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Original Research Article

# Clinical and Aetiological Profile of Abnormal Uterine Bleeding in Adolescent Girls: A Prospective Hospital-Based Study

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**Abstract**

**Background**: Abnormal uterine bleeding (AUB) is a common gynaecological problem among adolescents and may result from ovulatory dysfunction, endocrine abnormalities, coagulation disorders, or structural lesions. It may lead to anaemia and interfere with the daily activities and quality of life of affected adolescents. Objectives: To describe the clinical and menstrual presentation of AUB among adolescent girls, classify its causes according to the FIGO PALM–COEIN system.

**Materials and Methods:** This prospective, observational, hospital-based study included 200 adolescent girls aged 10–19 years presenting with AUB to the gynaecology outpatient department of J.K. Lone Mother and Child Hospital, Government Medical College, Kota, from June 2019 to May 2020. Participants were enrolled consecutively. Detailed menstrual, medical, sexual, and bleeding histories were obtained. Menstrual blood loss was assessed using the Pictorial Blood Loss Assessment Chart. Causes of AUB were classified according to the FIGO PALM–COEIN system.

**Results:** The mean age of the participants was 15.08 ± 2.25 years, and the mean age at menarche was 12.07 ± 0.80 years. Heavy menstrual bleeding was the most common presenting complaint (45.0%), followed by irregular menstrual bleeding (20.0%). The mean haemoglobin level was 8.70 ± 1.25 g/dL; moderate anaemia was present in 67.5%, while severe anaemia was present in 8.0%. Ovulatory dysfunction was the most common PALM–COEIN category, accounting for 90.0% of cases. Among these, immaturity of the hypothalamic–pituitary–ovarian axis accounted for 47.2%, polycystic ovary syndrome for 39.4%, and thyroid dysfunction for 13.3%. Structural causes were uncommon. Tranexamic acid was administered to 58.0%, oral progesterone to 48.5%, and blood or blood-component transfusion was required in 9.5%.

**Conclusion:** Ovulatory dysfunction was the predominant cause of adolescent AUB, and anaemia was common. Systematic evaluation using the PALM–COEIN classification and timely medical management are important for identifying the underlying cause and preventing complications.

**Keywords:** Adolescence; Abnormal uterine bleeding; Anaemia; Ovulatory dysfunction; PALM–COEIN.

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## Introduction

AUB is defined as bleeding from the uterine corpus that is abnormal in frequency, regularity, duration, or volume and occurs in the absence of pregnancy. [1] Heavy menstrual bleeding is a common clinical presentation of AUB and is defined as excessive menstrual blood loss that interferes with physical, social, emotional, or material quality of life. Standardised terms based on bleeding frequency, regularity, duration, and volume have therefore replaced older terms such as menorrhagia, metrorrhagia, and dysfunctional uterine bleeding. [2] Abnormal uterine bleeding (AUB) has been reported to account for approximately half of the gynaecological problems encountered in adolescents. [3] A recent systematic review reported that the prevalence of heavy menstrual bleeding among adolescents varied from 4% to 63%. [4] In a rural school-based study from Tamil Nadu, 87.7% of adolescent girls reported at least one menstrual problem, while heavy menstrual bleeding was reported by approximately 45.7%. [5] Another Indian study involving 536 adolescent girls found abundant menstrual blood loss in 30.1%, menstrual flow lasting longer than 7 days in

12%, and irregular cycles in approximately one-fourth of early adolescents. [6] In a tertiary-care study of 655 adolescent girls, menstrual complaints constituted 84.9% of all gynaecological presentations. [7]

Most adolescent menstrual cycles occur at intervals of 21–45 days and last for 7 days or less. [3,8] Bleeding that occurs more frequently than every 21 days, persists for more than 7 days, is sufficiently heavy to require frequent changes of sanitary protection, or is associated with an interval of 90 days or more between cycles requires clinical evaluation. [8]

The International Federation of Gynecology and Obstetrics developed the PALM–COEIN system to standardise the classification of AUB. The PALM component includes structural causes: polyp, adenomyosis, leiomyoma, and malignancy or hyperplasia. The COEIN component includes non-structural causes: coagulopathy, ovulatory dysfunction, endometrial causes, iatrogenic causes, and causes not otherwise classified. [9] In adolescents, non-structural causes are more common than structural uterine abnormalities.

Ovulatory dysfunction is the most common cause of AUB in adolescents. [10] Immaturity of the hypothalamic–pituitary–ovarian axis can cause anovulation, absence of cyclic progesterone secretion, and irregular endometrial shedding, resulting in heavy, prolonged, or irregular bleeding. Although anovulation is common during the early postmenarchal years, persistent abnormalities warrant evaluation for polycystic ovary syndrome, thyroid dysfunction, hyperprolactinaemia, obesity, excessive exercise, nutritional disorders, and chronic systemic illness. [10,11]

Coagulation disorders are an important cause of AUB, particularly when heavy bleeding begins at menarche. They occur in approximately 20% of adolescents evaluated for heavy menstrual bleeding and nearly one-third of those requiring hospitalisation. [2] Von Willebrand disease is the most common inherited disorder, although platelet abnormalities, thrombocytopenia, and coagulation factor deficiencies may also occur. [12] Heavy bleeding since menarche, epistaxis, gum bleeding, easy bruising, prolonged bleeding after procedures, or a family history of abnormal bleeding should raise suspicion. Coagulopathy may coexist with ovulatory dysfunction; therefore, anovulation does not exclude a bleeding disorder.

Other causes of AUB include pregnancy-related conditions, genital tract infections, trauma, medications, endometrial dysfunction, and structural lesions. Polyps, leiomyomas, adenomyosis, and endometrial abnormalities are uncommon in adolescents but should be considered when bleeding persists despite treatment or pelvic abnormalities are suspected. [3,10] A confidential sexual and medication history is essential to identify pregnancy and drugs that may alter menstrual patterns. Persistent or heavy bleeding may cause iron deficiency and anaemia, resulting in fatigue, dizziness, reduced exercise tolerance, and impaired concentration. [2,12] It may also disrupt school attendance, academic performance, sports, routine activities, and social interaction. An Indian study found that 78.5% of affected adolescents missed school during menstruation, while more than half reported restrictions in routine activities. [13]

Clinical evaluation should include menstrual history, assessment of blood loss, symptoms of anaemia or endocrine disease, medication and sexual history, and personal or family history of abnormal bleeding. Examination should assess haemodynamic stability, pallor, body mass index, bruising, thyroid enlargement, acne, and hirsutism. Initial investigations include a complete blood count, coagulation profile, pregnancy testing when indicated, thyroid function tests, and selected hormonal tests. [2,3,10] Pelvic ultrasonography may be performed when ovarian or structural pathology is suspected. Menstrual loss may be estimated using the Pictorial Blood Loss Assessment Chart. [14]

Menstrual disorders are often underreported because of limited awareness, embarrassment, social restrictions, and the belief that irregular menstruation is normal during puberty. [5,6] Indian studies have mainly examined school populations or general adolescent gynaecological complaints. Hospital-based evidence on clinical presentation, PALM–COEIN aetiology, prevalence among adolescent gynaecology attendees, and treatment patterns remains limited. Structured evaluation is therefore important, particularly in tertiary-care settings where adolescents may present with severe bleeding, anaemia, endocrine abnormalities, or coagulation disorders. Therefore, the present study was undertaken to describe the clinical and menstrual presentation of AUB among adolescent girls, classify the underlying causes according to the FIGO PALM–COEIN system, estimate its prevalence among adolescent attendees, and document the management provided according to the underlying cause and clinical severity.

## Materials and Methods

This prospective, observational, hospital-based study was conducted in the Department of Obstetrics and Gynaecology at J.K. Lone Mother and Child Hospital, Government Medical College, Kota, Rajasthan, over a period of one year, from June 2019 to May 2020.

A total of 200 adolescent girls with abnormal uterine bleeding were included in the study. Participants were enrolled consecutively from among eligible girls aged 10–19 years attending the gynaecology outpatient department during the study period, until the required sample size was achieved.

Adolescent girls aged 10–19 years who presented to the gynaecology outpatient department with abnormal uterine bleeding were included in the study. Girls with pregnancy-related bleeding, those younger than 10 years or older than 19 years, and those presenting with primary amenorrhoea, isolated dysmenorrhoea, genital tract injury, or non-menstrual complaints without evidence of abnormal uterine bleeding were excluded.

**Clinical Assessment:** A detailed history was obtained from each participant. Information was collected directly from the adolescent and, when required, supplemented by information from the parent or guardian. Wherever appropriate, part of the history was obtained in privacy to maintain confidentiality. The menstrual history included age at menarche, duration and regularity of menstrual cycles, duration of menstrual bleeding, number of sanitary pads used per day, passage of clots, episodes of flooding, and the presence of intermenstrual bleeding.

The onset, duration, severity, and pattern of abnormal bleeding were also recorded. A detailed medical history was taken. A confidential sexual history was obtained.

Participants were also assessed for symptoms suggestive of endocrine or systemic disorders, including obesity, polycystic ovary syndrome, thyroid dysfunction, hyperprolactinaemia, hypothalamic dysfunction, and adrenal disorders. Particular attention was given to symptoms suggesting an underlying bleeding disorder.

**Assessment of Menstrual Blood Loss:** Menstrual blood loss was assessed using the Pictorial Blood Loss Assessment Chart. The chart was used to estimate the amount of bleeding based on the number and degree of saturation of sanitary pads, passage of blood clots, and episodes of flooding.

**Laboratory Investigations:** Initial laboratory evaluation included complete blood count, prothrombin time, activated partial thromboplastin time, kidney and liver function tests, random blood glucose, and thyroid function tests. Further coagulation studies were performed in participants with abnormal screening results. In girls with clinical features suggestive of polycystic ovary syndrome or other endocrine abnormalities, additional investigations included follicle-stimulating hormone, luteinising hormone, serum prolactin, free testosterone, and serum insulin levels.

Transabdominal pelvic ultrasonography was performed to evaluate the uterus, endometrium, ovaries, and adnexal structures.

**Classification of Abnormal Uterine Bleeding:** The causes of abnormal uterine bleeding were classified according to the FIGO PALM–COEIN system. Structural causes included polyp (AUB-P), adenomyosis (AUB-A), leiomyoma (AUB-L), and malignancy or hyperplasia (AUB-M), while non-structural causes included coagulopathy (AUB-C), ovulatory dysfunction (AUB-O), endometrial causes (AUB-E), iatrogenic causes (AUB-I), and causes not otherwise classified (AUB-N). The final classification was based on menstrual and medical history, clinical examination, laboratory investigations, medication history, and imaging findings. Ovulatory dysfunction was assessed using the menstrual pattern, clinical features, hormonal profile, and ultrasonographic findings. Coagulopathy was evaluated from the personal and family bleeding history, physical examination, and coagulation profile, while iatrogenic causes were identified from the history of medication use.

**Management:** Treatment was individualised according to the severity of bleeding, haemodynamic status, degree of anaemia, underlying cause, and associated clinical findings. Girls with mild bleeding and stable haemodynamic parameters were managed conservatively or with appropriate medical treatment. Those with moderate or severe bleeding received haemostatic or hormonal therapy according to their clinical condition. Iron supplementation and treatment of anaemia were provided whenever required. Participants with an identified endocrine, haematological, or structural disorder were managed according to the underlying condition.

**Statistical Analysis:** The collected data were entered and analysed using Statistical Package for the Social Sciences, version 23.0. Categorical variables were presented as frequencies and percentages. Findings were displayed using tables and appropriate graphical representations.

## Results

[Table-1] The mean age of the participants was 15.08 ± 2.25 years. Most participants were aged 13–15 years (47.5%), followed by 16–19 years (40.0%). The mean age at menarche was 12.07 ± 0.80 years. Menstrual flow lasted less than 3 days in 40.5% of participants and more than 5 days in 38.5%. A menstrual cycle length of 21–35 days was reported by 40.5%, while 38.5% had cycles longer than 35 days. Nearly half of the participants had a normal body mass index.

[Table-2] Heavy menstrual bleeding was the most common presenting complaint, reported by 45.0% of participants, followed by irregular menstrual bleeding in 20.0%. Most participants had no relevant medical history. Weight gain was reported by 8.0%, while 7.0% had acne, weight gain, and hirsutism. A personal or family history of bleeding disorder was present in a small proportion of participants. Four participants were sexually active.

[Table-3] The mean haemoglobin level was 8.70 ± 1.25 g/dL. Moderate anaemia was present in 67.5% of participants, while 22.0% had mild anaemia and 8.0% had severe anaemia. A raised LH/FSH ratio was observed in 27.0%. Among the 67 participants tested for serum testosterone, 7.5% had raised levels. Raised prolactin and thyroid-stimulating hormone levels were observed in 4.5% and 12.0% of participants, respectively. [Table-4] Pelvic ultrasonography was normal in 46.5% of participants. Polycystic ovarian morphology was observed in 35.5%, while 14.5% had an isolated ovarian cyst.

According to the PALM–COEIN classification, ovulatory dysfunction was the most common cause of abnormal uterine bleeding, accounting for 90.0% of cases. Among participants with ovulatory dysfunction, 47.2% had immaturity of the hypothalamic–pituitary–ovarian axis, 39.4% had polycystic ovary syndrome, and 13.3% had thyroid dysfunction.

[Table-5] Tranexamic acid was administered to 58.0% of participants, while 48.5% received oral progesterone. A combination of oral progesterone and tranexamic acid was used in 47.0%. Combined oral contraceptive pills were prescribed to 14.5%, and levothyroxine was given to 12.0%. Blood or blood-component transfusion was required in 9.5% of participants.

**Table 1: Demographic and menstrual characteristics of the study participants (N = 200)**

| Characteristic | Category | n (%) |
|---|---|---|
| **Current age (years)** | 10–12 | 25 (12.5) |
| | 13–15 | 95 (47.5) |
| | 16–19 | 80 (40.0) |
| **Age at menarche (years)** | 10–12 | 67 (33.5) |
| | 13–15 | 131 (65.5) |
| | 16–19 | 2 (1.0) |
| **Duration of menstrual flow** | <3 days | 81 (40.5) |
| | 3–5 days | 42 (21.0) |
| | >5 days | 77 (38.5) |
| **Length of menstrual cycle** | <21 days | 42 (21.0) |
| | 21–35 days | 81 (40.5) |
| | >35 days | 77 (38.5) |
| **Body mass index (kg/m²)** | <18.5 | 81 (40.5) |
| | 18.5–24.9 | 99 (49.5) |
| | 25.0–29.9 | 17 (8.5) |
| | ≥30.0 | 3 (1.5) |
| **Pattern of bleeding** | Infrequent heavy bleeding | 85 (42.5) |
| | Infrequent light bleeding | 22 (11.0) |
| | Frequent heavy bleeding | 6 (3.0) |
| | Frequent light bleeding | 33 (16.5) |
| | Irregular mild bleeding | 10 (5.0) |
| | Irregular moderate bleeding | 34 (17.0) |
| | Irregular severe bleeding | 10 (5.0) |
| | Intermenstrual bleeding | 12 (6.0) |

## Discussion

In the present study, 200 adolescent girls with AUB were evaluated for their clinical presentation, laboratory and ultrasonographic findings, underlying cause according to the PALM–COEIN classification, and treatment received.

The mean age of the participants was 15.08 ± 2.25 years, and nearly half were aged 13–15 years. Singh et al. reported that 44.82% of adolescents with AUB were aged 14–16 years, while 34.48% were aged 16–19 years. [15] Mandal et al. similarly observed that 42% of affected adolescents were aged 13–16 years. [16] These findings indicate that AUB is frequently encountered during the middle and late adolescent period, when menstrual cycles may still be affected by incomplete maturation of the hypothalamic–pituitary–ovarian axis.

The mean age at menarche was 12.07 ± 0.80 years. Mandal et al. reported that 42.5% of participants

attained menarche between 12 and 13 years, while 34.5% attained menarche after 13 years. [16]

Variations in the reported age at menarche may be related to nutritional, socioeconomic, environmental, and population-related differences.

Heavy menstrual bleeding was the most common(45%) presenting complaint in the present study, Irregular menstrual bleeding in 20%, while secondary amenorrhoea, abdominal pain, vaginal discharge, and dysmenorrhoea were less frequent complaints. Laddad et al. reported heavy menstrual bleeding in 47.61% and irregular menstruation in 32.73% of adolescents with AUB. [17] Singh et al. also observed heavy menstrual bleeding as the most frequent presentation, occurring in 68.95% of cases. [15] The lower proportion in the present study may be related to the inclusion of different menstrual patterns, including irregular, frequent, infrequent, and absent menstrual bleeding.

Infrequent heavy bleeding was observed in 42.5%, while frequent light bleeding and irregular moderate bleeding were also commonly recorded. Singh et al. reported irregular menstrual cycles in 39.65%, frequent cycles in 20.68%, infrequent cycles in 32.75%, and intermenstrual bleeding in 6.89% of adolescents. [15] Gautam et al. reported heavy bleeding with regular cycles in 39.21%, heavy bleeding with prolonged cycles in 29.41%, and heavy bleeding with short cycles in 25.49%. [18] The variation in bleeding patterns reflects the irregular endometrial response associated with anovulatory cycles during adolescence.

**Table 2: Clinical presentation and relevant history of the study participants (N = 200)**

| Characteristic | Category | n (%) |
|---|---|---|
| **Chief complaint** | Heavy menstrual bleeding | 90 (45.0) |
| | Irregular menstrual bleeding/oligomenorrhoea | 40 (20.0) |
| | Abdominal pain | 25 (12.5) |
| | Absent menstrual bleeding/secondary amenorrhoea | 24 (12.0) |
| | Vaginal discharge | 14 (7.0) |
| | Painful menstruation | 7 (3.5) |
| **Relevant medical history** | Weight gain | 16 (8.0) |
| | Acne, weight gain, and hirsutism | 14 (7.0) |
| | Acne and weight gain | 5 (2.5) |
| | Acne alone | 4 (2.0) |
| | Bleeding from gums | 1 (0.5) |
| | Delayed bleeding | 1 (0.5) |
| | Epistaxis | 1 (0.5) |
| | Epistaxis and gum bleeding | 1 (0.5) |
| | No relevant medical history | 157 (78.5) |
| **Personal or family bleeding history** | Family history of a bleeding disorder | 1 (0.5) |
| | Coagulopathy associated with dengue-related thrombocytopenia | 1 (0.5) |
| | Coagulopathy associated with malaria | 1 (0.5) |
| | Coagulopathy associated with immune thrombocytopenia | 1 (0.5) |
| | No relevant bleeding history | 196 (98.0) |

**Table 3: Haematological and hormonal findings among the study participants**

| Investigation | Finding | n (%) |
|---|---|---|
| **Haemoglobin level (N = 200)** | Normal, >11.4 g/dL | 5 (2.5) |
| | Mild anaemia, 10.0–11.4 g/dL | 44 (22.0) |
| | Moderate anaemia, 7.0–9.9 g/dL | 135 (67.5) |
| | Severe anaemia, <7.0 g/dL | 16 (8.0) |
| **LH/FSH ratio (N = 200)** | Raised | 54 (27.0) |
| | Normal | 145 (72.5) |
| | Decreased | 1 (0.5) |
| **Serum testosterone (n = 67)** | Raised | 5 (7.5) |
| | Normal | 60 (89.6) |
| | Decreased | 2 (3.0) |
| **Serum prolactin (n = 198)** | Raised | 9 (4.5) |
| | Normal | 188 (94.9) |
| | Decreased | 1 (0.5) |
| **Thyroid-stimulating hormone (N = 200)** | Raised | 24 (12.0) |
| | Normal | 174 (87.0) |
| | Decreased | 2 (1.0) |

**Table 4: Ultrasonographic findings and aetiological classification of abnormal uterine bleeding**

| Assessment | Finding | n (%) |
|---|---|---|
| **Ultrasonographic findings (N = 200)** | Normal pelvic ultrasonography | 93 (46.5) |
| | Bulky ovaries/polycystic ovarian morphology | 71 (35.5) |
| | Isolated ovarian cyst | 29 (14.5) |
| | Pelvic inflammatory disease/endometritis | 4 (2.0) |
| | Leiomyoma | 2 (1.0) |
| | Endometrial polyp | 1 (0.5) |
| **PALM–COEIN classification (N = 200)** | AUB-P: Polyp | 1 (0.5) |
| | AUB-A: Adenomyosis | 0 (0.0) |
| | AUB-L: Leiomyoma | 2 (1.0) |
| | AUB-M: Malignancy and hyperplasia | 0 (0.0) |
| | AUB-C: Coagulopathy | 5 (2.5) |
| | AUB-O: Ovulatory dysfunction | 180 (90.0) |
| | AUB-E: Endometrial cause | 4 (2.0) |
| | AUB-I: Iatrogenic cause | 0 (0.0) |
| | AUB-N: Not otherwise classified | 8 (4.0) |
| **Causes of ovulatory dysfunction (n = 180)** | Immaturity of the hypothalamic–pituitary–ovarian axis | 85 (47.2) |
| | Polycystic ovary syndrome | 71 (39.4) |
| | Thyroid dysfunction | 24 (13.3) |

**Table 5: Treatment modalities used in adolescent girls with abnormal uterine bleeding (N = 200)**

| Treatment category | Treatment modality | n (%) |
|---|---|---|
| **Individual medical agents** | Tranexamic acid | 116 (58.0) |
| | Oral progesterone | 97 (48.5) |
| | Combined oral contraceptive pills | 29 (14.5) |
| | Levothyroxine | 24 (12.0) |
| | Estrogen | 11 (5.5) |
| **Combination regimens** | Oral progesterone and tranexamic acid | 94 (47.0) |
| | Combined oral contraceptive pills and tranexamic acid | 15 (7.5) |
| | Combined oral contraceptive pills and oral progesterone | 5 (2.5) |
| | Estrogen followed by oral progesterone | 3 (1.5) |
| **Supportive treatment** | Blood or blood-component transfusion | 19 (9.5) |

Nearly half of the participants had a normal body mass index, while 40.5% were underweight. Singh et al. reported that 51.72% of adolescents had a normal body mass index, 36.2% were underweight, and 10.34% were overweight. [15] These findings were comparable with the present study. Nutritional assessment is relevant in adolescents with AUB because both undernutrition and excess body weight may influence hypothalamic–pituitary–ovarian function and menstrual regularity.

Anaemia was a major clinical finding. The mean haemoglobin level was 8.70 ± 1.25 g/dL, and 67.5% of participants had moderate anaemia. Severe anaemia was present in 8%, while only 2.5% had haemoglobin levels within the normal range. Mandal et al. reported haemoglobin levels of 10 g/dL or less in 63.5% of adolescents presenting with puberty menorrhagia. [16] Singh et al. also reported anaemia in all study participants, including severe anaemia in 6.89%. [15] The high burden of anaemia indicates that many adolescents presented after prolonged or recurrent bleeding.

Coagulopathy was classified as the cause of AUB in 2.5% of participants. A personal history of coagulopathy was recorded in cases associated with dengue-related thrombocytopenia, malaria, and immune thrombocytopenia, while one participant had a family history of a bleeding disorder. Zia et al. found a family history of bleeding symptoms in 21% and an established family history of a bleeding disorder in 6.5%. [19] In the present study, specialised testing for von Willebrand disease, platelet function disorders, and coagulation factor deficiencies was not available.

Hormonal evaluation showed a raised LH/FSH ratio in 27% of participants. Among those tested, serum testosterone was raised in 7.5%, while hyperprolactinaemia was present in 4.5%. Raised TSH levels were found in 12%. Suzera Bashir et al. reported a raised LH/FSH ratio in 20.20%, raised serum testosterone in 9.74%, and hyperprolactinaemia in 3.39% of adolescents.20 Deo et al. reported hyperprolactinaemia in 5.88%, [21] while Janani Anuradha et al. observed hypothyroidism in 17.1% of cases. [22] These findings support the inclusion of thyroid and selected hormonal investigations in adolescents with persistent irregular cycles, obesity, acne,

hirsutism, or other features of endocrine dysfunction.

Pelvic ultrasonography was normal in 46.5% of participants. Polycystic ovarian morphology was observed in 35.5%, isolated ovarian cysts in 14.5%, pelvic inflammatory disease or endometritis in 2%, leiomyoma in 1%, and an endometrial polyp in 0.5%. Laddad et al. reported polyps in 1.2% and noted that leiomyoma was rare among adolescents. [17] Mandal et al. found polycystic ovarian disease in 10.5%, hypothyroidism in 8.5%, genital tuberculosis in 2.5%, and immune thrombocytopenic purpura in 3% of patients. [16] The higher frequency of polycystic ovarian morphology in the present study may reflect differences in referral pattern, clinical criteria, and ultrasonographic assessment.

According to the PALM–COEIN classification, ovulatory dysfunction accounted for 90% of cases. Structural causes accounted for only 1.5%, including leiomyoma in 1% and polyp in 0.5%. Coagulopathy accounted for 2.5%, endometrial causes for 2%, and causes not otherwise classified for 4%. Laddad et al. similarly reported ovulatory dysfunction in 96.9% and coagulopathy in 2.42% of adolescents with AUB. [17] Singh et al. found anovulatory causes in 80.98%, structural causes in 5.16%, and coagulopathy in 3.44%. [15] These comparisons confirm that non-structural causes, particularly ovulatory dysfunction, constitute the main aetiological group in adolescents.

Among the 180 participants with AUB-O, immaturity of the hypothalamic–pituitary–ovarian axis accounted for 47.2%, polycystic ovary syndrome for 39.4%, and thyroid dysfunction for 13.3%. Laddad et al. reported hypothalamic–pituitary–ovarian axis immaturity in 60.60%, polycystic ovary syndrome in 27.87%, and thyroid disorders in 8.48% of adolescents with ovulatory dysfunction.17 Mandal et al. observed anovulatory bleeding in 72%, polycystic ovarian disease in 10.5%, and thyroid dysfunction in 8.5%. [16] The predominance of ovulatory dysfunction in these studies is consistent with the physiological immaturity of the reproductive axis during the early postmenarchal years.

Treatment was mainly medical and according to the severity and cause of bleeding. Tranexamic acid was administered to 58% of participants, oral progesterone to 48.5%, and a combination of oral progesterone and tranexamic acid to 47%. Combined oral contraceptive pills were prescribed to 14.5%, while levothyroxine was given to participants with thyroid dysfunction. Blood or blood-component transfusion was required in 9.5%. Udayashree et al. reported the use of oral progesterone with tranexamic acid in 51.94%, combined oral contraceptive pills in 15.58%, and combined oral contraceptive pills with tranexamic acid in 15.58%. [23] Mandal et al. reported that 38% responded to iron and tranexamic acid, 41% received oral progesterone, and 12% were treated with combined oral contraceptive pills. [16] These findings are comparable with the treatment pattern in the present study and show that most adolescent AUB can be managed with antifibrinolytic agents, hormonal therapy, correction of anaemia, and treatment of the underlying endocrine or haematological condition.

## Conclusion

Abnormal uterine bleeding in adolescents was most commonly related to ovulatory dysfunction, with immaturity of the hypothalamic–pituitary–ovarian axis and polycystic ovary syndrome being the major underlying causes. Heavy menstrual bleeding was the most frequent presenting complaint, and anaemia was common, with most participants having moderate anaemia. Structural causes were uncommon, while thyroid dysfunction and coagulopathy accounted for a smaller proportion of cases. Most participants were managed medically with tranexamic acid, oral progesterone, combined oral contraceptive pills, iron supplementation, or treatment of the underlying endocrine disorder. These findings support the need for systematic clinical assessment, appropriate laboratory evaluation, PALM–COEIN-based classification, and timely medical management of abnormal uterine bleeding in adolescent girls.

## References

1. Munro MG, Critchley HOD, Fraser IS; FIGO Menstrual Disorders Committee. The two FIGO systems for normal and abnormal uterine bleeding symptoms and classification of causes of abnormal uterine bleeding in the reproductive years: 2018 revisions. Int J Gynaecol Obstet. 2018;143(3):393–408.
2. American College of Obstetricians and Gynecologists. Screening and management of bleeding disorders in adolescents with heavy menstrual bleeding: ACOG Committee Opinion No. 785. Obstet Gynecol. 2019;134(3):e71–e83.
3. Elmaoğulları S, Aycan Z. Abnormal uterine bleeding in adolescents. J Clin Res Pediatr Endocrinol. 2018;10(3):191–197.
4. Pouraliroudbaneh S, Peate M, Hearps SJC, et al. Heavy menstrual bleeding and dysmenorrhea in adolescents: a systematic review of self-management strategies, quality of life, and unmet needs. Int J Gynaecol Obstet. 2024;167(1):18–32.
5. Ravi R, Shah P, Palani G, Edward S, Sathiyasekaran BWC. Prevalence of menstrual problems among adolescent school girls in

rural Tamil Nadu. J Pediatr Adolesc Gynecol. 2016;29(6):571–576.
6. Omidvar S, Amiri FN, Bakhtiari A, Begum K. A study on menstruation of Indian adolescent girls in an urban area of South India. J Family Med Prim Care. 2018;7(4):698–702.
7. Rathod AD, Chavan RP, Pajai SP, Bhagat V, Thool P. Gynecological problems of adolescent girls attending outpatient department at tertiary care center with evaluation of cases of puberty menorrhagia requiring hospitalization. J Obstet Gynaecol India. 2016;66(Suppl 1):400–406.
8. American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 651: Menstruation in girls and adolescents: using the menstrual cycle as a vital sign. Obstet Gynecol. 2015;126(6):e143–e146.
9. Munro MG, Critchley HO, Broder MS, Fraser IS; FIGO Working Group on Menstrual Disorders. FIGO classification system (PALM–COEIN) for causes of abnormal uterine bleeding in nongravid women of reproductive age. Int J Gynaecol Obstet. 2011;113(1):3–13.
10. Yaşa C, Uğurlucan FG. Approach to abnormal uterine bleeding in adolescents. J Clin Res Pediatr Endocrinol. 2020;12(Suppl 1):1–6.
11. Kabra R, Fisher M. Abnormal uterine bleeding in adolescents. Curr Probl Pediatr Adolesc Health Care. 2022;52(5):101185.
12. Borzutzky C, Jaffray J. Diagnosis and management of heavy menstrual bleeding and bleeding disorders in adolescents. JAMA Pediatr. 2020;174(2):186–194.
13. Ravi R, Shah P, Palani G, Edward S, Sathiyasekaran BWC. Social impact of menstrual problems among adolescent school girls in rural Tamil Nadu. Int J Adolesc Med Health. 2017;30(5):20160088.
14. Higham JM, O'Brien PMS, Shaw RW. Assessment of menstrual blood loss using a pictorial chart. Br J Obstet Gynaecol. 1990;97(8):734–739.
15. Singh P, Nandi N, Najam R, Agarawal S. Study of Etiological Factors of Abnormal Uterine Bleeding in adolescent age group. JMSCR.2020;08(08): 166-175.
16. Mandal RC, Bhar D, Mahapatra C et al. Etiological factors and management of puberty menorrhagia in a rural medical college of South Bengal: A prospective study. Int J Health Sci Res. 2015; 5(12):81-88.
17. Laddad MM, Kshirsagar N, Patil SK, Shinde G, Bhosale R. Study of Adolescent Abnormal Uterine Bleeding (AUB) and its Outcome-In Tertiary centre K.I.M.S. Karad. Journal of Evolution of Medical and Dental Sciences, 2015; 4(69):12043-12051,
18. Gautam A, Radha R, Shah S, Vaidya P. Acute adolescent menorrhagia. J ObsGyn India 1992; 686-91.
19. Zia A, Jain S, Kouides P, Zhang S, Gao A, Salas N, Lau M, Wilson E, DeSimone N, Sarode R. Bleeding disorders in adolescents with heavy menstrual bleeding in a multicenter prospective US cohort. Haematologica. 2020 Jul;105(7):1969-1976.
20. Bashir S, Khan SA, Habib R. Abnormal Uterine Bleeding Among Adolescents in Kashmir: A Tertiary-Care Hospital Based Study. Ann. Int. Med. Den. Res. 2020; 6(5):OG01-OG04.
21. Deo S, Agrawal M, 1Jaiswar SP, Sankhwar PL, Babu S, Sonalika and Nigam N. Evaluation of etiological factors and management of puberty menorrhagia. International Journal of Biomedical Research 2018; 09(03): 112-116.
22. Jananii D, Anuradha, Aandal. Etiology of puberty menorrhagia: a prospective study. Paripex Indian J Res. 2019;8(10):26-27
23. Udayashree V, Kulkarni N, Bhat P. Adolescent Abnormal Uterine Bleeding (AUB) In A Tertiary Referral Hospital: A Retrospective Study. Indian journal of applied research. 2018;8(3):19-21