH levels are a hallmark of those diagnosed with PCOS and studies have shown that the LH:FSH ratio can be greater than 2 [4]. Due to the high levels of LH, there is an increased production of androgens. High levels of androgens can then stimulate the sebaceous glands in the skin to produce more sebum, causing abnormal desquamation of follicular epithelial cells resulting in comedones formation [4]. Moreover, the high levels of LH cause an overstimulation of androgen receptors which then lead to an enhanced response of macrophages and neutrophils causing a direct increase in sebum production, provoking acne vulgaris [1].

In addition, insulin resistance can lead to acne formation through its effects on insulin-like growth factor 1 (IGF-1). Hyperinsulinemia leads to increased binding to IGF-1 receptor, IGF-1 is also found on epidermal keratinocytes and so an increase in the insulin levels will result in increased proliferation of basal keratinocytes which can then lead to acne formation [1].

Inflammation also plays a vital role in acne formation as acne vulgaris is characterized by chronic inflammation of the pilosebaceous unit. Women with PCOS are in a chronic pro-inflammatory state [9]. As such, the genes that are related to inflammatory cytokines such as tumor necrosis factor alpha, interleukin 6, and interleukin 1, have been hypothesized to be overexpressed [9]. A systematic review and meta-analysis with 10,000 participants has shown that IL-6 is significantly higher in PCOS women [1]. However, TNF- alpha had no difference between PCOS vs non PCOS women. Despite no difference found in TNF - alpha, the meta-analysis revealed strong evidence of chronic inflammation in women with PCOS [11].

As insulin resistance is commonly associated with PCOS and has been shown to have an association with acne, Metformin has been proposed as a popular treatment for acne vulgaris in those with PCOS [1]. Metformin is a biguanide hypoglycemic drug that works to improve insulin sensitivity, decrease insulin levels, and correct ovarian and functional adrenal hyperandrogenism in PCOS [12]. New studies have shown a new therapy that has been proposed to treat insulin resistance; a compound that combines myo-inositol and d-chiro- inositol [1]. Myo-inositol is the precursor to a second messenger that regulates thyroid stimulating hormone and follicle stimulating hormone as well as insulin. One study followed 50 patients with PCOS and found that after 6 months of administration of myo-inositol, acne decreased [1]. The mechanism that is proposed is that inositol has been found to reduce hyperandrogenism. As mentioned above, an excess of androgens can stimulate sebaceous glands to produce more sebum leading to acne formation. Furthermore, inositols play a role in insulin signaling and hormone synthesis in the ovaries [1]. According to a literature review of 197 articles, 47 of which were clinical trials, research has found that inositols decrease the severity of hyperandrogenism including acne [15].

Furthermore, the use of estrogen- progesterone combined birth control pills has been widely used to manage the symptomatic acne of PCOS [13]. Spironolactone is also a popular treatment for those suffering with acne vulgaris [1]. It is frequently combined with an oral antibiotic therapy or oral contraceptive pill for patients with PCOS [16].

In addition, pioglitazone, an oral antidiabetic agent used in type 2 diabetes patients [1] has been used to ameliorate insulin resistance in individuals with PCOS. In a randomized clinical trial done to see the effects of metformin and pioglitazone on PCOS, women who took pioglitazone showed a significant reduction in acne as well as hair loss [2].

Discussion

The findings from the reviewed literature provide valuable insights into the relationship between Polycystic Ovary Syndrome (PCOS) and acne. In particular, the meta-analysis of 60 studies revealed a significant association between PCOS and an increased prevalence of acne, with individuals with PCOS experiencing a significantly higher incidence of acne compared to those without PCOS. Furthermore, the analysis demonstrated that this relationship persisted across different age groups and geographical regions, reinforcing the robustness of the findings. The observed association between PCOS and acne aligns with the known pathophysiological mechanisms underlying both conditions. Hyperandrogenism, a hallmark of PCOS, stimulates sebaceous gland activity and contributes to the development of acne. Additionally, insulin resistance and hyperinsulinemia, commonly associated with PCOS, can exacerbate acne by promoting sebum production and inflammation. Chronic inflammation, also characteristic of PCOS, may contribute to the persistence and severity of acne in affected individuals. The findings suggest that addressing the hormonal imbalances and insulin resistance associated with PCOS may be important in managing acne symptoms in these patients.

While the meta-analysis provided compelling evidence, it is essential to consider the limitations of the individual studies

included in the analysis. Firstly, the heterogeneity in study designs, participant characteristics, and geographic locations may introduce potential confounders and limit the generalizability of the results. Additionally, some studies may have relied on self-reported acne prevalence, which could introduce recall bias and affect the accuracy of the data. Moreover, most studies were cross-sectional in nature, preventing the establishment of a causal relationship between PCOS and acne. To address these limitations, future research should consider using longitudinal designs with standardized methodologies and larger, diverse cohorts to obtain more robust and reliable findings.

These findings have several implications for future research in the field of PCOS and acne. Firstly, longitudinal studies are warranted to elucidate the temporal relationship between PCOS and acne development. Such research could provide a clearer understanding of whether PCOS contributes to the onset of acne or vice versa, guiding the development of preventive and therapeutic strategies. Additionally, further investigations into the specific molecular pathways and signaling cascades linking PCOS-related hormonal imbalances and insulin resistance to acne formation would deepen our understanding of the pathophysiology. This knowledge may lead to the identification of novel therapeutic targets for managing acne in individuals with PCOS.

Moreover, future research should aim to compare different treatment options for acne in PCOS patients through well-designed randomized controlled trials. These studies could provide evidence-based guidelines for choosing the most effective and safe treatment modalities, taking into account the individual needs and characteristics of the patients. Additionally, investigations into the long-term effects of various treatments on acne outcomes and PCOS-related complications would be valuable in optimizing patient care and improving quality of life.

Furthermore, given the significant regional variation in acne prevalence among PCOS patients, further research should explore potential environmental, genetic, and cultural factors that may contribute to these differences. Understanding these regional disparities may aid in tailoring interventions to meet the specific needs of diverse populations.

Conclusion

Conclusively, numerous studies have established a connection between PCOS and the prevalence of acne. The pathophysiology of acne involves factors such as insulin resistance, hyperinsulinemia, and inflammation. Treatment options include metformin, pioglitazone, inositols, birth control pills, and spironolactone. Overall understanding the underlying mechanisms linking PCOS and acne can guide the development of effective treatment strategies for managing this dermatological manifestation in individuals of PCOS. Further research in this area may lead to improved therapeutic options and better quality of life for those affected by PCOS related acne.

Author Contributions: The execution of this study involved a collaborative effort among the authors, each contributing distinct expertise to various facets of the research process. The conceptualization and design of the study was orchestrated by Mr. Benyaminpour with input from Dr. Sachmechi shaping the research framework. Data acquisition and analysis were done by Mr. Benyaminpour and interpretation of data was done by Dr. Sachmechi. Drafting the manuscript was a joint effort, wherein all authors actively participated in presenting the findings and ensuring the coherence of the narrative. Subsequent revisions were undertaken critically, incorporating insightful feedback from each author to enhance the intellectual content and methodological rigor of the manuscript. The final approval of the version to be published was a consensus decision, signifying the culmination of a collaborative scholarly endeavor. Mr. Benyaminpour assumes the role of the 'guarantor,' ensuring accountability for the overall integrity of the study.

Conflicts Of Interest: Both authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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