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ASSOCIATION BETWEEN THYROID DYSFUNCTION AND OVARIAN MORPHOLOGY IN WOMEN WITH MENSTRUAL DISORDERS

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ABSTRACT

Background: Thyroid hormones are significant hormones in female reproductive physiology affecting menstrual cyclicity, ovarian steroidogenesis, follicular development and ovulation. Thyroid dysfunction can be associated with irregular menstrual periods and can cause changes in the morphology of the ovary in ultrasound examination.

Objective: To determine the association between thyroid dysfunction and ovarian morphology among women presenting with menstrual disorders.

Methods: This descriptive cross sectional study was conducted during the period from January 2025 to June 2025 in the Muhammad College of Medicine, Peshawar. It was the non-probability consecutive sampling, which resulted in inclusion of 88 women suffering from menstrual disorders. The data collected were demographic and clinical which were entered onto a structured proforma. The thyroid function was determined by assessing the level of serum TSH, free T3 and free T4. The subjects were divided into two groups: euthyroid and thyroid dysfunction. Pelvic ultrasonography was done to evaluate the morphological characteristics of the ovary, such as ovarian volume, number of follicles, stromal echogenicity, polycystic ovarian morphology and simple ovarian cysts. Data was analysed using SPSS version 26. P value < 0.05 was taken as statistically significant.

Results: The mean age of participants was 28.7 ± 6.1 years, while the mean BMI was 25.9 ± 4.3 kg/m². Oligomenorrhea was the most common menstrual disorder, observed in 31 (35.2%) women. Thyroid dysfunction was present in 37 (42.0%) participants, with subclinical hypothyroidism being the most frequent abnormality. Normal ovarian morphology was observed in 44 (50.0%) women, polycystic ovarian morphology in 28 (31.8%), and simple ovarian cysts in 16 (18.2%). Polycystic ovarian morphology was significantly more frequent among women with thyroid dysfunction compared with euthyroid women (45.9% vs 21.6%, p=0.041). Women with thyroid dysfunction also had significantly higher mean ovarian volume, follicle count, and stromal echogenicity. TSH level showed a positive correlation with ovarian volume and follicle count.

Conclusion: Thyroid dysfunction was significantly associated with altered ovarian morphology among women with menstrual disorders. Subclinical hypothyroidism was the most common thyroid abnormality, and women with thyroid dysfunction showed a higher frequency of polycystic ovarian morphology, increased ovarian volume, and higher follicle count. Thyroid function testing should be considered as part of routine evaluation in women presenting with menstrual irregularities.

KEYWORDS: Thyroid dysfunction, menstrual disorders, ovarian morphology, polycystic ovarian morphology, TSH, ultrasonography

INTRODUCTION

Menstrual disorders are one of the most common complaints in women of reproductive age, which can manifest as oligomenorrhea, menorrhagia, polymenorrhea, amenorrhea or irregular menstrual cycles. Such abnormalities can impact quality of life, reproductive planning, psychological health and fertility. Menstrual regularity is dependent on the interaction of the hypothalalmic-pituitary-ovarian axis, and any imbalance in the hormones of the axis can cause irregular cycle, menstrual changes or the absence of menstruation [1-3].

Thyroid hormones play an important part in female reproductive function. They affect ovarian follicular development, ovulation, activity of sex hormone-binding globulin, metabolism of estrogen and activity of gonadotropins. Thyroid

dysfunction may affect menstrual cyclicity in several ways: changes in prolactin levels, changes in luteal function, anovulation, or changes in production of ovarian steroid levels. Oligomenorrhea, amenorrhea, menorrhagia, anovulatory cycles are commonly seen in hypothyroidism, and irregular or decreased menstrual flow is seen in hyperthyroidism [4-6].

Ovarian morphology measured using ultrasonography is important for knowing the ovarian volume, dominant follicle formation, ovarian cysts, polycystic ovarian morphology, and follicle number. Many women with irregular periods have polycystic ovarian morphology and endocrine disturbances may be responsible for this. Thyroid dysfunction can have overlapping clinical and sonographic features, although it is thought that the former is the more likely to cause altered ovarian morphology. Thus, thyroid disorders should be taken into account when assessing women with menstrual irregularities and ovarian morphological changes [7-9].

It is important to note that subclinical thyroid dysfunction may be especially significant in that many women may not have any symptoms of thyroid disease. There may be some minor levels of thyroid stimulation or suppression that have a clinical impact on reproductive function, which can be a contributor to menstrual irregularity and impact follicular development. Women may continue to have unnecessary follow-up gynecological checks without correcting the underlying thyroid condition if it is not detected. Early identification of thyroid disorder can help to promote normal menstruation and reproductive management [10, 11].

Despite the known relationship between thyroid function and menstrual health, the association between thyroid dysfunction and ovarian morphology remains less frequently assessed in routine clinical practice. Evaluating thyroid profile together with ultrasonographic ovarian findings may provide better understanding of endocrine and structural changes in women with menstrual disorders. This study was therefore conducted to determine the association between thyroid dysfunction and ovarian morphology among women presenting with menstrual disorders at Muhammad College of Medicine, Peshawar.

METHODOLOGY

This descriptive cross-sectional study was conducted at Muhammad College of Medicine, Peshawar, from January 2025 to June 2025**.** The study was designed to evaluate the association between thyroid dysfunction and ovarian morphology among women presenting with menstrual disorders. A total of 88 women were included in the study after fulfilling the selection criteria. Participants were enrolled through a non-probability consecutive sampling technique from the outpatient department and relevant gynecology evaluation units.

The study included women in the age range of 20 to 44 years who complained of any of the mentioned menstrual abnormalities (oligomenorrhea, menorrhagia, polymenorrhea, amenorrhea, irregular periods). If there was a history of ovarian malignancy, a previous laparotomy, pregnancy, lactation, use of hormonal therapy in the previous three months or chronic systemic illness that affected on any of the reproductive or thyroid functions, the patient was excluded. Women who were already on thyroid treatment were also not included to avoid the changes in biochemical thyroid parameters.

After enrollment, written informed consent was obtained from all participants. Demographic and clinical data (age, marital status, BMI, duration of menstrual symptoms, type of menstrual disorder, regularity of cycles, flow pattern and associated symptoms-dysmenorrhea) was collected using a structured proforma. BMI was defined as body weight (kg/m2). A detailed history of the menstrual period was taken and the type of menstrual disturbance was classified.

Each participant had their venous blood drawn for thyroid function testing, under aseptics. Standard laboratory methods were used to measure serum thyroid-stimulating hormone (TSH), free triiodothyronine (FT3) and free thyroxine (FT4). Participants were classified as EUTHYROID, subclinical hypothyroid, overt hypothyroid, subclinical hyperthyroid, or overt hyperthyroid based on the thyroid function tests. Thyroid dysfunction was considered to be any thyroid test abnormality that was not within the normal range of the institutional laboratory.

A pelvic ultrasound protocol was utilized by an experienced sonologist to evaluate the morphology of the ovary by ultrasound. Transabdominal or transvaginal ultrasound was chosen based on marital status, patient comfort, and clinical appropriateness. Ovarian volume, the number of follicles, their size, echogenicity of the stroma, presence of dominant follicles, polycystic ovary and simple cysts of the ovary were assessed in both ovaries. The volume of the ovary was estimated by the standard ellipsoid formula. Increased number of follicles and/or increased ovarian volume on ultrasound with peripheral follicles was considered as polycystic ovarian morphology.

The primary outcome variable was ovarian morphology, which included ovarian morphology within the normal range, polycystic ovarian morphology and simple ovarian cyst. The main independent variable was thyroid status. Other parameters were: Age, BMI, menstrual disorder period, type of menstrual disorder, TSH, free T3, free T4, volume of the ovary, number of follicles, and stromal echogenicity. Data were systematically compiled before entering and analysing them.

The data was analysed by SPSS version 26. Means and standard deviations were reported for quantitative variables (age, BMI, duration of symptoms, TSH level, ovarian volume, and the number of follicles). Menstrual disorder type, thyroid status and ovarian morphology were presented as frequencies and percentages (qualitative variables). The chi-

square test was used to determine the association between thyroid dysfunction and ovarian morphology. Independent sample t-test was used to compare the mean ovarian volume and follicle count between euthyroid women and women with thyroid dysfunction. The correlation between TSH and parameters of ovarian morphology was done by Pearson or Spearman correlation, depending on distribution of data. The p value of < 0.05 was accepted as statistically significant.

RESULTS

Overall, 88 women suffering from menstrual disorders participated in the study. The mean age of the participants was 28.7 ± 6.1 years, while the mean BMI was 25.9 ± 4.3 kg/m². The age group of the majority of women was 26-35 years. Oligomenorrhea was the most common menstrual abnormality, followed by menorrhagia and irregular menstrual cycles.

Table 1. Baseline demographic and clinical characteristics of participants

Variable	Frequency / Mean	Percentage
Total participants	88	100.0
Age, years	28.7 ± 6.1	—
BMI, kg/m²	25.9 ± 4.3	—
Duration of menstrual symptoms, months	11.6 ± 5.4	—
Age group		
18–25 years	27	30.7
26–35 years	45	51.1
>35 years	16	18.2
BMI category		
Normal weight	32	36.4
Overweight	37	42.0
Obese	19	21.6
Marital status		
Married	56	63.6
Unmarried	32	36.4

Oligomenorrhea was the most frequent menstrual disorder observed in 35.2% of women. Twenty-two women had menorrhagia (22.7%) and 20.5% had irregular cycles. Amenorrhea and polymenorrhea were less common.

Table 2. Distribution of menstrual disorders among study participants

Menstrual disorder	Frequency	Percentage
Oligomenorrhea	31	35.2
Menorrhagia	20	22.7
Irregular cycles	18	20.5
Amenorrhea	11	12.5
Polymenorrhea	8	9.1
Total	**88**	**100.0**

Thyroid dysfunction was found in 42.0% of the participating subjects. Subclinical hypothyroidism was the most common thyroid abnormality, followed by overt hypothyroidism. Hyperthyroid condition was less common in this study group.

Table 3. Thyroid function status of participants

Thyroid status	Frequency	Percentage
Euthyroid	51	58.0
Subclinical hypothyroidism	21	23.9
Overt hypothyroidism	10	11.4
Subclinical hyperthyroidism	4	4.5
Overt hyperthyroidism	2	2.3
Total	**88**	**100.0**

On ultrasonography, normal ovarian morphology was found in 50.0% of women. Ovarian morphology was polycystic in 31.8% and simple ovarian cysts in 18.2% of the participants. The average volume of the right ovary was 8.4 cm³ ± 2.9 and of the left ovary was 8.1 cm³ ± 2.7.

Table 4. Ultrasonographic ovarian morphology findings

Ovarian morphology finding	Frequency / Mean	Percentage
Normal ovarian morphology	44	50.0
Polycystic ovarian morphology	28	31.8
Simple ovarian cyst	16	18.2
Right ovarian volume, cm^3	8.4 ± 2.9	—
Left ovarian volume, cm^3	8.1 ± 2.7	—
Mean follicle count	13.8 ± 5.2	—
Increased stromal echogenicity	24	27.3

Polycystic ovarian morphology was more common among women with thyroid dysfunction compared with euthyroid women. The frequency of polycystic ovarian morphology was 45.9% among women with thyroid dysfunction and 21.6% among women with euthyroidism. This correlation was significant statistically with p-value of 0.041.

Table 5. Association between thyroid dysfunction and ovarian morphology

Ovarian morphology	Euthyroid n=51	Thyroid dysfunction n=37	Total	p-value
Normal ovarian morphology	31 (60.8%)	13 (35.1%)	44	
Polycystic ovarian morphology	11 (21.6%)	17 (45.9%)	28	0.041
Simple ovarian cyst	9 (17.6%)	7 (18.9%)	16	
Total	**51 (100.0%)**	**37 (100.0%)**	**88**	

Women with thyroid deficiency had a higher mean ovarian volume and a higher mean number of follicles than did women with normal thyroid function. The average ovarian volume was 9.2 ± 2.8 cm^3 in women with thyroid dysfunction and 7.6 ± 2.4 cm^3 in euthyroid women. The difference was statistically significant at the p-value of 0.006.

Table 6. Comparison of ovarian parameters according to thyroid status

Ovarian parameter	Euthyroid n=51	Thyroid dysfunction n=37	p-value
Mean ovarian volume, cm^3	7.6 ± 2.4	9.2 ± 2.8	0.006
Mean follicle count	12.1 ± 4.6	16.0 ± 5.4	0.001
Increased stromal echogenicity	9 (17.6%)	15 (40.5%)	0.018
Dominant follicle present	29 (56.9%)	13 (35.1%)	0.044

The results of correlation analysis revealed the positive correlation between serum TSH level and ovarian volume. There was also a strong positive correlation between TSH level and the number of follicles. This suggests that women with menstrual disorders who had a higher TSH level had larger ovarian volume and a higher number of follicles.

Table 7. Correlation of TSH level with ovarian morphology parameters

Parameter	Correlation coefficient r	p-value
TSH and mean ovarian volume	0.36	0.001
TSH and follicle count	0.41	<0.001
TSH and stromal echogenicity	0.29	0.007
TSH and duration of menstrual symptoms	0.25	0.019

In general, menstrual dysfunction was found to be associated with thyroid dysfunction in women. Subclinical hypothyroidism was the most common thyroid disorder. Thyroid dysfunction women had significantly higher frequency of polycystic ovarian morphology, ovarian volume, number of follicles and echogenicity of ovarian stromal area than the euthyroid women. The results indicated that there is an important correlation between thyroid dysfunction and ovarian morphological alterations in women with menstrual disorders.

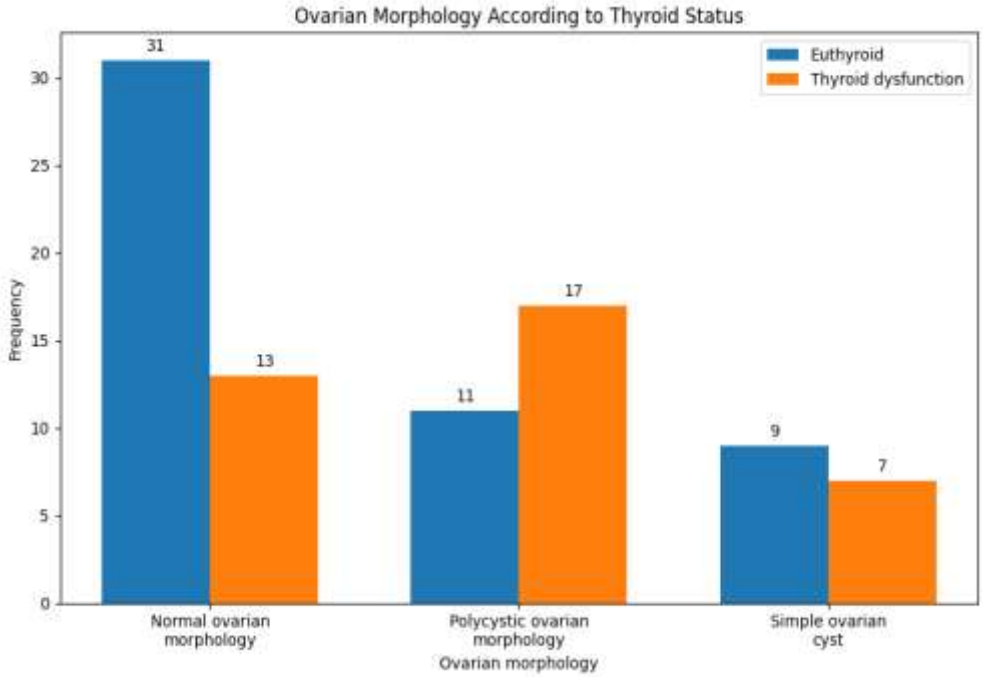

Figure 1. Ovarian morphology according to thyroid status among women with menstrual disorders.

DISCUSSION

The present study evaluated the association between thyroid dysfunction and ovarian morphology among women presenting with menstrual disorders. In this study, thyroid dysfunction was observed in a considerable proportion of participants, with subclinical hypothyroidism being the most frequent thyroid abnormality. This finding suggests that thyroid imbalance may remain clinically mild but still contribute to reproductive disturbances. Since thyroid hormones influence ovarian steroidogenesis, gonadotropin activity, prolactin regulation, and menstrual cyclicity, even minor thyroid dysfunction can disturb normal ovarian and endometrial function [12, 13].

The most prevalent menstrual abnormalities among the study population were oligo and menorrhagia, in that order, followed by irregular menstrual periods. The pattern suggests that the dysfunction of the thyroid gland can influence the menstrual function in various ways. Altered estrogen metabolism and changes in sex hormone-binding globulin are associated with delayed cycles, anovulation and heavy menstrual bleeding, all of which are common features of hypothyroidism. However, an overactive thyroid can cause irregular or light periods. The variations in menstrual pattern observed in this study is significant and highlights the need to screen for thyroid in women with persistent menstrual complaints [14-16].

The polycystic ovarian morphology was more prevalent in women with thyroid dysfunction than in those who were euthyroid in the ultrasound evaluation. 45.9 % of women with thyroid dysfunction versus 21.6 % of women with euthyroid had polycystic ovarian morphology and the association was statistically significant. This is a finding that corroborates the possibility that thyroid dysfunction may affect the structure of the ovary through its impact on follicular growth and function. Hyperthyroidism can lead to hyperresponsiveness of the ovary to gonadotropins and follicular persistence, manifested in the form of an increased number of ovarian follicles or polycystic morphology of the ovary on ultrasound [8, 16].

Both ovarian volume and ovarian follicle count were significantly higher in thyroid dysfunction female than in euthyroid female. The thyroid dysfunction group was also more likely to have increased stromal echogenicity. The results suggest that thyroid dysfunction can not only impact menstruation but may also be associated with the morphological changes of the ovary which can be seen. There was positive correlation between TSH level and ovarian volume, and TSH level and the number of follicles. Higher levels of thyroid stimulating hormone may be associated with greater ovarian changes in women who have menstrual disorders [17, 18].

The results of this study are clinically relevant. Thyroid function is seldom evaluated in women with menstrual irregularities, and gynecological or ovarian disorders may be the first diagnosis made. Based on the obtained results, it seems that thyroid function tests should be performed as a regular part of the assessment in women with menstrual disorders, especially in those in whom ultrasound reveals increased ovarian volume and/or polycystic ovarian

morphology and/or increased follicle count. Preventing unnecessary delay for diagnosis may be achieved due to early detection and management of thyroid dysfunction, which may help improve menstrual regularity [19, 20].
There are some limitations in this study. This was done in a single centre and the sample size was small (88) so results may not be applicable to other populations. One of the drawbacks of the cross sectional design is that it is unable to determine a direct cause and effect relationship between thyroid dysfunction and ovarian morphology. The hormonal parameters, which might have given a wider picture of hormonal interactions, were not included in detail. More extensive reproductive hormonal analysis is suggested and multicenter studies with larger numbers are recommended to confirm these results.

CONCLUSION

This study concluded that thyroid dysfunction was common among women presenting with menstrual disorders, with subclinical hypothyroidism being the most frequent abnormality. Polycystic ovarian morphology, increased ovarian volume, higher follicle count, and increased stromal echogenicity were more frequent among women with thyroid dysfunction compared with euthyroid women. A significant positive correlation was observed between TSH level and ovarian volume and follicle count. These findings suggest that thyroid dysfunction is significantly associated with ovarian morphological changes in women with menstrual irregularities. Routine thyroid function assessment should be considered in the evaluation of women with menstrual disorders to support early diagnosis and appropriate management.

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