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Original Research Article

An observational study to classify causes of abnormal uterine bleeding according to PALM-COEIN classification

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ABSTRACT

Background: Abnormal uterine bleeding (AUB) is a frequent gynecological complaint affecting women of all ages, significantly impacting quality of life. To standardize its diagnosis and management, the International Federation of Gynecology and Obstetrics (FIGO) introduced the PALM-COEIN classification system, which categorizes AUB into structural and non-structural causes. To classify AUB according to PALM-COEIN classification, to know associated risk factors, to know their demography and modality of treatment required.

Methods: This observational cross-sectional study was conducted in the Department of Obstetrics and Gynaecology at New Civil Hospital, Surat, from May 2024 to April 2025. Approval was obtained from the Institutional Research Review Committee (Approval ID: GMCS/RRC-2/13433/24).

A total of 200 consenting women with AUB (non-pregnancy related) were included. Exclusion criteria: pregnancy-related bleeding or refusal to consent. Detailed clinical history, examination, investigations, imaging and biopsy when indicated were done. Classification was as per PALM-COEIN. Treatment included medical or surgical modalities. Response was assessed over a 3-month follow-up.

Results: The most common cause of AUB was adenomyosis (AUB-A, 33%), followed by leiomyoma (AUB-L, 30.5%) and ovulatory dysfunction (AUB-O, 14%). Among non-structural causes, AUB-O was predominant. In this study simple endometrial hyperplasia without atypia in 4 cases and half of those patients improved with medical treatment. Medical management was effective in 64.48% of treated patients, while 65.5% required surgical intervention. Obesity (26%) and thyroid disorders (17.5%) were the most common comorbid risk factors.

Conclusions: The PALM-COEIN classification system was a useful and thorough tool for understanding the causes of AUB, helping to standardize diagnoses, plan better treatments and achieve better results in patient care. It also facilitated effective communication and comparison across clinical and research settings.

Keywords: Abnormal uterine bleeding, Adenomyosis, Histopathology, Leiomyoma, Medical management, PALM-COEIN, Surgical intervention

INTRODUCTION

The menstrual cycle is a physiological phenomenon characterized by the cyclical shedding of the endometrium, typically occurring every 28±7 days in response to hormonal changes during a woman's reproductive years. On average, each cycle involves a blood loss of approximately 50±30 ml over a span of 5 days, amounting to nearly 67 months of bleeding over a lifetime.[1] The menstrual cycle is increasingly recognized as a vital sign of women's overall health.[2] The hormonal control of the menstrual cycle involves a specific system that includes the hypothalamus (which releases gonadotropin-releasing hormone), the pituitary gland (which makes follicle-stimulating hormone and luteinizing hormone) and the ovaries (which produce estrogen and progesterone).

Disruptions at any level of this axis can alter cycle regularity, leading to menstrual abnormalities. Menstrual disorders pose a significant public health concern, particularly among adolescents and young women, where they are associated with poor academic performance, absenteeism, psychological distress and reduced quality of life.[3] Among these, abnormal uterine bleeding (AUB) is one of the most common complaints in gynecological practice, often necessitating interventions such as hysterectomy and contributing substantially to healthcare costs.[4]

AUB is associated with considerable physical and psychosocial morbidity and may occasionally be the first manifestation of a serious underlying pathology.[5] It is particularly common during the perimenopausal period 2 to 8 years before menopause and 1 year after the last menstrual period when irregular and more frequent missed ovulation make women more likely to experience unusual bleeding patterns.[6]

According to the American College of Obstetricians and Gynaecologists (ACOG), AUB is defined as "bleeding from the uterine corpus that is abnormal in regularity, volume, frequency or duration and occurs in the absence of pregnancy".[7] The National Institute for Health and Care Excellence (NICE) defines it as a change in menstrual loss or bleeding pattern different from that experienced by the general age-matched population.[8]

The International Federation of Gynecology and Obstetrics (FIGO) further classifies non-pregnancy-related AUB as either acute requiring urgent intervention or chronic persisting for most of the prior 6 months.[9] Women with AUB often experience dysmenorrhea, anemia, restricted physical activity and social withdrawal, all contributing to a deterioration in quality of life.[3]

To address inconsistencies in terminology and management, FIGO introduced a standardized classification system in 2011 the PALM-COEIN system later adopted by ACOG. This system sorts the causes of AUB in women of childbearing age into two groups: structural issues (PALM: polyp, adenomyosis, leiomyoma, malignancy and hyperplasia) and non-structural issues (COEIN: coagulopathy, ovulatory dysfunction, endometrial, iatrogenic and not yet classified). It also recommends discontinuing the term "dysfunctional uterine bleeding" due to its ambiguity and overlap with other conditions.

The PALM-COEIN classification not only standardizes terminology across clinical and research settings but also streamlines diagnostic workup and treatment planning. For instance, in adolescents, common causes such as coagulopathy and ovulatory dysfunction warrant screening for bleeding disorders like von Willebrand disease to prevent unnecessary imaging or surgery. In reproductive-aged women, polyps and fibroids often predominate and benefit from targeted imaging and histopathology prior to initiating treatment. In perimenopausal and postmenopausal women, structural causes such as malignancy or atypical hyperplasia must be prioritized and it is important to perform endometrial sampling.[8]

Checking tissue samples is essential for diagnosis, especially in perimenopausal women, to make sure there are no serious conditions before starting hormonal treatment. Globally, AUB affects approximately 9–14% of women between menarche and menopause, with reported prevalence in India as high as 17.9% .[10] Using the PALM-COEIN system has been found to make diagnoses more consistent, help in choosing the right treatment plans and enable useful comparisons in clinical research among different groups and healthcare systems. In this study we aim to evaluate the underlying causes of abnormal uterine bleeding using the PALM-COEIN classification system.

METHODS

This observational cross-sectional study was conducted between May 2024 to April 2025 in the Department of Obstetrics and Gynecology at New Civil Hospital, including patients from both OPD 20 and the gynecology ward. The study spanned over a period of 16 months comprising 12 months of active data collection, followed by 2 months for data analysis and 2 months for manuscript preparation after obtaining approval from the Institutional Research Review Committee. A total of 200 consenting women were included using a random sampling method. The criteria for including participants were all women visiting the gynecology outpatient department or staying in the gynecology ward who had AUB due to physical, systemic or medical reasons. Women who declined to participate or those with pregnancy-related bleeding were excluded from the study.

After obtaining informed consent, detailed clinical and demographic information was collected. This included age, age at menarche, parity, last childbirth and socioeconomic status. A focused menstrual history was obtained, covering cycle length, duration, volume of bleeding, intermenstrual spotting, postcoital bleeding and any associated symptoms, such as dysmenorrhea. Past medical, surgical and family histories were noted to identify potential systemic or hereditary causes. Each participant underwent a thorough general physical and gynecological examination, including per abdominal, per speculum and per vaginal assessments. Laboratory tests such as complete blood count, thyroid profile, coagulation profile and pregnancy tests (where indicated) were performed. BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m^2) and categorized per WHO criteria into underweight (<18.5), normal (18.5–24.9), overweight (25.0–29.9) and obese (≥30.0).

To determine the underlying cause of AUB, patients were evaluated according to the PALM-COEIN classification system developed by FIGO. Structural causes (PALM:

Polyp, Adenomyosis, Leiomyoma, Malignancy and Hyperplasia) were primarily identified using imaging techniques like transvaginal sonography, while non-structural causes (COEIN: Coagulopathy, Ovulatory dysfunction, Endometrial, Iatrogenic and Not yet classified) were deduced based on history, laboratory parameters and clinical findings. Endometrial sampling and biopsy were performed in indicated cases, particularly in women above 40 years or those with risk factors for endometrial pathology. Depending on the diagnosis, patients were treated either with medications (like NSAIDs, hormonal therapy or tranexamic acid) or with surgery (such as removing polyps, myomectomy, endometrial ablation or hysterectomy), following standard treatment guidelines.

For those managed medically, a response was considered successful if the patient's symptoms resolved or improved significantly over a 3-month follow-up period. Surgical management was undertaken either as first-line treatment in clearly indicated cases or as second-line when medical therapy failed. All data were compiled systematically using Microsoft Excel. Descriptive statistics, including frequencies and percentages, were calculated to summarize the findings. The classification and management trends of AUB based on the PALM-COEIN system were thus documented and analyzed.

RESULTS

Table 1 shows a comprehensive overview of the demographic and clinical characteristics of the study population. The majority of participants were in the age group of 41–55 years (45%), indicating a predominance of perimenopausal women, followed by those aged 26–40 years (39%), representing reproductive-age women. Socioeconomically, a large proportion belonged to the lower middle (42%) and upper lower (30%) classes, indicating greater AUB incidence in lower-income groups. In terms of parity, most women were multiparous, with the highest percentage being second para (36.5%), followed by third para (28%), suggesting that AUB commonly affects women who have completed or nearly completed their families.

Regarding body mass index (BMI), a significant number were pre-obese (40%) and obese (26%), suggesting obesity as a notable risk factor for AUB. Based on the PALM-COEIN classification, the most common etiological subtype was AUB-A (adenomyosis, 33%), followed by AUB-L (leiomyoma, 30.5%) and AUB-O (anovulatory bleeding, 14%). Malignancy-associated bleeding (AUB-M ii) was observed in only 1% of the cases.

Table 2 shows the histopathological findings from endometrial biopsies and their associated treatment outcomes. Four patients were diagnosed with simple hyperplasia without atypia, all of whom received medical management. Out of these, two responded successfully to medical treatment while the remaining two required surgical intervention. In contrast, patients diagnosed with complex hyperplasia without atypia (n=3) and simple hyperplasia with atypia (n=3) were all managed surgically, as medical management was not attempted or deemed ineffective. No cases of complex hyperplasia with atypia were reported in the current cohort. This data reinforces the role of endometrial biopsy in distinguishing between low-risk and high-risk hyperplastic lesions, aiding clinicians in determining whether conservative or surgical approaches are more appropriate.

Table 3 shows the distribution of body mass index across various PALM-COEIN categories. AUB-A (adenomyosis) and AUB-L (leiomyoma) were most prevalent among overweight and obese women, with nearly 40% of these cases seen in the obese category. This finding indicates a strong correlation between increased BMI and structural causes of AUB. In contrast, functional causes like AUB-O (anovulatory bleeding) were more evenly distributed across BMI categories, suggesting multifactorial influences. AUB-P (polyp), AUB-M (hyperplasia or malignancy) and AUB-I (iatrogenic) also showed moderate associations with elevated BMI. Meanwhile, AUB-C (coagulopathy) and AUB-E (endometrial) occurred primarily in women with normal or underweight BMI. These trends underline the importance of considering BMI during clinical evaluation and decision-making in AUB.

Table 4 shows the use of contraceptive methods among the study population. The most commonly used method was tubal ligation (37%), followed by barrier contraception (30%), indicating a preference for permanent or non-hormonal methods among these women. A noteworthy proportion of women (20%) were not using any contraception at the time of evaluation. Hormonal methods (4%), intrauterine contraceptive devices (IUCDs, 6%) and Implanon (3%) were used by a smaller segment of the population. These patterns may reflect sociocultural preferences, economic constraints or health-related contraindications to hormonal contraceptive use. Additionally, the type of contraception used may influence bleeding patterns, particularly in the case of hormonal and IUCD users.

Table 5 shows the prevalence of various clinical risk factors among the women with AUB. Obesity emerged as the most frequent comorbidity, affecting 26% of participants, consistent with the high rates of elevated BMI observed in Table 1. Thyroid dysfunction was also common (17.5%), underscoring its known impact on menstrual regulation. Chronic hypertension and diabetes mellitus were present in 10% and 6% of subjects, respectively conditions that may indirectly contribute to endometrial pathology. Interestingly, no patients reported a family history of endometrial carcinoma. Coagulopathy, although uncommon (2%), remains an important differential diagnosis, particularly in adolescents or those presenting with prolonged or excessive bleeding. Table 6

shows the participants based on their reported menstrual blood flow patterns. Moderate bleeding was the most frequently reported pattern (31.5%), followed closely by heavy bleeding (29.5%). A smaller subset experienced irregular (16%) or continuous (10.5%) bleeding patterns often associated with hormonal imbalance or structural lesions like fibroids and adenomyosis. Passage of clots (6.5%) and intermenstrual bleeding (2.5%) were less common but clinically significant, warranting evaluation for polyps or endometrial pathology. Scanty bleeding was noted in 4.5% of the cases. These diverse bleeding patterns highlight the importance of individualized assessment in patients with AUB.

Table 1: Distribution of study subjects according to demographic, clinical and PALM-COEIN classification (n=200).

Variables		Number (n=200)	%
Age (in years)	10-25	24	12
	26-40	78	39
	41-55	90	45
	56-70	8	4
Socio- economic status	Upper class (I)	0	0
	Upper middle (II)	38	19
	Lower middle (III)	84	42
	Upper lower (IV)	60	30
	Lower (V)	18	9
Parity	Nulligravida	20	10
	Primi para	23	12.5
	2nd para	73	36.5
	3rd para	56	28
	Multipara	28	14
BMI	Underweight (<18.5)	8	4
	Normal (18.5-24.9)	60	30
	Pre- obese (25-29.9)	80	40
	Class-1 obesity (30-34.9)	36	18
	Class-2 obesity (35-39.9)	12	6
	Class 3 obesity (>=40kg/m^2	4	2
Classification	AUB-P (POLYP)	12	6
	AUB-A (Adenomyosis)	66	33
	AUB-L (Leiomyoma)	61	30.5
	AUB-M (i-hyperplasia)	10	5
	(ii- malignancy)	2	1
	AUB-C (coagulopathy)	4	2
	AUB-O (Anovulatory)	28	14
	AUB-E (Endometrial)	4	2
	AUB-I (Iatrogenic)	10	5
	AUB-N (Yet not classified)	3	1.5

Table 2: Histopathological profile and treatment outcomes in hyperplasia subtypes.

Histopathology	Number of subjects	Medical management given	Success of medical management	Taken for surgery
Simple hyperplasia w/o atypia	4	4	2	2
Complex hyperplasia w/o atypia	3	0	0	3
Simple hyperplasia with atypia	3	0	0	3
Complex hyperplasia with atypia	0	0	0	0

Table 3: BMI distribution across PALM-COEIN subtypes.

PALM-COEIN classification	Underweight (n=8)	Normal (n=60)	Pre-obese (n=80)	Obese (Class 1-3) (n=52)
AUB-P	1 (12.5%)	4 (6.66%)	6 (7.5%)	1 (1.92%)
AUB-A	2 (25%)	18 (30%)	25 (31.25%)	21 (40.38%)
AUB-L	0 (0%)	15 (25%)	26 (32.5%)	20 (38.46%)
AUB-M	0 (0%)	5 (8.33%)	5 (6.25%)	2 (3.84%)
AUB-C	0 (0%)	4 (6.66%)	0 (0%)	0 (0%)
AUB-O	2 (25%)	8 (13.33%)	12 (15%)	6 (11.53%)
AUB-E	1 (12.5%)	1 (1.66%)	1 (1.25%)	1 (1.92%)
AUB-I	2 (25%)	5 (8.33%)	3 (3.75%)	0 (0%)
AUB-N	0 (0%)	0 (0%)	2 (2.5%)	1 (1.92%)

Table 4: Distribution according to contraceptive method usage (n=200).

Contraceptive method	Number	%
Barrier	60	30
Hormonal	8	4
IUCD	12	6
Tubal ligation	74	37
Implanon	6	3
No contraception	40	20

Table 5: Distribution of risk factors among study subjects.

Risk factor	Number	%
Obesity	52	26
Thyroid disorder	35	17.5
Chronic hypertension	20	10
Diabetes mellitus	12	6
Family history of endometrial carcinoma	0	0
Thrombocytopenia/coagulation disorder	4	2

Table 6: Menstrual blood flow patterns among study subjects (n=200).

Amount of blood flow	Number	%
Heavy	59	29.5
Heavy + clots	13	6.5
Irregular	32	16
Moderate	63	31.5
Scanty	9	4.5
Continuous	19	10.5
Intermenstrual	5	2.5

DISCUSSION

In our observational cross-sectional study conducted at a tertiary care center in South Gujarat, we classified 200 women with AUB according to the FIGO-recommended PALM-COEIN classification system. The most common cause of abnormal uterine bleeding was adenomyosis, found in 33% of the patients, followed by leiomyoma in 30.5% and ovulatory dysfunction in 14%. These findings are in alignment with previous literature. For example, Mahapatra et al reported that AUB is most prevalent among multiparous women in the fourth to fifth decades of life, with fibromyoma (leiomyoma) being the most frequently observed condition, followed by adenomyosis. Menorrhagia was noted as the most common bleeding pattern, consistent with our study population, where 29.5% reported heavy bleeding and 6.5% had heavy bleeding with passage of clots.[11] Additionally, Ratnani et al found that leiomyoma was the main cause of AUB in 35% of cases, followed by cancer, adenomyosis and problems with ovulation, which matches what we found in our study. Mishra et al also found that PALM components were linked to a larger number of AUB cases when confirmed

by tissue analysis (63.98%), especially highlighting the presence of both AUB-A and AUB-L types together. Our study similarly noted combined pathologies such as AUB-A+L in 6.5% of subjects.[12]

The COEIN category accounted for a smaller proportion in our study, with AUB-O (14%) being the most common non-structural etiology. These results parallel those of Gouri et al and Goel et al who reported ovulatory dysfunction in 27% and 28.3% of AUB cases, respectively.[13,14] Sharda et al also backed this finding by showing that ovulatory dysfunction was the most common cause at 28.2%, followed by leiomyoma and endometrial issues.[15] In the study, we found that the AUB-E subtype was present in 2%, which might be missed in diagnoses because there aren't enough biomarkers available, as mentioned in recent studies.

The endometrial biopsy results in our study showed that hyperplasia without atypia was treated with medication successfully in 50% of cases, while complex or atypical hyperplasia was treated with surgery. This method follows WHO guidelines and supports findings from Divya et al who highlighted the importance of histopathology and the PALM-COEIN system in helping to choose the right treatment for each patient.[15]

Regarding treatment response, 64.48% of women who received medical therapy showed improvement, while 65.5% ultimately required surgical management. Structural causes like AUB-L and AUB-A had higher rates of surgical intervention. Studies like Whitaker et al advocating for surgical management in fibroid-associated AUB when medical management fails, support this observation. Furthermore, Divya et al highlighted that adenomyosis is often underdiagnosed preoperatively, contributing to a higher rate of hysterectomies.[15]

The PALM-COEIN classification also aided in evaluating risk factors. Obesity was present in 26% of subjects and thyroid disorders in 17.5%, reaffirming known associations. Singh et al similarly reported a high prevalence of hypothyroidism in women with AUB.16Additionally, our study found that AUB-O and AUB-I responded well to medical treatment, which aligns with the treatment recommendations from ACOG and FIGO guidelines.

This was a single center study with limited sample size in subgroup (AUB-C,I,N).

CONCLUSION

The study validated the practicality and effectiveness of the PALM-COEIN system in a real-world clinical setting. It facilitated structured diagnosis, guided rational treatment decisions and enabled systematic documentation and comparison with global data. The results show that we still need to do histopathological evaluations, proper imaging and hormonal tests, especially when the causes are mixed or not clear. Thus, PALM-COEIN serves as a robust tool in improving AUB management, optimizing patient outcomes and streamlining research and clinical audits.

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