



Prevalence of Endocrine Abnormalities in Adolescent Girls with Menstrual Disorders in a Tertiary Care Hospital in Chennai

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Purpose: To identify endocrine abnormalities such as hyperandrogenism, thyroid disorders, and hyperprolactinemia in adolescents with menstrual disorders.

Methods: This was a case-control study carried out in adolescent girls aged 10–19 years in the gynecology outpatient department of a tertiary care hospital. The participants' demographic details, medical, surgical, family, and personal history was obtained. Data of hormonal evaluation, namely serum T3, T4, TSH, serum prolactin and serum testosterone was also collected.

Results: The most common menstrual abnormality was oligomenorrhea at 66% followed by menorrhagia at 10%. Primary amenorrhea was seen in 8% cases, metrorrhagia was seen in 4% and polymenorrhea in 4% of cases. Secondary amenorrhea and hypomenorrhea were both seen in 2% of cases. 10% adolescents with menstrual abnormalities had biochemical hyperandrogenism. Only 2% had hyperandrogenism in the control group. Thyroid dysfunction was more prevalent in the adolescents with menstrual disorders (14%) when compared to controls (4%). Among those with oligomenorrhea, only in one case was serum prolactin raised (3.0%).

Conclusion: Immaturity of hypothalamic pituitary ovarian axis is considered to be the most common cause of menstrual irregularities in adolescent girls, but endocrine abnormalities may be responsible in some cases. Therefore it is paramount to examine the prevalence endocrine abnormalities among among adolescents with menstrual problems to promote their quality of life, lower her risks for future disease, and ill health.

Keywords: Adolescents; Thyroid disorders; Hyperprolactinemia; Hyperandrogenism; Oligomenorrhea.

1. INTRODUCTION

Adolescence is the stage of life between childhood to adulthood. During this period of transition, children undergo rapid changes which are mediated by sex hormones. Ages from 10 to 19 years is considered the period of adolescence by the WHO. The most common complaint amongst adolescent girls is menstrual dysfunction. An Egyptian cross-sectional survey showed that approximately 7.7% of girls had significant menstrual dysfunction affecting life activities and resulting in school absence [1]. Menstrual dysfunction has a negative impact on daily life activities of adolescent girls resulting in inability to concentrate on studies, work, class, school absenteeism, and inability to perform physical training. The most common cause of menstrual dysfunction during adolescence is anovulatory cycles due to immaturity of hypothalamic pituitary ovarian (HPO) axis [2]. Other hormonal abnormalities that can cause anovulation and prolonged menstrual bleeding includes excess androgen production, thyroid disorders, hyperprolactinemia.

Hyperandrogenism has been observed in up to 12.2% of adolescent girls with menstrual disorders [3]. Although thyroid disorders are proven to be able to cause menstrual abnormalities [4], there is a lack of this data for adolescents. Hyperprolactinemia is also a cause of menstrual dysfunction and it is not rare in young women. It is prevalent in 5.5% of adolescents with secondary amenorrhea [5].

The evidence available in this area of gynaecology is often based on older women in the reproductive age group between 20–45 years. It is assumed that the results can be extrapolated to adolescents, however this may not always be the case. Therefore, this study was proposed to identify endocrine abnormalities such as hyperandrogenism, thyroid disorders, and hyperprolactinemia in adolescent girls aged 10–19 years with menstrual disorders. Identifying and treating endocrine abnormalities may correct the menstrual disorders which would not

necessitate treatment with estrogen and progesterone, which are often used to treat menstrual irregularities in adolescents.

2. METHODS

This case–control study was conducted in the Gynecology outpatient department of Saveetha Medical college and hospital. The Ethics Committee of SMCH approved the study protocol. Girls aged between 10 and 19 years were asked to participate. After obtaining informed consent, patients who fulfilled the inclusion criteria based on their menstrual history were included into the study.

2.1 Inclusion Criteria

The case group included adolescent girls between 10–19 years who had complaints of menstrual disorders. Menstrual disorders included primary amenorrhea, oligomenorrhea, polymenorrhea, hypomenorrhea, secondary amenorrhea, and menorrhagia.

The control group was adolescent girls aged 10–19 years in whom menstrual disorders were not present.

Primary amenorrhea was defined as the absence of menstruation by 14 years of age without the presence of secondary sexual characteristics or menarche not attained by 16 years of age with secondary sexual characteristics. Secondary amenorrhea was defined as the cessation of menstruation for more than three cycles or less than six months once they had commenced. Oligomenorrhea was defined as infrequent menstruation that occurs at intervals greater than 45 days in adolescents. Polymenorrhea was defined as frequent episodes of menstruation usually occurring at intervals of less than 21 days. Hypomenorrhea was defined as regular menstrual cycles with scanty bleeding. Menorrhagia was defined as regularly timed episodes of bleeding that are excessive in amount greater than 80 ml or duration of flow greater than five days.

Briefing was done for the participants and parents/guardians of the participants regarding the study. The participants' demographic details, medical, surgical, family, and personal history was obtained. Data of hormonal evaluation, namely serum T3, T4, TSH, serum prolactin and serum testosterone was also collected.

Sample size was calculated to be 50 for each group with a 1:1 ratio of cases to controls. Calculations were based on two-sided confidence levels of 95% using OpenEPI software. Categorical variables were compared using the Chi-squared test.

Continuous variables such as age, serum T3, T4, TSH, serum testosterone and serum prolactin are presented with mean and standard deviation. Data was analyzed using SPSS version 16.0; $p < 0.05$ was considered significant.

3. RESULTS

The mean age of the participants was found to be 16.5 ± 1.6 years in the cases and 16.9 ± 1.7 in the control group. Majority of girls in the study population had completed or were completing higher secondary school education. 64% of adolescents enrolled in this study hailed from Chennai, the remaining girls were from other nearby towns.

The most common complaint reported in the control group was white discharge per vaginum (42%) followed by pain in abdomen (20%), urinary tract infection 18%, dysmenorrhea 8%, and 12% other. Other complaints included body ache, coarse skin, myalgia and not gaining weight.

26% of the girls in the case group attained menarche at 13 years of age. 34% of girls in the control group 34% had menarche at 12 years of age. The difference in the age of attaining menarche among two groups was found to be significant ($p < 0.001$). Among the cases, the most common abnormality was oligomenorrhea at 66% followed by menorrhagia at 10%. Primary amenorrhea was seen in 8% cases, metrorrhagia was seen in 4% and polymenorrhea in 4% of

cases. Secondary amenorrhea and hypomenorrhea were both seen in 2% of cases.

The mean total testosterone level was found to be 36.32 ± 17.28 ng/dl in the controls and 42.17 ± 23.76 ng/dl in the cases. The difference between the total testosterone level between the cases and controls was found to be statistically significant ($p = 0.004$). 10% adolescents with menstrual abnormalities had biochemical hyperandrogenism in comparison with 2% in the control group as shown in Table 1. The risk of menstrual abnormalities was more among the subjects with biochemical hyperandrogenism compared to those with normal testosterone levels. The Odd's ratio was found to be 5.4 with 95% confidence interval between 0.6 - 48.4. Clinical hyperandrogenism was prevalent in 10% of cases. No girls in the control group with normal menstruation had clinical hyperandrogenism. The difference in the prevalence of hyperandrogenism, regardless of biochemical or clinical hyperandrogensim, between cases and controls was found to be statistically significant in the present study.

Mean level of serum free T3 in cases (2.74 ± 0.69 pg/ml) was lesser than that in controls (2.77 ± 0.64 pg/ml). No statistical significance was found ($p = 1.644$). The mean level of free serum T4 in the cases was 1.47 ± 0.61 pg/dl and in the controls it was 1.43 ± 0.64 pg/dl. No statistical significance was found ($p = 0.134$). The mean level of serum TSH was higher in cases (6.76 ± 18.68 μ IU/ml) than in controls (3.04 ± 1.47 μ IU/ml). This was found to be statistically significant ($p = 0.001$). Overall thyroid dysfunction was seen in in 9 of the 100 participants enrolled in the study. Table 2 shows that thyroid dysfunction was more prevalent in the adolescents with menstrual disorders (14%) when compared to controls (4%). The chances of having menstrual abnormalities was increased in tsubjects who had abnormal thyroid function tests when compared to those who had normal thyroid status. Odd's ratio was found to be 3.9 with 95% confidence interval between 0.7 to 19.8.

Table 1. Prevalence of hyperandrogenism in the study groups

	Case (n = 50)	Control (n = 50)	Total (n = 100)
Biochemical Hyperandrogenism			
Present	5 (5%)	1 (2%)	6 (6%)
Absent	45 (90%)	49 (98%)	94 (94%)
Clinical Hyperandrogenism			
Present	5 (5%)	0 (0%)	5 (5%)
Absent	45 (90%)	50 (100%)	95 (95%)

Table 2. Prevalence of thyroid dysfunction in the study groups

Thyroid condition	Cases (n = 50)	Controls (n = 50)	Total (n= 100)
Normal	43 (86%)	48 (92%)	91 (91%)
Hypothyroidism	6 (12%)	2 (4%)	8 (8%)
Primary	5 (10%)	2 (4%)	7 (7%)
Secondary	1 (2%)	0 (0%)	1 (1%)
Hyperthyroidism	1 (2%)	0 (0%)	1 (1%)
Primary	1 (2%)	0 (0%)	1 (1%)
Secondary	0 (0%)	0 (0%)	0 (0%)
Total	50	50	100

Table 3. Prevalence of hormonal abnormalities in adolescents with menstrual disorders

Menstrual abnormality	Cases	Hyperandrogenism	Thyroid Dysfunction	Hyperprolactinemia
Primary Amenorrhea	4 (8%)	0 (0.0%)	1 (25.0%)	0 (0.0%)
Secondary Amenorrhea	2 (4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Polymenorrhea	2 (4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Oligomenorrhea	33 (66%)	4 (12.1%)	3 (9.1%)	1 (3.0%)
Hypomenorrhea	1 (2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Menorrhagia	5 (10%)	1 (20.0%)	2 (40.0%)	0 (0.0%)
Metrorragia	2 (4%)	0 (0.0%)	1 (50.0%)	0 (0.0%)
Intermenstrual Bleeding	2 (4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	50	5 (10.0%)	7 (11.2%)	1 (2.0%)

The mean serum prolactin level was 13.97 ± 8.58 ng/ml in the cases and 12.87 ± 4.29 ng/ml in the controls. However, this difference in was not found to be statistically significant ($p = 0.178$). Only in one case was serum prolactin raised (3.0%). Hyperprolactinemia was not seen in any of the girls in the control group.

4. DISCUSSION

Typically adolescent girls don't approach the gynecologist, probably because of embarrassment, fear, or ignorance about normality of menstruation. A large study in 2411 adolescents found that only 33% girls had consulted general practitioners and only 9% were referred to specialists for menstrual complaints [6]. This fear and embarrassment is unfounded because during adolescence, there is a tendency of irregularity in menstrual cycles, and this is mostly due to immaturity of hypothalamic pituitary ovarian axis. Occasionally irregular menses may be caused by underlying endocrine disorders such as hyperandrogenism, hypothyroidism, hyperthyroidism, and hyperprolactinemia.

Current studies which evaluate endocrine abnormalities in adolescents with menstrual disorders are few. In this study, the mean age was lower than other studies which had a mean age of 18.15 ± 2.4 years [7], but similar to another study [8]. The prevalence of polymenorrhea in this study was similar to an Italian study [9], but

other studies from Malaysia and Africa [10] have shown higher prevalence.

Because hirsutism takes a long time to develop in the presence of high levels of circulating androgens, it is uncommon in adolescents when compared to adults [3]. Hirsutism with various grades of F–G score was prevalent in 10.0% of all participants in this study. A community-based study in Puducherry has found a similar prevalence of hirsutism (13.7%) [11]. The prevalence of clinical hyperandrogenism was found to be lower in other studies ranging from 3.4 to 5.65% [10]. The cause of this prevalence could be due to a lower score cutoff was used (F–G score less than six). The mean total testosterone level in our study was similar to another community-based study, which found total testosterone levels of 34 ± 10 ng/dl in the non-PCOS group and a level of total testosterone of 45 ± 19 ng/dl in the PCOS group [7]. Mean testosterone level in adolescents with PCOS was found to be 33.37 ± 20.47 ng/dl in another study done in Korea [5]. Six cases of biochemical hyperandrogenism were seen in adolescents with menstrual dysfunction, out of which 80.0% had oligomenorrhea and 20.0% had menorrhagia.

There is a lack of studies in the literature evaluating the prevalence of thyroid disorders specifically in adolescents with menstrual abnormalities. The data currently available describes menstrual disturbances in patients who

already had existing thyroid dysfunction among women in the reproductive age group [10]. The evidence shows that the prevalence of menstrual disturbances in thyroid dysfunction was either not different from those in healthy controls or was less frequently associated with menstrual irregularities. Our study has attempted to establish prevalence of thyroid disorders in adolescent girls with and without menstrual disorders. The prevalence of hypothyroidism was 12.0% and hyperthyroidism was 2.0% in girls with menstrual disorders. Another study from Puducherry, India which evaluated thyroid dysfunction in women in the age group between 20–80 years found that 84.2% women were euthyroid, 11.5% women hypothyroid and 1.8% women hyperthyroid. This shows a comparable prevalence of thyroid dysfunction in older women and adolescent girls.

Seven adolescents with menstrual disorders had thyroid dysfunction in the present study. Among those with thyroid dysfunction, 42.9% had oligomenorrhea, 28.6% were menorrhagic, 14.2% had primary amenorrhea, and 14.2% had metrorrhagia. A study conducted in older women aged between 20 and 45 years found a higher prevalence of hypomenorrhea (3.7%) and secondary amenorrhea (2.5%) in patients with severe hyperthyroidism than those with mild or moderate hyperthyroidism (0.2% for secondary amenorrhea and 0.9% for hypomenorrhea). Menstrual disturbances were shown to be more common in patients with severe hypothyroidism (34.8%) when compared to mild or moderate hypothyroidism (10.2%) [11].

Out of the cases in this study, the prevalence of hyperprolactinemia was found to be 2.0%. The prevalence varies from 0.4% in the normal adult population to as high as 9 to 17% in women who have menstrual disorders [11]. In our study, hyperprolactinemia was seen with oligomenorrhea. Another study found the prevalence of hyperprolactinemia was 5.5% in cases with secondary amenorrhea and 2.6% in abnormal uterine bleeding in the adolescent age group [12,13].

This is one among the few studies which provided information regarding the pattern of menstrual disturbances and prevalence of endocrine abnormalities in adolescents with menstrual disorders. Other studies examine wide ranges of age, but this study has restricted the inclusion age to 10–19 years to accurately assess adolescent girls. The prevalence of symptoms and etiology may vary from that of all

adolescent girls with menstrual problems since the study population was recruited from a tertiary care hospital. Immaturity of hypothalamic pituitary ovarian axis is considered to be the most common cause of menstrual irregularities in adolescent girls, but endocrine abnormalities may be responsible in some cases, warranting further evaluation.

5. CONCLUSION

Menstruation is a unique female phenomenon, that signifies the start of reproductive potential, and it is considered as an indicator of women's health. Because of this adolescent girls should have an understanding of their own menstruation pattern and any factors which may contribute to menstrual disorders such as age, weather, activities and body mass index. To increase their understanding, appropriate management of menstrual dysfunction and clarification of menstrual issues would be greatly beneficial to them.

Current literature shows that a majority of adolescent girls experience menstrual dysfunction of varying degrees. Although most menstrual problems can be attributed to an ill developed hypothalamo-pituitary ovarian axis, menstrual problems can also be caused by endocrine diseases. Assessing the prevalence of endocrine abnormalities in these girls will allow for more accurate diagnosis. Therefore it is paramount to examine the prevalence endocrine abnormalities among adolescents with menstrual problems to promote their quality of life, lower her risks for future disease, and ill health.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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