Journal of Iranian Medical Council, Volume 10, Issue no. 1
http://dx.doi.org/10.18502/jimc.v10i1.23282

Original Article

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Assessment of Carotid Intima-Media Thickness in Patients with Uterine Leiomyoma and Adenomyosis: A Comparative Study with Healthy Controls

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Abstract

Background: Leiomyoma (fibroid) is a benign smooth muscle tumor with a low risk of malignancy. This study aimed to compare Carotid artery Intima-Media Thickness (CIMT)—a marker of subclinical atherosclerosis—among women with uterine leiomyoma, adenomyosis, and healthy controls. No prior comprehensive research has been conducted in Iran on this association.

Methods: This case-control study included 195 women aged 30–50 years with a Body Mass Index (BMI) below 30, recruited from Al-Zahra Hospital. Participants were categorized into three equal groups (leiomyoma, adenomyosis, and control) confirmed by ultrasonographic diagnosis. Carotid intima-media thickness was measured using B-mode ultrasonography, and data were analyzed with SPSS version 26, using a significance threshold of $p<0.05$.

Results: Waist circumference was significantly higher in both leiomyoma and adenomyosis groups compared to controls ($p<0.05$). The adenomyosis group demonstrated a significantly greater CIMT compared with the leiomyoma and control groups ($p<0.001$). A positive correlation was observed between CIMT and age and waist circumference in patients with leiomyoma and adenomyosis ($p<0.05$).

Conclusion: CIMT was significantly higher in women with adenomyosis, suggesting an increased cardiovascular risk compared to those with leiomyoma and healthy controls. The positive correlations of CIMT with age and waist circumference highlight the importance of monitoring vascular health in patients with these gynecological conditions.

Keywords: Adenomyosis, Atherosclerosis, Carotid intima-media thickness (CIMT), Smooth muscle tumor

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Received: 14 Jul 2025
Accepted: 1 Feb 2026

Citation to this article
Souri Z, Dareshiri M, Sharifnia S, Farzin M. Assessment of Carotid Intima-Media Thickness in Patients with Uterine Leiomyoma and Adenomyosis: A Comparative Study with Healthy Controls. *J Iran Med Counc*. 2027;10 (1):249-54.

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Introduction

Uterine leiomyoma (fibroid) is a benign smooth muscle tumor and one of the most prevalent gynecologic disorders among women of reproductive age. Although these tumors are non-cancerous and rarely undergo malignant transformation (0.1%), they can cause significant morbidity and are among the leading indications for hysterectomy worldwide (1,2). While their gynecological complications are well recognized, their potential systemic effects—particularly those related to cardiovascular risk—have gained increasing research interest (3).

Adenomyosis is another common benign uterine disorder characterized by the presence of ectopic endometrial glands and stroma within the myometrium, resulting in uterine enlargement, pelvic pain, and menorrhagia (2). Like leiomyoma, adenomyosis is influenced by hormonal and inflammatory mechanisms, especially those involving estrogen dominance, which may also affect vascular structure and function. Emerging evidence suggests that chronic inflammation, endothelial dysfunction, and hormonal imbalances observed in these uterine conditions may contribute to subclinical atherosclerosis, reflected by increased Carotid artery Intima-Media Thickness (CIMT) (4).

Several studies have reported a potential link between gynecological disorders such as leiomyoma and adenomyosis and early markers of cardiovascular disease, including elevated CIMT, altered lipid profiles, and metabolic dysregulation (5,6). Understanding these associations is crucial, as women with these benign uterine disorders may have unrecognized cardiovascular risks that require preventive attention (7).

CIMT is a non-invasive and reliable indicator of early atherosclerotic changes and cardiovascular risk. Increased CIMT has been associated with higher risks of myocardial infarction and stroke (1,7). Studies support the hypothesis that the development of leiomyoma and atherosclerosis may share common biological mechanisms (8).

Miller *et al* reported that transdermal estrogen/17β-estradiol therapy did not significantly impact CIMT or atherosclerosis progression in postmenopausal women, although CIMT increased with age and time since menopause (9). Aksoy *et al* observed that women with uterine fibroids had higher CIMT and lower HDL cholesterol levels, while Korkmaz *et al* found significant differences in lipid profiles, insulin resistance, and CIMT among women with leiomyomas (10,11).

This study was designed to evaluate and compare CIMT values among women with uterine leiomyoma, adenomyosis, and healthy controls, aiming to elucidate the potential vascular implications of these conditions.

Materials and Methods

This study employed a case-control design involving a total of 195 women aged 30 to 50 years with a Body Mass Index (BMI) below 30, recruited from Al-Zahra Hospital. The participants were divided equally into three groups: leiomyoma (n=65), adenomyosis (n=65), and healthy controls (n=65).

Inclusion criteria included women of reproductive age who were diagnosed with uterine leiomyoma or adenomyosis based on ultrasonographic findings. The control group consisted of age- and weight-matched women with normal pelvic ultrasound findings and without any uterine pathology.

Exclusion criteria included pregnancy, a history of diabetes mellitus, hypertension, dyslipidemia, thyroid disease, cardiovascular disorders, smoking, and the use of hormonal or lipid-lowering medications within the past six months. Women with prior uterine surgery or systemic inflammatory diseases were also excluded from the study.

Sampling was performed using a convenience sampling method. Demographic data, obstetric history, waist circumference, and BMI were recorded for all the participants.

CIMT measurement

CIMT was measured using a Logiq 7 ultrasound system equipped with a 12-*MHz* linear transducer, following the Mannheim consensus protocol. The participants were examined in the supine position with the neck slightly extended and rotated opposite to the examined side. Measurements were obtained from the distal wall of the common carotid artery, approximately 1 *cm* proximal to the carotid bulb, on both sides, and the average value was recorded for analysis.

The sample size was determined based on previous studies comparing mean CIMT values between groups, with an estimated 65 participants per group to achieve adequate statistical power.

Statistical analysis: Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY, USA). The Shapiro–Wilk test was applied to assess normality, and Levene's test was used for homogeneity of variances. Continuous variables were analyzed using one-way ANOVA, and categorical variables were compared using the chi-square test. Correlations were assessed using the Pearson correlation coefficient, and a p-value <0.05 was considered statistically significant.

Results

A total of 195 women were enrolled in this study, divided equally among three groups: leiomyoma (n=65), adenomyosis (n=65), and healthy controls (n=65). The mean ages (±SD) were 39.36±5.40, 39.46±5.74, and 39.15±5.03 years, respectively, with no significant age difference between groups (p=0.946).

There were no statistically significant differences in smoking status (p=0.129) or history of hypertension (p=0.275) among the groups. Waist circumference was significantly higher in the leiomyoma and adenomyosis groups compared to the control group (p=0.02). BMI showed no significant difference among the three groups (p=0.524).

Obstetric history comparisons revealed no significant differences in parity (p=0.505) or gravidity (p=0.631) across the groups. CIMT was significantly higher in the adenomyosis group than in both the leiomyoma and control groups (p<0.001).

Correlation analysis demonstrated significant positive relationships between CIMT and age and waist circumference in the leiomyoma and adenomyosis groups (p<0.05), while no significant correlation was found in the control group (Table 1).

Discussion

Although this study did not observe a significant association between hypertension across the three groups, prior research has yielded inconsistent findings. Numerous studies have indicated a potential link between hypertension and uterine fibroids (12,13). For instance, Sivri *et al* (14) reported a significantly higher prevalence of hypertension in patients with leiomyomas (42.3% *vs*. 28%, p=0.004). Regarding adenomyosis, recent research has shown that this condition may also be associated with an increased risk of hypertension, suggesting that affected women should be closely monitored for blood pressure changes (15). These discrepancies between studies may be attributed to variations in study design, population characteristics, and the control of confounding factors. Consistent with our findings, meta-analyses by Chiaffarino *et al* and studies by Wise *et al* (16,17).

Table 1. Comparison of demographic and clinical characteristics among women with leiomyoma, adenomyosis, and healthy controls

Parameter	Leiomyoma (Mean±SD)	Adenomyosis (Mean±SD)	Control (Mean±SD)	p-value	Significance
Age (yrs)	39.36±5.40	39.46±5.74	39.15±5.03	0.946	NS
Smoking (%)	18.5%	33.8%	24.6%	0.129	NS
Hypertension (%)	10.8%	12.3%	20.3%	0.275	NS
Waist Circumference (*cm*)	84.96±5.89	86.20±7.58	81.90±7.17	0.02	Significant
BMI (*kg/m²*)	26.06±1.92	25.95±2.07	25.67±1.95	0.524	NS
Parity	1.56±0.14	1.78±0.15	1.76±0.13	0.505	NS
Gravidity	1.78±0.15	1.96±0.15	1.96±0.15	0.631	NS
IMT (*mm*)	0.61±0.07	0.67±0.07	0.62±0.05	<0.001	Significant (↑ in Adeno)

Indicated that smoking does not significantly affect the risk of uterine leiomyomas. Other studies have reported mixed findings, with some suggesting a reduced risk (18) or no association (19,20). Differences in smoking history assessment and population demographics may explain these conflicting results (20,21). Most participants in the current study were multiparous and multigravid, which is consistent with previous studies showing a relationship between multiparity and adenomyosis (22-24).

Anatomical and physiological changes in the uterus following multiple pregnancies may predispose women to leiomyoma formation, although some epidemiologic studies have suggested that multiparity may reduce the risk of fibroids (16,25).

Despite similar BMI across the three groups, waist circumference was significantly higher in women with leiomyoma and adenomyosis than in controls. This suggests that central adiposity, rather than total body weight, may play a more critical role in vascular changes associated with these conditions. Tatlici *et al* (26) and Uimari *et al* (27) similarly found that increased waist circumference, but not BMI, correlated with a higher risk of uterine fibroids.

The most remarkable finding of this study was the significantly higher CIMT in patients with adenomyosis compared to those with leiomyoma and healthy controls. This suggests that adenomyosis may be associated with greater vascular remodeling and subclinical atherosclerosis. Chronic inflammation and estrogen dominance in adenomyosis could contribute to endothelial dysfunction and thickening of the arterial wall.

Previous studies have primarily focused on leiomyoma and reported conflicting results. While Laughlin-Tommaso *et al* (28) and Aksoy *et al* (10) observed higher CIMT in leiomyoma patients, the present results suggest that adenomyosis may be linked to even greater vascular changes. This difference might reflect the more diffuse inflammatory activity and elevated estrogen levels typical of adenomyosis compared to the localized fibrotic nature of leiomyoma. Korkmaz *et al* (11) found no significant difference in CIMT between treatment and control groups, although CIMT increased with age and time since menopause, emphasizing the influence of aging on vascular health.

It was also demonstrated that women with leiomyomas exhibit an unfavorable lipid profile, insulin resistance, and increased CIMT, supporting the hypothesis that benign uterine disorders may reflect systemic vascular dysfunction. Conversely, Miller *et al* (9) found no significant difference in CIMT between treatment and control groups, although CIMT increased with age and time since menopause, emphasizing the influence of aging on vascular health.

Taken together, findings of the current study support the hypothesis that adenomyosis is associated with greater vascular changes than leiomyoma, independent of BMI. The positive correlations of CIMT with age and waist circumference further reinforce the role of metabolic and hormonal factors in subclinical atherosclerosis among women with these uterine disorders. Larger longitudinal studies are required to clarify whether adenomyosis independently contributes to cardiovascular risk and to explore potential preventive strategies for affected women.

Conclusion

This study evaluated CIMT as an indicator of vascular health in women with uterine leiomyoma, adenomyosis, and healthy controls. The findings revealed that CIMT was significantly higher in the adenomyosis group, suggesting a greater impact of this condition on vascular remodeling and subclinical atherosclerosis compared to leiomyoma and normal uterine structure.

A positive correlation was observed between CIMT and both age and waist circumference in women with leiomyoma and adenomyosis, indicating that aging and central adiposity contribute to early vascular changes in these patients.

These results highlight the importance of cardiovascular risk assessment in women with benign uterine disorders, particularly adenomyosis. Further multi-center, longitudinal studies are recommended to better understand the underlying mechanisms and confirm whether adenomyosis serves as an independent risk factor for cardiovascular disease.

Ethical approval

This study was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.

REC.1402.550). All the participants provided written informed consent prior to inclusion in the study and were informed of their right to withdraw at any stage without any consequences. This study was not registered as a clinical trial.

Funding

This research received no external funding.

Acknowledgement

The authors would like to express their gratitude to the Guilan University of Medical Sciences, the Anesthesiology Research Center, the Department of Anesthesiology, and the Razi Clinical Research Development Unit for their support. Special thanks are also extended to the nurses and staff who contributed to data collection and patient coordination during this study.

Conflict of Interest

The authors declare no conflict of interest related to this study.

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