



Original Article

Psychological effects of precocious puberty on young girls and their mothers

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ABSTRACT

Objectives: Puberty is a period during which children undergo significant biological, physical, and emotional changes. Parents are often concerned about early sexual maturation. This study aimed to investigate the psychological impact of early pubertal onset on girls and their mothers.

Material and Methods: A pediatric psychiatrist evaluated female patients with early breast enlargement and their mothers. Children and adolescents were assessed using a Behavior Assessment Scale and a Depression Scale, while their mothers were assessed using the Depression, Anxiety and Stress Scale, and the Positive and Negative Emotion Scale.

Results: Twenty-one female subjects, 14 with early breast development and seven controls with no signs of puberty, were evaluated. The mean age at the onset of puberty signs was 7.25 ± 0.42 years. Somatic complaints, social problems, and slow cognitive tempo scores were significantly higher in patients with central precocious puberty (CPP) in comparison to both the premature thelarche (PT) patients and the control group. Maternal anxiety scores were higher in both the CPP and PT groups compared to the controls.

Conclusion: Higher anxiety scores in the mothers of girls with both CPP and PT indicate that the physical changes have an impact on maternal anxiety. Higher scores in girls with true CPP than those with still pre-pubertal hormone levels indicated that the activation of the hypothalamic-pituitary-gonadal axis and associated biological alterations may influence the psychological, cognitive, and behavioral status of the child.

Keywords: Precocious puberty, Premature thelarche, Children, Mothers, Psychological effects

INTRODUCTION

Precocious puberty (PP) is defined as the onset of secondary sexual development before the age of 8 years in Caucasian girls.^[1] The first sign of puberty in girls is breast development, which may occur due to the activation of the hypothalamic-pituitary-gonadal axis (central PP) or the secretion of steroids from the gonads or other tissues (peripheral PP), and due to premature thelarche (PT). PT is a condition characterized by isolated breast development without other signs of puberty, such as rapid progression, accelerated growth and skeletal maturation, and increased levels of gonadotropins and estradiol.^[2]

Parents are often concerned about early sexual maturation, particularly the early onset of menstruation, which can be stressful for a young girl. Some studies have linked PP to higher rates of psychiatric disorders and behavioral problems, while others have found no differences between

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children with PP and healthy populations. The current guidelines emphasize that there is insufficient evidence to make a treatment decision based on psychosocial effects in children with PP. The benefit of treatment is controversial, and further research is needed on this subject.^[3,4]

Puberty is a stage of development during which children undergo significant biological, physical, and emotional changes. Effective parent-adolescent communication is considered a protective factor against psychological issues. According to research, adolescent girls typically view their mothers as the primary source of information regarding puberty, menarche, and menstruation.^[5] Bader *et al.*^[6] analyzed interviews with young mothers of adolescent girls to gain a better understanding of mother–daughter communication. The study found that mothers play a primary role in communicating with girls about puberty. However, these conversations were often constrained due to a lack of knowledge and communication skills.

In clinical practice, it has been observed that parents, particularly mothers, experience more stress than their children when physical signs of puberty appear. They may perceive it as too early, even if it is normal for their child's age, and may attribute any problematic behavior to the onset of puberty. In other words, some mothers find it challenging to accept that their child is now an adolescent.

Thus, this study aims to examine the psychological impact of puberty on girls with early breast development and their mothers.

MATERIAL AND METHODS

The study analyzed girls aged 7–9 years who were referred to the pediatric endocrine outpatient clinic due to early-onset breast development. The aim was to evaluate the psychological effects on girls and their mothers in cases of PP in the gray zone (pubertal onset at 7–8 years of age) and early normal onset puberty (8–9 years of age). Patients and their mothers who agreed to undergo psychological evaluation in addition to endocrinologic evaluation were included in this study. Patients and/or mothers were excluded if they were deemed mentally incompetent to complete the study forms, had a known psychiatric illness, were taking psychiatric medication, had severe social problems, were illiterate, or had language barriers. Patients with abnormal brain magnetic resonance imaging results were also excluded from the study.

Patients were referred for psychiatric evaluation as part of the study. Psychological testing scales were administered concurrently with biochemical evaluation. A psychiatric evaluation was conducted before the treatment decision, and the results of the test scores were not disclosed to the endocrine specialist until the conclusion of the study to prevent any potential influence on the treatment decision.

The study adhered to the Helsinki II declaration and was approved by the local Ethical Committee (Approval number: 24.07.2019. B.10.1.TKH.4.34.H.GP.0.01/147).

Endocrinologic evaluation

Anthropometric measurements, bone age assessment, and baseline (and, if necessary, pharmacologically stimulated) gonadotropin levels, as well as ultrasonography for ovarian and uterine dimensions, were performed on patients in the endocrine outpatient clinic. The pubertal stages of the patients were evaluated according to the Tanner stages. The decision for treatment was made on an individual basis, considering the patient's age at puberty onset, progression rate of puberty, accelerated growth and bone age, hormone levels, ultrasonographic measurements, and the expectation of early menarche.

Endocrine parameters

1. Age at presentation, age at puberty onset, bone age, bone age advance (the difference between age and bone age), target height, predicted adult height, final height loss (the difference between predicted adult height and target height)
2. Birth weight, weight standard deviation score (SDS), height SDS, body mass index (BMI) SDS
3. Maternal menstrual age
4. Baseline and stimulated luteinizing hormone (LH) levels

The study analyzed patients who underwent a gonadotropin-releasing hormone (GnRH) stimulation test. This was because patients and their mothers had more time to complete study forms and psychological scales while waiting for the test procedure in the hospital. The GnRH test involved obtaining blood samples to measure stimulated gonadotropin levels at 30 and 60 min after intravenous administration of LH-releasing hormone (RH) Ferring® 0.1 mg/mL ampoule. Based on the LH-RH test, girls with a stimulated LH level above 5 mIU/mL were considered to have entered central puberty.^[7]

Psychiatric evaluation

First, the patients included in the study completed an evaluation form. The form requested information on the child's perinatal history, major illnesses, chronic illnesses or drug use, motor-mental development, the onset of puberty symptoms, weight gain and growth status, parents' age, occupation, education level and health status, number of children in the family, and mother's age at menarche. The questionnaire included two small tests on PP and its treatment, as well as one each for the anxiety status of the child and mother. The questions covered topics such as short adult stature, excessive weight gain with treatment, feelings of guilt and shame, anxiety about treatment side effects, and

fear of injection pain. Patients and their mothers completed separate sections of the questionnaire.

The mothers completed the Turkish version of the “Behavior Assessment Scale for Children and Adolescents Aged 6–18” by Achenbach T for their daughters.^[8,9] The daughters also completed the “Depression Scale for Children.”^[10] In addition, the mothers completed the Turkish version of the “Depression, Anxiety and Stress Scale (DASS)” by Lovibond and Lovibond (1995) for themselves.^[11,12] They also completed the “Positive and Negative Emotion Scale.”^[13,14]

Patients and mothers who agreed to participate in the study but were unable to complete the test scales were excluded. The study included 14 patients who met the criteria and seven age-matched control group patients who had no signs of puberty and met the other inclusion and exclusion criteria. The study excluded girls who had missing information on either their own or their mother’s scales.

Psychological parameters

1. Child’s Depression Scale Score
2. Mother’s DASS (total score: DASS-total, anxiety score: DASS-A, depression score: DASS-D, stress score: DASS-S)
 - DASS-A: 0-7: Normal, 8-9: Mild, 10-14: moderate, 15-19: Severe, >20: Extremely severe
 - DASS-D: 0-9: Normal, 10-13: Mild, 14-20: moderate, 21-27: Severe, >28: Extremely severe
 - DASS-S: 0-14: Normal, 15-18: Mild, 19-25: moderate, 26-33: Severe, >34: Extremely severe
3. Behavior Assessment Scale Scores (anxiety-depression, social introversion-depression, somatic complaint, rule-breaking behavior, aggressive behavior, social problem, thought problems, attention problems, obsessive-compulsive behavior, post-traumatic stress, slow cognitive tempo).

Statistical analysis

The Statistical Package for the Social Sciences 22.0 package program was used to analyze the data. The distribution of data was evaluated using the Shapiro–Wilks test. Descriptive analysis results were presented as mean \pm SD for normally distributed data and as median and interquartile range for non-normally distributed data. The patient group’s scale scores were compared with those of the control group. The study compared the scores of patients and mothers in two age groups (7–8 years and 8–9 years), the scores of girls diagnosed with CPP after endocrine tests to those with PT, the scores of university graduates and non-university graduate mothers, and the scores over 36 years old and younger mothers. The data of

individuals whose predicted height was below the target height were compared with the data of those who met the target height.

The Mann–Whitney U test was used to compare two independent groups, while the Kruskal–Wallis test was used for comparisons involving more than two groups. Correlations were evaluated using the Spearman correlation test. The level of significance for all tests was set at $P < 0.05$.

RESULTS

Children

The study analyzed a group of 21 girls, 14 of whom had breast development, while the remaining 7 were controls with no signs of puberty. The mean age at presentation was 7.71 ± 0.72 years, while the mean age at the onset of puberty signs was 7.25 ± 0.42 years. The mean duration between the onset of puberty signs and the date of presentation was 0.46 ± 0.41 years. At the presentation, 11 patients were at Tanner stage 2, three patients were at the stage 3 of puberty, and none had menarche yet. Eight patients were admitted before the age of 8, while six were between the ages of 8 and 9. Eight of the patients were first-born children of the family, while six were second-born children. When comparing the psychological test scores of first-born and second-born children within families, no significant differences were found. The daughters of non-university graduate mothers had higher anxiety-depression scores than daughters of university graduate mothers ($P = 0.014$).

Child behavior assessment scales showed a significant difference in somatic complaints, social problems, and slow cognitive tempo scores between the CPP patients and PT and control groups [Table 1].

The correlations of baseline LH, stimulated LH, and bone age parameters with psychological test parameters revealed a positive correlation between stimulated LH level and pediatric depression scale scores ($r = 0.714$; $P = 0.006$).

Patients who presented at the age of 8–9 years had higher social problem scores and slow cognitive tempo scores compared to those who presented at the age of 7–8 years ($P = 0.022$, $P = 0.022$, respectively).

Evaluation of the predicted adult height (calculated using the height and bone age parameters of the patients) and the target adult height (calculated according to the parent heights) values suggested a final height loss in six patients. However, the comparison of the test scores of these six patients with the others showed no significant difference.

Mothers

The mean age of the mothers was 35.5 ± 4.8 years (ranging from 23 to 43 years). Out of the total number of mothers, 5

had completed primary school, 3 had completed high school, and 6 had completed university. The DASS-stress score was higher in younger mothers than in those who were ≥ 36 years old ($P = 0.011$). No significant difference was found between the group with a maternal menarche age of ≥ 12 and the group with a younger maternal menarche age. Mothers with non-university graduates had higher DASS-A scores, and their daughters had higher anxiety-depression scores in the behavioral assessment scale compared to mothers with university degrees ($P = 0.014$, $P = 0.014$, respectively).

The results of the DASS-A (anxiety) assessment indicated that ten mothers in the patient group experienced anxiety (one mother mild anxiety, four moderate, three severe, and two extremely severe anxieties). In contrast, the mothers in the control group had normal scores. Maternal DASS-A scores were significantly higher in both CPP and PT groups compared to controls.

The results of the DASS-D (depression) assessment indicated that five mothers in the patient group had depression (three mild and two severe), while all mothers in the control group had normal scores. Maternal DASS-D scores were higher in mothers of patients who presented at the age of 8–9 compared to those who presented at the age of 7–8 ($P = 0.043$). However, maternal DASS-D scores were not different between CPP, PT, and controls [Table 1].

The results of the DASS-S (stress) assessment indicated that four mothers in the patient group had excessive stress (one mild, one moderate, and two severe), while all mothers in the control group had normal scores. Maternal DASS-S scores were negatively correlated with patients' BMI SDS ($r: -0.595$; $P: 0.032$). However, maternal DASS-S scores were not different between CPP, PT, and controls.

The scores of mothers of the six patients with an expectation of adult height loss were not different than the scores of others. Furthermore, no correlation was found between maternal scores and patients' height or predicted adult height.

DISCUSSION

Parents are often concerned about early puberty, particularly the early onset of menstruation. Some studies in the literature have reported that girls with PP are more likely to experience depression and behavioral disorders. However, it is important to note that not all studies support this finding. The current recommendations suggest that further research is needed to fully evaluate the psychological impact of PP on children.^[7] This study evaluated the psychological status of girls with early puberty and their mothers. The elevated anxiety scores in the mothers of girls with both CPP and PT indicate that the physical changes have an impact on maternal anxiety. The concerns of both the girls and mothers

were found to be primarily related to early physical changes and earlier menarche, rather than height loss. Significantly higher scores in girls with true CPP than those with still pre-pubertal hormone levels indicated that the activation of the hypothalamic–pituitary–gonadal axis and associated biological alterations may influence the psychological, cognitive, and behavioral status of the child.

During our analysis of the study results, we came across a multicenter study conducted by Temelturk *et al.*^[15] in our country. The study employed a similar methodology to ours and highlighted the importance of considering the psychiatric conditions of children when evaluating their clinical findings. The study group in our research was more selective, with an onset before the age of 8, and no treatment had been initiated yet. It was not yet clear whether treatment should be initiated, which supported their findings.^[15]

Odabasi *et al.*^[16] conducted a study to evaluate the resilience of girls with central PP (CPP) during treatment with GnRH agonists (GnRHa). The study concluded that treatment of PP may decrease the discrepancy of somatic changes between patients and their peers, which may help them to overcome the stress of CPP and long-term treatment. Yu *et al.*^[17] applied the Korean version of the Child Behavior Checklist and Children's Depression Inventory to assess the effects of GnRHa treatment on children's psychological well-being. The study found that after 1 year of treatment, scores improved from baseline ranges.

The current study aimed to investigate the impact of physical findings and biological changes during early pubertal development. All 14 patients in the study were presented with breast enlargement. Patients diagnosed with CPP after endocrinological evaluation had higher scores for somatic complaints, social problems, and slow cognitive tempo compared to patients with PT and controls. This suggests a link between biological changes and psychological state. It is currently unclear whether biological changes play a role in the psychological changes that occur during puberty or if psychiatric disorders and high-stress situations contribute to the early onset of puberty. Psychosocial factors have been identified as potential triggers for early pubertal development.^[18] According to biological theories, early exposure to sex steroids may have various effects on the developing brain that could lead to behavioral changes, emotional instability, and may also trigger underlying psychopathologies to become overt.^[19]

A study from South Korea suggests that mothers of girls with PP require more specific education and psychological interventions.^[20] In a study by Schoelwer *et al.*, mothers of girls with premature adrenarche reported increased psychological distress.^[21] In the 1-year follow-up of this study group, there was an increase in perceived maternal acceptance compared to baseline.^[22]

Table 1: Psychological scale scores of girls with precocious puberty and with premature thelarche and the comparison with age-matched controls.

Scale scores	Precocious puberty (n: 7)	Premature thelarche (n: 7)	Controls (n: 7)	P-value
Child depression score (Median [IQR])	10.0 (9.0)	12.0 (10.5)	4.5 (3.75)	0.079
Child behavior assessment scale (completed by mothers)				
Anxiety-depression (median [IQR])	3.00 (5.00)	5.00 (4.00)	0.00 (1.25)	0.078
Social introversion-depression (median [IQR])	1.00 (4.00)	1.00 (2.00)	0.00 (0.50)	0.108
Somatic complaints (median [IQR])	4.00 (7.00) ^a	1.00 (1.50) ^b	0.00 (0.25) ^b	0.009*
Rule-breaking behavior (median [IQR])	1.00 (1.00)	1.00 (3.50)	0.00 (1.00)	0.509
Aggressive behavior (median [IQR])	3.00 (5.00)	6.00 (8.00)	0.00 (2.00)	0.101
Social problem (median [IQR])	3.00 (4.00) ^a	2.00 (3.50) ^b	1.00 (2.50) ^b	0.037*
Thinking problems (median [IQR])	2.00 (4.00)	1.00 (2.50)	0.00 (1.00)	0.202
Attention problems (median [IQR])	2.00 (4.00)	2.00 (10.0)	0.00 (2.00)	0.097
Obsessive-compulsive behavior (median [IQR])	3.00 (3.00)	2.00 (4.50)	0.00 (0.50)	0.057
Post-traumatic stress (median [IQR])	2.00 (3.00)	6.00 (5.50)	0.00 (1.25)	0.121
Slow cognitive tempo (median [IQR])	1.00 (1.00) ^a	0.00 (2.00) ^b	0.00 (0.25) ^b	0.043*
Maternal Depression, Anxiety and Stress Scale (DASS)				
DASS-total (median [IQR])	36.0 (27.0)	31.0 (46.5)	18.5 (12.0)	0.188
DASS-anxiety (median [IQR])	14.0 (8.00) ^a	14.0 (13.5) ^a	5.0 (2.00) ^b	0.037*
DASS-depression (median [IQR])	9.00 (8.00)	5.00 (18.0)	3.50 (5.50)	0.125
DASS-stress (median [IQR])	12.0 (12.0)	13.0 (24.5)	9.00 (6.00)	0.723

* $P < 0.05$. (Kruskal–Wallis test). *Post hoc* analyses (“a” and “b” represent the statistically different results among groups): Somatic complaint, social problem, and slow cognitive tempo were different between the “precocious puberty” and “control” group ($P=0.041$, $P=0.003$, $P=0.031$, respectively). Maternal anxiety score was different between patient groups and controls ($P=0.045$), DASS: Depression, Anxiety and Stress Scale, IQR: Interquartile range

The higher maternal anxiety scores and depression scores in our patient group, especially in those between 8 and 9 years of age, suggest that the mother's behaviors may influence the treatment decision of the physician as well as the emotional state of the child. However, the sample size was not large enough to draw such conclusions. The results indicate that the concerns of the girls and their mothers were not primarily related to height loss, but to early physical changes and worry about earlier menarche. The study found that younger mothers had higher stress scores. Mothers with lower education levels had higher anxiety scores, and their daughters had higher anxiety-depression scores. This may be related to the opportunity for using more scientific and reliable sources of knowledge by mothers with higher education levels.

It is unclear whether psychosocial stress should be considered a consequence of the decision to start therapy, and if so, whether treatment relieves such stress. Psychological states are also related to the perception of the individual and others.^[23]

Limitations

Small sample size resulting from difficulties in completing study forms and scales as well as psychiatric assessments of both girls and mothers.

CONCLUSION

As children grow and puberty symptoms emerge, mood changes and anxiety may occur in both the child and mother. A thorough clinical assessment and professional guidance from an endocrinologist can help alleviate negative emotions and anxiety experienced by both the child and parents over time. It is important to note that in certain cases, seeking specialist consultation may be necessary to prevent underdiagnosis of issues that may require psychiatric support. Before considering the psychological state as an indicator for pubertal suppression therapy, it would be better to conduct a professional evaluation and provide information to ensure a rational treatment approach.

Ethical approval

The research/study approved by the Institutional Review Board at University of Health Sciences, Ümraniye Training and Research Hospital, number B.10.1.TKH.4.34.H.GP.01/147, dated July 24, 2019.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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