

Aetiological Classification of Abnormal Uterine Bleeding using the FIGO PALM-COEIN System: A Retrospective Observational Study

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ABSTRACT

Introduction: Abnormal Uterine Bleeding (AUB) has a profound impact on the reproductive health and overall quality of life of women. Although many causes have been identified, the role of regional, sociodemographic, and clinical factors is still not thoroughly examined in India.

Aim: To assess the aetiological classification of AUB by employing the FIGO PALM-COEIN system.

Materials and Methods: The present retrospective observational study investigated 384 cases of AUB at the Department of Obstetrics and Gynaecology, Government General Hospital, Guntur, Andhra Pradesh, from September 2024 to February 2025. The analysis involved data extracted from electronic and physical medical records, encompassing demographic, clinical, and diagnostic information. The causes were classified according to the FIGO PALM-COEIN criteria. Descriptive statistics were employed to encapsulate the demographic and

clinical attributes of the study cohort. Categorical variables were represented as frequencies and percentages.

Results: Among 384 women with AUB, the mean age was 38.9 ± 7.6 years, with most patients aged 36-45 years (198, 51.6%). Overweight or obesity was observed in 245 subjects (63.8% of participants). The most frequent co-morbidities were hypothyroidism in 103 subjects (26.8%) and Polycystic Ovary Syndrome (PCOS) in 66 subjects (17.2%). AUB-L (Leiomyoma) in 119 subjects (31.0%), AUB-O in 97 subjects (Ovulatory dysfunction) (25.3%), and AUB-A (Adenomyosis) in 55 subjects (14.3%) were the predominant aetiologies. Significant associations were noted between AUB subtypes and age, early marriage, endocrine disorders, and nulliparity ($p < 0.05$).

Conclusion: According to the findings of the present study AUB in Indian women arises from multiple factors shaped by both structural and hormonal influences.

Keywords: Adenomyosis, Diabetes mellitus, Hypertension, Hypothyroidism, Leiomyoma, Malignancy, Obesity, Polycystic ovary syndrome, Polyp

INTRODUCTION

The AUB is a prevalent and troubling gynaecological issue that greatly affects the physical, emotional, social, and economic health of women at all stages of their reproductive lives. It is defined by any deviation from the typical parameters of menstrual bleeding, which encompasses alterations in frequency, regularity, duration, or volume [1]. Worldwide, AUB impacts a significant percentage of women of reproductive age, with prevalence rates reported to differ considerably based on the population examined and the diagnostic criteria applied, typically falling between 10% and 30% [2]. If left unaddressed, AUB may result in severe outcomes, including iron deficiency anaemia, decreased fertility, and a notable decline in overall quality of life [3].

The International Federation of Gynaecology and Obstetrics (FIGO) have established a standardised classification system for AUB, referred to as PALM-COEIN [1]. This system classifies the causes of AUB into two categories: structural causes, represented by the acronym Polyp, Adenomyosis, Leiomyoma, Malignancy (PALM), and hyperplasia), and non structural causes, denoted by the acronym Coagulopathy, Ovulatory dysfunction, Endometrial issues, Iatrogenic factors, and Not yet classified (COEIN).

A multitude of factors have been associated with the onset and continuation of AUB. These factors encompass demographic elements such as age and parity, in addition to medical co-morbidities including obesity, PCOS, thyroid dysfunction, diabetes mellitus, and hypertension [4]. The interaction of these elements

may lead to hormonal imbalances, endometrial irregularities, and various systemic problems that present as AUB. Nevertheless, the particular prevalence and range of related risk factors can differ by region, influenced by variations in genetic predispositions, lifestyle choices, healthcare availability, and environmental factors.

In India, AUB continues to pose a major public health challenge, with prevalence rates reported to be 17.9%. Previous study has shown that prevalence varies between different regions and it ranges between 10-30% [5]. Although some research has investigated AUB in different regions of India, there is a scarcity of comprehensive data from tertiary care settings that focus on specific local contexts, such as Guntur, Andhra Pradesh, India. With this background, the present study was conducted to assess the aetiological classification of AUB by employing the FIGO PALM-COEIN system. The secondary objective is to evaluate the association of selected clinical and reproductive risk factors with different PALM-COEIN categories of AUB.

MATERIALS AND METHODS

The present retrospective observational study was performed at the Department of Obstetrics and Gynaecology, Government General Hospital, located in Guntur, Andhra Pradesh, India, from September 2024 to February 2025. The study was observational in nature and involved the analysis of anonymised data collected during routine clinical care. As per institutional and national ethical guidelines, formal approval from the Institutional Ethics Committee was deemed unnecessary.

Inclusion and Exclusion criteria: Female patients aged ≥ 18 years diagnosed with AUB who attended the Gynaecology Outpatient Department or were admitted during the study period, and whose medical records contained complete data required for classification under the FIGO PALM-COEIN system, were included in the study. Patients experiencing bleeding related to pregnancy, postpartum haemorrhage, or gynaecological cancers (unless AUB was the initial symptom that led to the cancer diagnosis) were excluded to concentrate specifically on non gestational and non malignancy-related AUB as outlined by FIGO PALM-COEIN.

Study Procedure

Data for this study were obtained from both Electronic Medical Records (EMR) and physical case files of patients diagnosed with AUB. The gathered data encompassed demographic characteristics such as age (in years), marital status, parity (including nulliparity, analysed as a categorical variable), and Body Mass Index (BMI), (calculated as kg/m^2). Medical history variables included the presence of comorbidities such as hypertension, diabetes mellitus, thyroid disorders, PCOS, and other notable systemic conditions. Socioeconomic status was assessed using the Modified Kuppuswamy Socioeconomic Status Classification, which is based on education, occupation, and monthly family income [6]. Gynaecological history data were collected on age at menarche, menstrual patterns before the onset of AUB, history of gynaecological surgeries, contraceptive use, and menopausal status; however, these variables were not included in the final statistical analysis due to incomplete or non-uniform documentation across records. Details of clinical presentation focused on the pattern of abnormal bleeding, such as heavy menstrual bleeding, intermenstrual bleeding, and irregular cycles. Diagnostic findings were documented from investigations including transvaginal ultrasonography, hysteroscopy, endometrial biopsy, and pertinent hormonal assays.

The primary outcome of the study was the aetiological classification of AUB according to the FIGO PALM-COEIN system [1], based on the diagnosis recorded by the treating physician.

STATISTICAL ANALYSIS

Data were entered and analysed using Microsoft Excel 2019 (Microsoft Corp., Redmond, WA, USA). Descriptive statistics were employed to encapsulate the demographic and clinical attributes of the study cohort. Categorical variables were represented as frequencies and percentages. To explore associations between potential risk factors and AUB, the chi-square (χ^2) test was applied for categorical variables. A two-sided p-value of less than 0.05 ($p < 0.05$) was regarded as statistically significant.

RESULTS

According to [Table/Fig-1], the majority of the participants fell within the age range of 36 to 45 years. The HMB with prolonged bleeding and pain was reported by 87 (22.7%) patients, followed by HMB with lower abdominal pain in 85 (22.1%) patients. The most common International Federation of Gynaecology and Obstetrics (FIGO) classifications identified were leiomyoma (AUB-L, 31%), ovulatory dysfunction (AUB-O, 25.3%), and adenomyosis (AUB-A, 14.3%) [Table/Fig-2].

Parameters	Category	No. of subjects (N=384)	Percentage (%)
Age group (years)	18-25	71	18.48%
	26-30	28	7.29%
	31-35	45	11.71%
	36-40	89	23.17%
	41-45	109	28.38%
	46-50	39	10.15%
	51-55	3	0.78%

Body Mass Index (BMI)	Underweight (<18.5)	9	2.34%
	Normal (18.5-24.9)	130	33.85%
	Overweight (25.0-29.9)	218	56.77%
	Obese Class I (30.0-34.9)	21	5.46%
	Obese Class II (35.0-39.9)	4	1.04%
Marital status	Obese Class III (>40)	2	0.52%
	Early Marriage (<18 years)	207	53.90%
	Marriage at ≥ 18 years	139	36.19%
Family history of AUB	Unmarried	38	9.89%
	Present	51	13.28%
	Absent	333	86.72%

[Table/Fig-1]: Demographic and clinical characteristics of study participants (N=384).

Parameters	Category	No. of subjects (N=384)	Percentage (%)
Presenting complaints	HMB + prolonged bleeding + lower abdominal pain	87	22.65%
	HMB + prolonged bleeding	58	15.10%
	HMB only	72	18.75%
	HMB + lower abdominal pain	85	22.13%
	Intermenstrual bleeding	12	3.13%
	Infrequent bleeding	24	6.25%
	Infrequent bleeding with lower abdominal pain	23	5.98%
	Amenorrhoea	5	1.302%
	Oligomenorrhoea	2	0.520%
	Polymenorrhagia	3	0.780%
	Lower abdominal Pain	13	3.38%
Co-morbidities	Hypothyroidism	103	26.82%
	PCOS	66	17.19%
	Idiopathic	83	21.61%
	Hypertension	43	11.2%
	Type 2 diabetes mellitus	30	7.81%
	Hypertension + Type 2 Diabetes Mellitus	23	5.98%
	Hypertension + Type 2 Diabetes mellitus + hypothyroidism	3	0.78%
	Cervicitis	5	1.302%
	Cervical cancer	1	0.26%
	Breast cancer	2	0.52%
	HIV	8	2.08%
	Bleeding disorders	2	0.52%
	Nulliparous	3	0.78%
	Hypothyroidism + PCOS	12	3.12%
AUB aetiology (PALM-COEIN)	Polyp (AUB-P)	26	6.77%
	Adenomyosis (AUB-A)	55	14.32%
	Leiomyoma (AUB-L)	119	30.98%
	AUB-M (Malignancy)	6	1.56%
	AUB-C (Coagulopathy)	2	0.52%
	Ovulatory dysfunction (AUB-O)	97	25.26%
	Endometrial (AUB-E)	41	10.68%
	AUB-I (Iatrogenic)	1	0.26%
	Not yet classified (AUB-N)	37	9.63%

[Table/Fig-2]: Presenting complaints, comorbidities, and aetiological classification of AUB (N=384).

HIV: Human immunodeficiency virus

The predominant group of participants originated from lower socioeconomic strata, with 65.89% classified as being from the upper-lower class [Table/Fig-3].

Parameters	Category	No. of subjects (N=384)	Percentage (%)
Education (head of family)	Illiterate	80	20.83%
	Primary school	62	16.14%
	Middle school	115	29.94%
	High school	90	23.4%
	Intermediate/diploma	27	7.03%
	Graduate	10	2.60%
Occupation (head of family)	Craft/trade workers	141	36.72%
	Plant/machine operators/ assemblers	118	30.73%
	Agriculture/fishery	56	14.6%
	Skilled workers/shopkeepers/ market sales	37	9.63%
	Technicians and associate professionals	3	0.781%
	Clerks	11	2.864%
	Professionals	1	0.260%
	Unemployed	2	0.520%
	Elementary occupation	15	3.906%
Monthly family income (INR)	₹18,859-31,435	249	64.84%
	₹6,294-18,858	91	23.70%
	₹31,436-47,034	40	10.42%
	≥₹47,035-62,874	1	0.26%
	62,875-1,25,752	1	0.26%
	≤6,293	2	0.52%
Socioeconomic class	Upper lower (IV)	253	65.89%
	Lower middle (III)	123	32.03%
	Upper middle (II)	7	1.82%
	Lower (V)	1	0.26%

[Table/Fig-3]: Socioeconomic characteristics of study participants (N=384).

Diabetes mellitus was significantly associated with both leiomyoma-related AUB (AUB-L) and ovulatory dysfunction (AUB-O), indicating a metabolic contribution to these subtypes. Early marriage was significantly associated with AUB-L, suggesting a role of early reproductive exposure. Nulliparity was significantly associated with AUB-O, but not with leiomyoma-related AUB (AUB-L), highlighting its link with ovulatory abnormalities [Table/Fig-4,5].

Diabetes mellitus	AUB-L present (n=119)	AUB-L absent (n=265)	p-value
Present	16 (13.4%)	14 (5.2%)	0.005
Absent	103 (86.6%)	251 (94.7%)	

[Table/Fig-4a]: Association of diabetes mellitus with leiomyoma (AUB-L). Chi-square test was used

PCOS	AUB-L Present (n=119)	AUB-L Absent (n=265)	p-value
Present	5 (4.2%)	61 (23.1%)	0.006
Absent	114 (95.8%)	204 (76.9%)	

[Table/Fig-4b]: Association of Polycystic Ovary Syndrome (PCOS) with Leiomyoma (AUB-L).

Early marriage (<18 years)	AUB-L present (n=119)	AUB-L absent (n=265)	p-value
Yes	74 (62.1%)	133 (50.1%)	0.029
No	45 (37.8%)	132 (49.8%)	

[Table/Fig-4c]: Association of early marriage with leiomyoma (AUB-L).

DISCUSSION

The present study findings highlight the predominance of structural and hormonal causes, leiomyoma (31%), ovulatory dysfunction (25%), and adenomyosis (14%), consistent with studies that applied

Diabetes mellitus	AUB-O Present (n=97)	AUB-O Absent (n=287)	p-value
Present	3 (3.1%)	27 (9.4%)	0.04
Absent	94 (96.9%)	260 (90.5%)	

[Table/Fig-5a]: Association of diabetes mellitus with ovulatory dysfunction (AUB-O).

PCOS	AUB-O Present (n=97)	AUB-O Absent (n=287)	p-value
Present	36 (37.1%)	30 (10.7%)	<0.001
Absent	61 (62.8%)	257 (89.5%)	

[Table/Fig-5b]: Association of PCOS with Ovulatory Dysfunction (AUB-O).

Nulliparity	AUB-O Present (n=97)	AUB-O Absent (n=287)	p-value
Yes	3 (3.1%)	0	0.002
No	94 (96.9%)	287 (100%)	

[Table/Fig-5c]: Association of nulliparity with ovulatory dysfunction (AUB-O).

Age >40 years	AUB-A Present (n=55)	AUB-A Absent (n=329)	p-value
Yes	39 (70.9%)	112 (34%)	0.002
No	16 (29.1%)	217 (65.9%)	

[Table/Fig-5d]: Association of age >40 years with adenomyosis (AUB-A).

the FIGO PALM-COEIN classification. A multicentre investigation in China [7] identified that AUB-O tends to reach its highest prevalence during the later stages of reproductive years, exhibiting a strong correlation with elevated BMI and various components of metabolic syndrome, such as hypertension and thyroid dysfunction.

In the present study, adenomyosis (AUB-A) showed a significant association with age above 40 years but did not demonstrate significant associations with diabetes mellitus, PCOS, or parity. This may be explained by the predominantly structural and age-related pathophysiology of adenomyosis, which is strongly linked to cumulative uterine tissue changes rather than metabolic or ovulatory disturbances. The relatively smaller number of AUB-A cases might have limited the ability to detect statistically significant associations with other clinical variables.

A comparison of the distribution of AUB categories according to the FIGO PALM-COEIN classification across studies, including the present study, is summarised in [Table/Fig-6] [8-11].

Study (Location)	Sample Size (n)	AUB-L; n (%)	AUB-O; n (%)	AUB-A; n (%)
Present/Current study (Andhra Pradesh)	384	119 (31%)	97 (25.3%)	55 (14.3%)
Singh K et al., (Haryana) [11]	300	90 (30%)	80 (26.6%)	89 (29.7%)
Betha K et al., (Telangana) [8]	250	76 (30.4%)	34 (13.6%)	NR
Vasava VH et al., (Gujarat) [9]	350	90 (25.7%)	99 (28.2%)	30 (8.5%)
Patel U et al., [10]	200	61 (30.5%)	28 (14%)	66 (33%)

[Table/Fig-6]: Prevalence of Abnormal Uterine Bleeding (AUB) categories according to FIGO PALM-COEIN classification in different studies [8-11]. NR: Not Reported

Previous study suggests that the effect of obesity on menstrual abnormalities is largely mediated through endocrine disorders such as thyroid dysfunction rather than acting as an independent determinant of AUB [12].

The patterns identified in this research collectively enhance the expanding evidence regarding the variability of AUB, especially among groups facing both structural and hormonal risk factors.

Limitation(s)

This single-centre retrospective observational study may limit the generalisability of the findings to other populations. Additionally, the observational design precludes establishing causal relationships,

and unmeasured factors such as lifestyle behaviours and stress levels cannot be evaluated.

CONCLUSION(S)

This study underscores the multifactorial nature of AUB in a tertiary care population in South India, where structural causes such as leiomyoma (AUB-L) and adenomyosis (AUB-A), along with the non-structural cause ovulatory dysfunction (AUB-O), were among the most common etiologies. Utilising the FIGO PALM-COEIN classification has allowed for organised categorisation, which aids in more effective clinical interpretation.

Authors' contribution: SM, RD and NSD were responsible for data collection and the drafting of the manuscript. SJB was involved in the analysis and interpretation of the data. SRK, PKY, and RRN offered clinical guidance and performed critical revisions of the manuscript, respectively. All authors reviewed and approved the final version of the manuscript.

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