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Assessing Health Outcomes for Women with Polycystic Ovary Syndrome and Hypertension

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Abstract: Introduction: The coexistence of hypertension (HTN) with polycystic ovary syndrome (PCOS) is prevalent and represents an extremely cardiometabolic risk in females. Purpose: The objective of this study was to evaluate cardiometabolic outcomes and quality of life among patients with PCOS and hypertension for 12 months. Methods: A cross-sectional study was carried out in different hospitals in Iraq. A total of 75 women with hypertension and PCOS during the period from May 2024 to May 2025 were studied. Baseline evaluation consisted of demographic characteristics, metabolic and clinical characterization, and phenotyping of PCOS. Patients were followed up for 12 months according to blood pressure control, metabolic data, treatment adherence (Morisky medication adherence scale), patient-oriented outcomes (SF-36), and side effects. Results: The cohort (mean age 32.4 ± 5.8 years) had a high baseline metabolic load; with mean BMI 34.1 kg/m ² and prevalent Dyslipidaemia (64.0%); insulin resistance (80.0%); Type 2 diabetes (25.3%); PCOS phenotype was the most frequent (60.0%); blood pressure control (<130/80 mmHg) at 12 months was reached in 37.3% of patients.; systolic BP (mean -12 mmHg, p<0.001); and HOMA-IR (median -0.5, (p=0.04) improved significantly, where greater adherence was associated with increased control rates of BP (54.3% vs. 22.5%, p=0.004) along with reduced hospital visits or ED visits (5.7% vs. 32.5%, p=0.003). Conclusion: our study indicates that PCOS women with PCOS and those with hypertension are at a high cardiometabolic risk profile, as well as have significant challenges in achieving guideline-recommended blood pressure.

Keywords: Polycystic ovary syndrome; hypertension; cardiometabolic risk; insulin resistance; health outcomes; and women's health.

INTRODUCTION

Polycystic Ovary Syndrome (PCOS) is a frequent endocrine disorder, with a prevalence ranging from 6% to 12% in reproductive age women, thus being one of the commonest endocrine disorders in this age range (Rotterdam, E. S. 2004; Azziz, R. *et al.*, 2016), which it has a highly variable clinical expression, consisting of a series of interrelated symptoms such as hyperandrogenism, ovulatory dysfunction, and polycystic ovary morphology (Cooney, L. G., & Dokras, A. 2018), as well as the significance of PCOS however is more than just infertility, it has since been established as a systemic metabolic disease process (Chang, A. Y. *et al.*, 2016).

Moreover, one of the forgotten elements to this metabolic mayhem has been the effect on the cardiovascular risk profile, where compared to women without PCOS, Classic CVD risk factors, such as insulin resistance, dyslipidemia, obesity, and particularly hypertension, are much more prevalent in women with PCOS. (Tehrani, F. R. *et al.*, 2020; Behboudi-Gandevani, S. *et al.*, 2018)

In addition, PCOS and hypertension coexist as a formidable clinical synergy with far-reaching implications for long-term health (Meun, C. *et al.*, 2020), which the pathophysiologic overlap between the two conditions is complex and multidirectional, encompassing causative factors such as hyperinsulinemia, sympathetic nervous system overload, and chronic low-grade inflammation (Pinola, P. *et al.*, 2017).

Furthermore, such an interaction would imply that not only can PCOS possibly be a predisposing factor for hypertension to develop prematurely in women, but it may also modify the natural course of the disease and the burden of its long-term complications actually (Ding, D. C. *et al.*, 2018)

Also, these women may be at increased risk of developing cardiovascular disease, chronic kidney disease, and cerebrovascular events prematurely and, as such, need to be assessed more closely (Tarkun, I. *et al.*, 2004), due to that. This study, therefore, seeks to examine in detail the multitude of health impacts of PCOS and hypertension in women.

MATERIALS AND METHODS

Study Design and Setting

We performed a cross–sectional study to assess and define a set of health outcomes within 12

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months at different hospitals in Iraq. Participants were enrolled from May 2024 to May 2025 and were tracked for 12 months starting from their first visit.

Study Population and Recruitment

The sample included 75 women aged 25 to 38. Inclusion criteria were 1) a diagnosis of PCOS as per the Criteria by at least two of the following: hyperandrogenism, clinical or biochemical oligo-/anovulation, and the presence of polycystic ovaries on ultrasound, and 2) a diagnosis of hypertension based on clinical criteria or SBP ≥ 130 or DBP ≥ 80 on two different days at enrollment. Exclusion conditions included secondary and type 1 hypertension, pregnancy, lactation, and known cardiovascular, severe renal, or hepatic disease.

Data Collection and Variables.

Data from both the baseline (enrollment) as well as the 12-month follow-up were collected at two significant points in time:

- Baseline Assessment: History-taking, analytics, and physical evaluation were completed for test cases. Age, BMI (kg/m2), waist circumference, and resting BP were collected. PCOS was classified as Classic, Ovulatory, or Non-Hyperandrogenic. Patient history, medication, and lab/workup results revealed the presence of comorbidities. Current antihypertensive regimens were collected.
- Follow-up Assessment (12 months): Participants underwent the same physical exam, BP (blood pressure) measurement, and laboratory tests as done during the baseline. Metabolically controlled parameters were calculated. Blood pressure control was defined as SBP < 130 mmHg, DBP < 80 mmHg.
- Patient Reported Outcomes (PROs): At month 0 and month 12, the validated 36-item SF-36 was used to measure the quality of life related to health.
- Clinical Outcomes: Parturients reported having adverse health events such as hospitalization and new diagnoses, which were systematically collected through patient interviews and medical records.
- Medication Adherence: In the evaluated 8-item Morisky scale, patients were classified as having high, medium, or low adherence access at month 12.
- Statistical Analysis
- This analysis was performed using SPSS Statistics version 24.0. Continuous variables are presented as a mean with SD, or as medians with interquartile ranges, depending on the distribution. Categorical variables are presented as frequencies (n, %).
- Primary Outcomes: The primary outcome was the proportion of patients who achieved BP (SBP/DBP < 130/80 mmHg) control after 12 months.
- Secondary Outcomes: Changes in the HOMA-IR index, lipid profile, composite health outcome, changes in SF-36 scores, and incidence of adverse events' incidence.
- Analytical Tests: Comparison of continuous variables over baseline to 12 months was done using paired samples t-test or Wilcoxon signed rank tests. Comparison of categorical variables (BP control rates across BMI categories, phenotype by insulin resistance, and adherence by outcomes) was done using Chi-square or Fisher's exact tests. All tests were deemed statistically significant with a p-value of less than 0.05.

RESULTS

Table 1: Baseline Demographic Characteristics of the Study Cohort (N=75)

Characteristic	**Value (n, %) or Mean (±SD)**
Age (years)	32.4 ± 5.8
Body Mass Index (BMI)	34.1 ± 6.3
Normal (18.5-24.9)	5 (6.7%)
Overweight (25-29.9)	18 (24.0%)
Obese (≥30)	52 (69.3%)

Table 2: Clinical and Metabolic Profile at Baseline.

Parameters	Mean (±SD) or Median [IQR]
Systolic BP (mmHg)	148 ± 11
Diastolic BP (mmHg)	92 ± 8
Waist Circumference (cm)	104.5 ± 12.3
Fasting Glucose (mg/dL)	102.5 [95.0, 114.8]

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Fasting Insulin (μIU/mL)	18.3 [12.1, 25.9]
HOMA-IR	4.6 [2.8, 6.9]
Total Cholesterol (mg/dL)	198 ± 32
HDL Cholesterol (mg/dL)	42 ± 9
LDL Cholesterol (mg/dL)	121 ± 28
Triglycerides (mg/dL)	165 [118, 220]

Table 3: Prevalence of PCOS Phenotypes.

Phenotype	n	%
Classic (Hyperandrogenism + Oligo/Anovulation)	45	60.0%
Ovulatory (Hyperandrogenism + Polycystic Ovaries)	12	16.0%
Non-Hyperandrogenic (Oligo/Anovulation + PCO)	18	24.0%

Table 4: Prevalence of Comorbid Conditions at Enrollment.

Comorbidity	n	%
Type 2 Diabetes	19	25.3%
Dyslipidemia	48	64.0%
Obstructive Sleep Apnea	22	29.3%
Non-Alcoholic Fatty Liver Disease (NAFLD)	27	36.0%
Anxiety/Depression	31	41.3%

Table 5: Types of Antihypertensive Medications Used.

Medication Class	n	%
ACE Inhibitors/ARBs	58	77.3%
Calcium Channel Blockers	32	42.7%
Diuretics (Thiazide)	29	38.7%
Beta-Blockers	18	24.0%
On ≥2 Antihypertensive Agents	41	54.7%

Table 6: Blood Pressure Control at 12-Month Follow-Up.

BP Status	n	%
Controlled (SBP <130 and DBP <80 mmHg)	28	37.3%
Uncontrolled (SBP ≥130 or DBP ≥80 mmHg)	47	62.7%

Table 7: Change in Metabolic Parameters from Baseline to 12 Months.

Parameter	**Baseline (Mean)**	**12-Month (Mean)**	**Mean Change**	**p-value**
Weight (kg)	89.5	87.8	-1.7	0.08
SBP (mmHg)	148	136	-12	<0.001
DBP (mmHg)	92	84	-8	<0.001
HOMA-IR	4.6	4.1	-0.5	0.04
HDL (mg/dL)	42	43	+1	0.32

Table 8: Achievement of Composite Health Goals at 12 Months.

Items	n Achieved	% Achieved
BP <130/80 mmHg	28	37.3%
HbA1c <5.7% (if diabetic, <7.0%)	42	56.0%
LDL <100 mg/dL	25	33.3%
Weight Loss ≥5%	16	21.3%
Met ALL 3 Goals (BP, LDL, HbA1c)	9	12.0%

Table 9: Patient-Reported Outcomes (SF-36 Quality of Life Scores).

Domain	Baseline Score (Mean)	12-Month Score (Mean)	Change
Physical Functioning	65.2	68.1	+2.9
Role Limitations (Physical)	58.4	62.3	+3.9
General Health Perceptions	45.8	49.5	+3.7
Vitality	38.5	42.0	+3.5

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Social Functioning	62.1	65.8	+3.7
Mental Health	59.7	63.2	+3.5

Table 10: Incidence of Adverse Health Events Over 12 Months.

Event	n	%
Hospitalization (any cause)	8	10.7%
Emergency Department Visit	15	20.0%
New Diagnosis of Type 2 Diabetes	5	6.7%
Worsening NAFLD (by imaging)	7	9.3%
Transient Ischemic Attack (TIA)	1	1.3%
None of the above	52	69.3%

Table 11: Association between BMI and Blood Pressure Control.

BMI Category	BP Controlled (n=28)	BP Uncontrolled (n=47)
Overweight (25-29.9)	10 (35.7%)	8 (17.0%)
Obese Class I (30-34.9)	11 (39.3%)	15 (31.9%)
Obese Class II/III (≥35)	7 (25.0%)	24 (51.1%)

Table 12: Impact of Phenotype on Insulin Resistance (HOMA-IR >2.5).

PCOS Phenotype	n with HOMA-IR >2.5	% with Insulin Resistance
Classic	41/45	91.1%
Ovulatory	8/12	66.7%
Non-Hyperandrogenic	11/18	61.1%
Total	60/75	80.0%

Table 13: Medication Adherence at 12 Months (Based on Morisky Scale).

Adherence Level	**n**	**%**
High Adherence	35	46.7%
Medium Adherence	27	36.0%
Low Adherence	13	17.3%

Table 14: Correlation of Medication Adherence with Outcomes.

Outcome	High Adherence (n=35)	Low/Medium Adherence (n=40)	p-value
Achieved BP Control	19 (54.3%)	9 (22.5%)	0.004
≥5% Weight Loss	10 (28.6%)	6 (15.0%)	0.17
ED Visit/Hospitalization	2 (5.7%)	13 (32.5%)	0.003

DISCUSSION

The cross-sectional study provides an advanced evaluation on the multi-health consequences at the 12-month mark for 75 women enduring the dual burden of having Polycystic Ovary Syndrome (PCOS) and hypertension.

The Difficulty in Controlling Blood Pressure and Metabolic Health

In relation to the ongoing study, the most striking finding is the 62.7% prevalence of uncontrolled hypertension across the cohort at the 12-month mark, even though all participants had received specialist follow-up, and over 50% of the participants (54.7%) were on combination antihypertensive therapy. The 37.3% prevalence of controlled hypertension and extended the follow-up in the study is one of the worst rates reported associated to the general population (Glintborg, D. *et al.*, 2018)

Our participants were young (mean age 32.4 years), yet metabolically unhealthy with obesity (69.3% obese), insulin resistance (80% had HOMA-IR >2.5), and hypertriglyceridemia (64.0%). Various studies have shown PCOS of insulin resistance, hyperinsulinemia, and sympathetic nervous overactivity, which all produce an environmenal effect leading to an environment resistant to normalizing the blood pressure (Osibogun, O. *et al.*, 2020; Joham, A. E. *et al.*, 2015), where the average SBP (-12 mmHg), DBP (-8 mmHg) decreased significantly from baseline ($p<0.001$), which is not just statistically but clinically significant as well.

Cumulative Effect of Obesity and PCOS Phenotype

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Our findings firmly support obesity's core position as a strong disease severity and control modifier. Also, our findings established a robust inverse gradient for the association between BMI and the probability of BP control, while 35.7% of the overweight women were in control, and this fell to 25.0% of the Class II/III obese (BMI ≥35) women. According to British studies, demonstrated connecting adiposity, especially visceral adiposity (indexed by the increased mean waist circumference of 104.5 cm), with aggravated hypertension via mechanisms such as leptin-mediated sympathetic stimulation, sodium retention, and mechanical compression of the kidneys (Christakou, C. D., & Diamanti-Kandarakis, E. 2008).

In addition, our phenotype-based analysis in PCOS showed a dramatic gradient for the frequency of insulin resistance, which was most pronounced (91.1%) in the Classic phenotype (hyperandrogenism and anovulation) compared with the Ovulatory and Non-Hyperandrogenic phenotypes, where the most advanced metabolic type presented in the Classic phenotype, based on one study (Amiri, M. *et al.*, 2020).

The Critical Role of Medication Adherence and Its Impact

Perhaps our most clinically relevant finding was the strong relationship between self-reported adherence to medication and outcomes, which adherent patients were significantly more likely to have BP control (54.3% vs. 22.5%, p=0.004) and, importantly, had a significantly lower rate of healthcare utilization (ED visit or hospitalization: 5.7% vs. 32.5%, p=0.003), (Zhu, S. *et al.*, 2019) where this dramatic contrast underscores that poor adherence is a primary reason for poor outcomes in this population.

Furthermore, the pathogenesis of low adherence is likely multi-factorial and includes the complexity of multi-drug regimens, side effects, the asymptomatic nature of hypertension, and the great psychosocial burden of PCOS; also, the high rate of anxiety/depression (41.3%) in our cohort is a significant confounding factor likely to compromise self-management behavior, including adherence (Kalaitzidis, R. G., & Elisaf, M. S. 2018).

Patient-Reported Outcomes and the Burden of Multimorbidity

The baseline scores for General Health Perceptions and Vitality in single measure individually were low, as an indication of high symptom burden due to reason of long-standing diseases such as hirsutism, worry over weight, fatigue, and anxiety with management of intensive drug regimen, along with Improvement noted, although statistically small, would probably be clinically meaningful and could be the result of reinforcement effect of interaction with a specialist care team with few clinical parameter improvements. Scores will still probably remain below population normal, to emphasize the heavy burden on quality of life (QoL) by virtue of multimorbidity. Japanese women with PCOS in the Japanese series (Ke, C. *et al.*, 2018; Cryer, M. J. *et al.*, 2016; Zolotareva, O. *et al.*, 2019; Xue, B., Head, J., & McMunn, A. 2020)were significantly lower on QoL than age-matched controls, and this was even more pronounced by co-morbidity with other comorbid diseases such as hypertension.

CONCLUSION

This study demonstrates that women with PCOS receiving antihypertensive therapy are a high-risk population with a significant barrier to long-term achievement of control of the disease, where over 60% of patients had persistent hypertension at 12 months despite intensive treatment, again delineating the recalcitrant nature of the disease in such a metabolically deranged group.

Surprisingly, drug compliance was the most potent modifiable predictor of outcomes, and compliance with medication was associated with substantially improved blood pressure control and decreased emergency attendance to healthcare, which there were negligible quality of life and metabolic parameter gains, but generally low rate of attainment of all composite health goals (12%) is reflective of how desperate the task of is treating this multimorbidity.

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