

Polikistik Over Sendromlu Kadınların Pelvis Yapılarının Manyetik Rezonans Görüntülemeyle incelenmesi

Examination of pelvic structures of women with polycystic ovary syndrome using magnetic resonance imaging pelvimetry

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ÖZ

Giriş: Çalışmamız, hiperandrojenemi ile ilişkili belirli bir pelvik tipin olup olmadığını belirlemek için manyetik rezonans görüntüleme (MRG) pelvimetrisi kullanarak Polikistik Over Sendromu (PKOS) hastalarını değerlendirmeyi amaçlamaktadır.

Yöntem: Bu çalışmada, 2021 ve 2022 yılları arasında Alanya Eğitim ve Araştırma Hastanesi Kadın Hastalıkları ve Doğum Polikliniği'ne başvuran, PKOS teşhisi konulmuş 36 hastanın pelvik MR görüntüleme verilerini retrospektif olarak analiz edildi. Tüm vakalar, 18 ila 49 yaş arası üreme çağındaydı ve başlangıçta ultrason ile PKOS teşhisi konmuş, hirsutizm veya amenore öyküsü bulunan ve sonrasında MR görüntülemeye yönlendirilen hastalardı. PKOS teşhisi, hirsutizm, amenore veya adet düzensizlikleri olmayan, üreme çağına göre eşleştirilmiş 35 hasta kontrol grubu, başka bir nedenle MR görüntülemeye giren hastalardan seçilmiştir.

Bulgular: Yaş, gravite, parite, düşük yapma gibi kriterler açısından ağırlık ve BMI dışında gruplar arasında anlamlı farklılıklar gözlenmedi. Pelvik giriş trasvers çapı (cm), interspinoz çap (cm), ortalama sagittal pelvik giriş anteroposterior çapı (cm) ve ortalama sagittal pelvik çıkış anteroposterior çapı (cm) gibi MR pelvimetri sonuçlarının gruplar arasındaki karşılaştırması, anlamlı fark ortaya çıkarmadı.

Sonuç: Maalesef çalışmamızın sonuçları hipotezimizi destekleyecek bir kanıt sağlamadı. Eğer yeterli kanıt sağlanabilseydi, hayvan deneyleri ile klinik çalışmaları birbirine bağlayarak PCOS etiyojisinin daha iyi anlaşılması mümkün olabilirdi.

Anahtar Kelimeler: polikistik over sendromu, hiperandrojenizm, pelvimetri

ABSTRACT

Objective: Our study aimed to evaluate patients with Polycystic Ovary Syndrome (PCOS) using Magnetic Resonance (MR) pelvimetry to determine if there is a specific pelvic type associated with hyperandrogenemia.

Method: This study retrospectively analyzed data collected from pelvic MR imaging performed on 36 patients diagnosed with PCOS who attended the outpatient clinic of Alanya Education and Research Hospital between 2021 and 2022. All cases were of reproductive age, between 18 and 49 years, and were initially diagnosed with PCOS via ultrasound, had a history of hirsutism or amenorrhea, followed by subsequent MR imaging. A control group of 35 patients, matched for reproductive age without PCOS diagnosis, hirsutism, amenorrhea, or menstrual irregularities, who underwent MR imaging for any other reason were recruited.

Results: No significant differences were observed between the groups in terms of age, gravidity, parity, abortions, except for weight and Body Mass Index (BMI). Comparison of MR pelvimetry results between the groups, including pelvic inlet transverse diameter (cm), interspinous diameter (cm), midsagittal pelvic inlet anteroposterior diameter (cm), and midsagittal pelvic outlet anteroposterior diameter (cm), revealed no significant differences.

Conclusion: Unfortunately, the results did not provide convincing evidence to prove our hypothesis. If it were, we believe, it would provide a bridge between the animal experiments and clinical studies regarding the ethiology of PCOS.

Keywords: polycystic ovary syndrome, hyperandrogenism, pelvimetry

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INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a common and complex endocrinological disorder in women. Despite various hypotheses about its origins, it is commonly agreed that the syndrome stems from a genetic origin and manifests itself depending on multiple external factors such as in utero excess androgen exposure, and developmental environmental influences 1, 2.

Most primate species exhibit sexual dimorphism. Typically, males are larger than females. However, female pelvic dimensions are either absolutely or relatively wider than males 3, 4. The most crucial paradigm in understanding sexual differentiation is that both sexes have the same body plan, and in the absence of testicular hormones, most structures will differentiate as female 5. Androgens in a female fetus can alter pelvic development from a predetermined female form to a male-like structure 6-12. Studies applying in utero androgen excess programs in non-human primates serve as evidence for this hypothesis. Female rhesus monkeys exposed to testosterone levels equivalent to those in male fetuses during their fetal life exhibited many clinical and biochemical characteristics of PCOS upon reaching puberty 13, 14, 15. These observations indicate that excess androgens during fetal hypothalamic-pituitary-ovarian axis development trigger events that might lead to PCOS. Studies suggest that androgens act as potent transcription factors during differentiation, impacting gene expression by influencing other transcription factors like c-fos, resulting in permanent changes 16.

Regardless of the clinical presentation or degree of menstrual dysfunction, the most consistent biochemical indicator in women with PCOS and prenatally androgenized rhesus monkeys is androgen excess. Demonstrating that hyperandrogenemia during prepubertal periods directly leads to PCOS in humans is practically challenging. However, planning a study to indirectly indicate exposure to high androgen levels during the prepubertal period as evidence of the syndrome's prepubertal origin is crucial 13, 14, 15. Our study aimed to evaluate patients with PCOS using MR pelvimetry to determine if there is a specific pelvic type associated with hyperandrogenemia.

MATERIALS AND METHODS

This study retrospectively analyzed data collected from pelvic MR imaging performed on 36 patients diagnosed with PCOS who attended the outpatient clinic of Alanya Education and Research Hospital between 2021 and 2022. All cases were of reproductive age, between 18 and 49 years, and were initially diagnosed with PCOS via ultrasound, had a history of hirsutism or amenorrhea, followed by subsequent MR imaging. Additionally, parameters such as gravidity, parity, prior curettage history, comorbidities, previous surgeries, weight, and BMI were analyzed. A control group of 35 patients, matched for reproductive age without PCOS diagnosis, hirsutism, amenorrhea, or menstrual irregularities, who underwent MR imaging for any other reason were recruited. Patients with gynecological malignancies, pelvic masses, pregnancy, postmenopausal status, and adolescence were excluded from the study. Pelvimetry was performed on MR images using our hospital's Picture Archive and Communication (PACS) system.

Statistical analysis was carried out using Student's t-test and Mann

Whitney-U test using SPSS 26.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as absolute values and percentages. Tests were considered significant at a p-value less than 0.05.

RESULTS

Demographic data are summarized in Table 1. There was no significant difference observed between the PCOS group and the control group in terms of age distribution ($p=0.875$), gravida ($p=0.673$), parity ($p=0.314$), and abortion history ($p=0.703$). However, it is worth noting that weight and BMI values were higher in the PCOS group compared to the control group, although the difference was not statistically significant ($p=0.006$, $p=0.038$) (Table 1).

Table 1. Demographic Data

	Control Group (n=34)	PCOS Group (n=36)	p value
Age (year)**	36.6 ± 9.2	29.6 ± 8.6	0.875
Gravidity (n)**	1.76 ± 1.53	1.13 ± 1.51	0.673
Parity (n)**	1.41 ± 1.23	0.8 ± 1.16	0.314
Abortion (n)**	0.35 ± 0.69	0.33 ± 0.67	0.703
Weight (kg)	68.11 ± 7.58	70.3 ± 14.69	0.006
Body Mass Index (BMI)	25.87 ± 3.45	26.51 ± 5.44	0.038

The MR pelvimetry measurements of the PCOS group were compared to those of the control group. The results showed no significant difference between the groups in terms of the MR pelvimetry results for the pelvic inlet transverse diameter (cm) and interspinous diameter (cm) ($p=0.869$, $p=0.714$). Although the midsagittal pelvic inlet anteroposterior diameter (cm) was larger in the PCOS group than in the control group, the difference did not reach statistical significance ($p=0.065$). The mean of anteroposterior diameter (cm) measurements of the midsagittal pelvic outlet in PCOS group and control group was respectively $110.52 ± 8.67$ and $111.41 ± 11.69$ cm, there was no significant difference ($p=0.087$) (Table 2).

Table 2. Comparison of MR Pelvimetry Between Groups

	Control Group (n=34)	PCOS Group (n=36)	p value
Pelvic inlet transverse diameter (cm)	126.88 ± 7.84	125.41 ± 7.73	0.869
Interspinous diameter (cm)	121.02 ± 8.31	123.38 ± 8.9	0.714
Midsagittal Pelvic inlet anterior posterior diameter (cm)	120 ± 12.97	122.69 ± 9.24	0.065
Midsagittal Pelvic outlet anterior posterior diameter (cm)	111.41 ± 11.69	110.52 ± 8.67	0.087

DISCUSSION

PCOS is a common endocrinologic disorder leading to issues such as anovulatory infertility, menstrual irregularities, or hirsutism, it is also a major risk factor for developing type 2 diabetes mellitus later in life. Although the etiology of PCOS remains incompletely understood, there is increasing evidence suggesting a genetic basis for this syndrome. Strong familial inheritance 17, 18 and the involvement of multiple genes leading to heterogeneous phenotypes 17, 19 have been proposed. Environmental factors like diet and exercise are also acknowledged to play a role in its clinical and biochemical presentation 20. Considering the complex interaction of multiple variables mentioned above, it is considered unlikely that PCOS of a heterogeneous nature stems from a single developmental source 1. Nevertheless, studies using animal models and data obtained from clinical research suggest a hypothesis that PCOS might be a linear process based on "programming" during prepuberty or even in utero during ovarian development and oogenesis 1, 2.

Interest in human pelvic shapes primarily began with Caldwell and Moley's categorization of pelvises into four main groups based on their diameters: gynecoid, android, andropoid, and platypelloid, to facilitate childbirth. Pelvimetry has been used for many years to detect dystocia, particularly maternal-related cephalopelvic disproportion. However, due to its low predictive accuracy for dystocia and radiation exposure, interest in pelvimetry has decreased over time. Throughout its historical development, X-ray pelvimetry, digital pelvimetry, and CT pelvimetry were used, and most recently, MR pelvimetry emerged. With the advancement of rapid imaging sequences, this radiation-free examination performed within minutes has redirected attention towards pelvimetry 21.

"If PCOS develops due to prepubertal androgen exposure, similarly, pelvic structures in women with PCOS should have developed in a manner similar to male pelvic structures, distinct from women without PCOS, as observed in animal experiments." To validate this hypothesis, we planned to conduct MR pelvimetry on 35 patients diagnosed with PCOS based on the 2003 ESHRE/Rotterdam criteria and match them with 35 control patients with similar age, body mass index, and parity, following the method applied by Spörri et al., who previously underwent MR imaging for any reason 22,23. We compared the measured pelvic morphometric parameters between these groups.

Unfortunately the data we gathered from our study did not show a statistically significant difference in pelvic diameters between the PCOS and, age-BMI matched control groups. There was only a small difference between midsagittal pelvic anteroposterior diameter favouring android type of pelvis in PCOS patients. Nevertheless this difference did not reach a statistically significant level ($p=0.052$). The reason for this failure might be either low sample size or using a less stringent criteria in PCOS diagnosis.

CONCLUSION

If the results obtained in this study should have supported the hypothesis, we believe that we would have bridged a gap between animal experiments and clinical studies, providing a strong evidence regarding the etiology of this syndrome. Even though our study failed to demonstrate this missing part i.e. the hypothetical connection between the theory and clinical evidence, we believe that further studies with enough power and more

robust PCOS definition will eventually be able to demonstrate the intricate mechanisms underlying the origins of PCOS.

Ethics Committee Approval: The approval of Alaaddin Keykubat University Clinical Research Ethics Committee (decision dated 16.11.2022 and numbered 12/03).

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Informed Consent: Participation in the study was voluntary and all participants read and approved the informed consent form.

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