Clinical and Experimental Obstetrics & Gynecology

Clin. Exp. Obstet. Gynecol. **2026**; 53(9): 52320
https://doi.org/10.31083/CEOG52320

Original Research

Clinical Characteristics of Hospitalized Patients With Abnormal Uterine Bleeding Among the Kyrgyz Ethnic Group in Plateau Regions

Jun Miao[1], Yiqing Lai[1], Xiuhua Yang[2], Jing Zhuang[1,*]

[1]Department of Gynecology, Changzhou Maternal and Child Health Care Hospital, 213000 Changzhou, Jiangsu, China
[2]Department of Internal Medicine, People's Hospital of Wuqia County, 845480 Kizilsu Kirghiz Autonomous Prefecture, Xinjiang, China
*Correspondence: zhj851124@126.com (Jing Zhuang)
Academic Editor: Michael H. Dahan
Submitted: 27 March 2026 Revised: 3 June 2026 Accepted: 18 June 2026 Published: 15 September 2026

Abstract

Background: Abnormal uterine bleeding (AUB) is a common gynecological disorder with complex etiologies. High-altitude hypoxic environments may influence disease presentation, yet few studies have focused on Kyrgyz women in such regions. This study aimed to investigate the clinical characteristics of hospitalized Kyrgyz AUB patients in a high-altitude area. **Methods:** A total of 112 Kyrgyz patients with AUB who were hospitalized at People's Hospital of Wuqia County in the Kizilsu Kyrgyz Autonomous Prefecture, Xinjiang (mean altitude 3197 m) between January 1, 2023 and March 31, 2025, were included. Patients were categorized by pathological type (physiological endometrium, n = 23; functional endometrial lesions, n = 71; organic endometrial lesions, n = 18), healthcare-seeking delay (≤14 days, n = 44; >14 days, n = 68), age (<45 years, n = 68; ≥45 years, n = 44), and anemia status (non-anemic, n = 55; anemic, n = 57). Clinical data, including general characteristics, etiology, pathological types, and subgroup characteristics, were retrospectively analyzed and statistically compared. **Results:** The mean age of the patients was 43.21 ± 5.91 years, the mean body mass index (BMI) was 26.45 ± 4.17 kg/m^2, and the median disease duration was 16.5 days. Menstrual cycle abnormalities were observed in 61.61% of patients, and ovulatory dysfunction was the predominant etiology (50.89%). The most common pathological type was disordered endometrial proliferation (44.64%). Disease duration was significantly longer in the delayed healthcare-seeking group than in the non-delayed group ($p < 0.001$), whereas none of the patients with diabetes mellitus exhibited delayed healthcare-seeking ($p = 0.022$). Patients aged 45 and older had higher BMI, gravidity, and parity, but lower platelet counts compared with those younger than 45 years (all $p < 0.05$). Menstrual cycle abnormalities were more frequent among women aged 45 years and older ($p = 0.019$), and the distribution of pathological types differed significantly between the two age groups ($p = 0.017$). Regarding etiological classification, the proportion of structural uterine abnormalities (PALM) was higher in patients aged 45 years and older (50.00%) than in those younger than 45 years (32.35%), a difference that approached statistical significance ($p = 0.062$). The structural Polyp, Adenomyosis, Leiomyoma, Malignancy and hyperplasia (PALM) etiologies were significantly more common in anemic patients than in non-anemic patients (49.12% vs. 29.09%, $p = 0.030$). Moreover, PALM etiology was independently associated with anemia in the exploratory multivariable analysis (odds ratio [OR] = 2.624, 95% confidence interval [CI]: 1.153–6.193). **Conclusions:** Plateau-dwelling Kyrgyz women hospitalized with AUB were predominantly middle-aged and overweight or obese, with ovulatory dysfunction as the leading etiology and disordered endometrial proliferation as the most common pathological finding. Longer disease duration was associated with delayed healthcare-seeking. Age and menstrual cycle abnormalities were associated with differences in pathological type distribution. Furthermore, PALM etiology was identified as an independent risk factor for anemia in this population.

Keywords: abnormal uterine bleeding; plateau region; clinical characteristics; Kyrgyz ethnic group

1. Introduction

Abnormal uterine bleeding (AUB) is a common gynecological disorder affecting women of all ages, with an overall incidence of approximately 11–13% [1]. The prevalence is even higher—up to one-third—particularly among adolescents and perimenopausal women [2]. The clinical symptoms of AUB are non-specific and primarily manifest as irregular menstruation or postmenopausal bleeding. Its etiology is complex and diverse; common contributing factors include ovulatory dysfunction and endometrial lesions, necessitating pathological examination for definitive diagnosis. This condition can severely impact patients' physical health and quality of daily life. Furthermore, its incidence, clinical presentation, etiological classification, and treatment options are influenced by various factors such as living environment, educational background, and economic status. In clinical management, accurate diagnosis based on the patient's specific etiology and individual differences, followed by stage-wise, individualized treatment, can effectively improve patient outcomes [3]. Studies have shown that high-altitude environments may delay menarche and advance menopause [4], while also exerting certain negative effects on fertility [5]. Additionally, the incidence of irregular menstrual cycles tends to be higher at high altitudes. Notably, when women migrate to low-altitude areas, these reproductive endocrine abnormalities often show

some degree of alleviation or even reversal [6]. In medical terms, high-altitude areas are defined as regions at an altitude of 2500 meters or more above sea level, where the human body experiences sustained low-pressure and low-oxygen stimulation [7]. This environment exerts significant biological effects that may exacerbate the risk and severity of certain diseases, including AUB.

Wuqia County in Kizilsu Kyrgyz Autonomous Prefecture, Xinjiang, is located at the westernmost end of China. It is a typical high-altitude region, situated at the western tip of the Tarim Basin, the eastern part of the Pamir Plateau, and the intersection of the Tianshan and Kunlun mountain ranges. It borders Artux City to the east, Kashgar City to the south, Shufu County and Akto County to the southwest, and the Kyrgyz Republic to the northwest. The altitude in the area ranges from 1760 to 6146 meters, with a mean altitude of 3197 meters [8]. The characteristic chronic mild hypobaric hypoxia in this region can induce DNA damage. When metabolic byproducts attack cells, DNA repair function declines [9], leading to adaptive changes in multiple physiological systems [10,11,12]. These changes may be associated with the risk and clinical severity of certain diseases, including AUB.

Wuqia County has limited medical resources, and local women have poor health awareness. In clinical practice, cases of AUB often progress to severe anemia or long-term bleeding complicated by ascending infections, and even serious complications such as pyometra or endometrial cancer that threaten patients' lives. Currently, few studies have examined the clinical characteristics of Kyrgyz patients with AUB in high-altitude regions. Therefore, this study aimed to describe the distribution of etiologies and pathological types, analyze the associations of age and healthcare-seeking delay with pathological types, and explore factors influencing anemia among Kyrgyz inpatients with AUB in a high-altitude region. The goal is to achieve early detection and treatment, thereby preventing severe complications.

2. Materials and Methods

2.1 General Data

Patients with AUB who were hospitalized at People's Hospital of Wuqia County in Kizilsu Kyrgyz Autonomous Prefecture, Xinjiang, between January 1, 2023 and March 31, 2025, and who underwent hysteroscopy with confirmed pathological results were selected. Inclusion criteria were: (1) Kyrgyz ethnicity; (2) complete medical records; and (3) meeting the diagnostic criteria for AUB. Exclusion criteria were: (1) pregnancy-related bleeding; (2) bleeding originating from the vagina or cervix; (3) coagulation disorders (screened by coagulation function tests and platelet function screening); and (4) traumatic bleeding. A total of 112 patients were included. Wuqia County is a pastoral ethnic county under the jurisdiction of Kizilsu Kyrgyz Autonomous Prefecture, Xinjiang, with a mean altitude of 3197 m, making it a high-altitude region. The Kyrgyz people account for more than 77% of the total population. People's Hospital of Wuqia County is the only secondary grade A hospital in the region, admitting more than 98% of gynecological inpatients from the entire county.

2.2 Patient Inclusion Process

Between January 1, 2023 and March 31, 2025, researchers screened 138 patients hospitalized with AUB who underwent hysteroscopy during hospitalization at People's Hospital of Wuqia County. A total of 26 patients were excluded (15 non-Kyrgyz and 11 with incomplete medical records), resulting in a final inclusion of 112 patients (Fig. 1).

2.3 Variable Definitions

Disease duration: The time interval (in days) from the first occurrence of AUB symptoms to the current hospitalization.

Delayed healthcare-seeking: The UK National Institute for Health and Care Excellence (NICE) guidelines recommend urgent specialist referral within 14 days for postmenopausal bleeding [13]. As no universally accepted cutoff exists for patient delay in this study population, and our disease course endpoint aligns with the referral pathway endpoint, we operationally defined delayed healthcare-seeking as >14 days from symptom onset to hospital visit.

Menstrual cycle abnormalities: These include abnormalities in cycle frequency (<21 days or >35 days), regularity (irregular bleeding), duration of menstrual flow (>7 days), or menstrual blood volume (excessive or scanty).

Overweight [14]: body mass index (BMI) 24 to less than 28 kg/m^2; Obesity: BMI of 28 kg/m^2 or higher.

Anemia definition (non-pregnant adult women): Anemia was defined as hemoglobin (Hb) <110 g/L. In high-altitude areas, the partial pressure of oxygen decreases, and an increase in Hb concentration is a normal physiological adaptation to maintain adequate tissue oxygenation. Previous studies have shown that Hb increases by 6 g/L for every additional 1000 m of altitude. Therefore, for adult women, we set the cutoff value for anemia at 128 g/L [15].

According to the International Federation of Gynecology and Obstetrics (FIGO) PALM-COEIN classification system [16], the etiologies of AUB are divided into two major categories: structural abnormalities (PALM) and non-structural causes (COEIN).

PALM: endometrial polyp, adenomyosis, leiomyoma, malignancy, and atypical hyperplasia.

COEIN: coagulopathy, ovulatory dysfunction, endometrial causes, iatrogenic causes, and other causes not otherwise classified.

According to the Gynecologic Pathology textbook and clinical practice guidelines [16,17], the pathological results of hysteroscopic biopsy are classified into three categories.

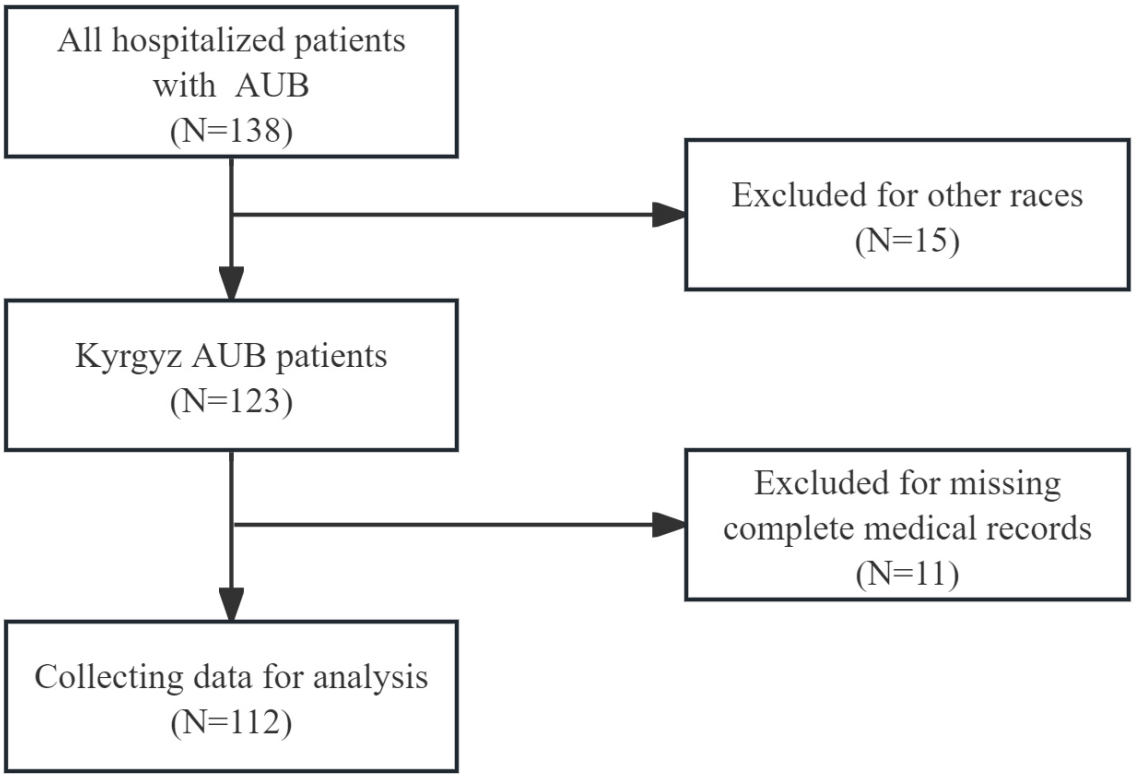

Fig. 1. Study flowchart. AUB, Abnormal Uterine Bleeding.

Table 1. Details of group assignment.

Variables	Group	No. of cases
Pathology type	Physiological endometrial group	23
	Functional endometrial lesion group	71
	Organic endometrial lesion group	18
Delay to presentation	Non-delayed group (disease duration ≤14 days)	44
	Delayed group (disease duration >14 days)	68
Age	<45 years group	68
	≥45 years group	44
Anemia	Non-anemic group (Hb ≥128 g/L)	55
	Anemic group (Hb <128 g/L)	57

Hb, Hemoglobin.

Physiological endometrium: proliferative endometrium, secretory endometrium, and atrophic endometrium.

Functional endometrial lesions: simple hyperplasia, complex hyperplasia, and disordered endometrial proliferation.

Organic endometrial lesions: uterine leiomyoma, endometrial polyp, endometritis, and endometrial carcinoma.

2.4 Grouping

The patients were categorized as follows: by pathology type, the physiological endometrium group (n = 23), the functional endometrial lesion group (n = 71), and the organic endometrial lesion group (n = 18). By delay to presentation, the non-delayed group (disease duration ≤14 days) consisted of 44 cases, and the delayed group (disease duration >14 days) consisted of 68 cases. By age, the <45 years group included 68 cases, while the ≥45 years group included 44 cases. By anemia status, the non-anemic group (Hb ≥128 g/L) comprised 55 cases, and the anemic group (Hb <128 g/L) comprised 57 cases (See Table 1).

2.5 Research Methods

This study was a single-center retrospective case analysis. Data collected included patient age, disease duration, BMI, menstrual history, obstetric history (gravidity, parity, and abortions), endometrial thickness, admission Hb level, platelet count, fasting blood glucose, presence of hypertension and diabetes mellitus, pathological results, and FIGO etiological classification (PALM-COEIN). The study was

approved by the Ethics Committee of People's Hospital of Wuqia County (Approval No. 2025012). Due to its retrospective nature, informed consent was waived.

2.6 Sample Size Estimation

The primary endpoint of this study was the distribution of pathological types. According to published literature, the proportion of disordered endometrial proliferation among AUB patients is approximately 27.8% [18]. With an allowable error of 8% and a confidence interval (CI) of 95%, the minimum required sample size was calculated using the cross-sectional study formula $n = Z^2_{1-\alpha/2} \times P(1-P)/d^2$, yielding $1.96^2 \times 0.278 \times 0.722 / 0.08^2 \approx 120$ cases. The actual number of cases included in this study was 112, which is close to the estimated sample size, indicating basic statistical power.

2.7 Statistical Analyses

All data were processed using SPSS 27.0 (IBM Corp., Armonk, NY, USA, 2020). Measurement data were tested for normality by the Shapiro-Wilk test. Normally distributed data are expressed as the mean ± standard deviation ($\bar{x} \pm s$), and between-group comparisons were performed using the independent sample *t*-test or one-way analysis of variance. Non-normally distributed data are expressed as the median (interquartile range), and between-group comparisons were performed using the Mann-Whitney U test or Kruskal-Wallis H test. Enumeration data are expressed as the frequency (percentage), and between-group comparisons were performed using the χ^2 test or Fisher's exact test. Multivariable logistic regression analyses were performed with anemia status (0 = no, 1 = yes) as the dependent variable. Covariates were selected based on clinical importance and univariate analysis findings, including age, BMI, disease duration, menstrual cycle abnormalities, and delayed healthcare-seeking, with etiology classification as the primary independent variable of interest. Other clinically relevant variables including hypertension, diabetes mellitus, platelet count, pathological type, and endometrial thickness, were not included because none showed a significant association with anemia in univariate analyses (all $p > 0.05$). Given the small sample size and exploratory study design, excessive inclusion of non-significant variables was avoided to prevent model overfitting and unstable parameter estimation. The covariate categories are as follows: etiology classification (0 = COEIN, 1 = PALM), menstrual cycle (0 = normal, 1 = abnormal), and delayed presentation (0 = no, 1 = yes). The goodness-of-fit of the logistic regression model was assessed using the Hosmer-Lemeshow test. Multicollinearity was examined by calculating the variance inflation factor (VIF), with a VIF >2 indicating Multicollinearity. $p < 0.05$ was considered statistically significant. Given the exploratory nature of this study and the number of comparisons, we did not adjust for multiple testing, therefore, all *p*-values should be interpreted with caution and considered exploratory rather than confirmatory.

3. Results

3.1 Patients Data

All 112 patients were of Kyrgyz ethnicity, with a mean age of 43.21 ± 5.91 years and a median bleeding duration before medical-seeking of 16.5 (10, 27.25) days. The mean BMI was 26.45 ± 4.17 kg/m^2, ranging from 16.49 to 38.09 kg/m^2. According to BMI classification criteria, there were 46 overweight patients (24 kg/m^2 ≤ BMI < 28 kg/m^2, 41.07%) and 37 obese patients (BMI ≥28 kg/m^2, 33.03%). The mean fasting blood glucose was 5.07 ± 0.55 mmol/L, median gravidity was 3 (2, 4), median parity was 2 (2, 3), and median abortion times were 0 (0, 1).

Postoperative pathological reports included 10 types, and the top three pathological types were proliferative disorder (50 cases, 44.64%), proliferative endometrium (17 cases, 15.18%), and simple hyperplasia (17 cases, 15.18%). According to the FIGO PALM-COEIN etiological classification system, the proportions of various etiologies were as follows: endometrial polyp (P) 8.93%, adenomyosis (A) 8.04%, leiomyoma (L) 21.43%, malignancy and hyperplasia (M) 0.89%, coagulopathy (C) 0%, ovulatory dysfunction (O) 50.89%, endometrial disorder (E) 4.46%, iatrogenic (I) 5.36%, and not otherwise classified (N) 0%. The top three etiologies were AUB associated with ovulatory dysfunction (AUB-O), AUB caused by leiomyoma (AUB-L), and AUB caused by polyps (AUB-P), and uterine structural lesions accounted for 39.29% (See Table 2 for details).

3.2 Comparison Among Different Pathological Type Groups

The physiological endometrium group had the oldest age (47.17 ± 5.77 years), and the functional endometrial lesion group had the youngest age (41.82 ± 5.60 years), with significant between-group differences ($p < 0.001$). In terms of etiology, COEIN type accounted for 65.22% in the physiological endometrium group, 70.42% in the functional endometrial lesion group, and PALM type accounted for 83.33% in the organic endometrial lesion group, which was significantly higher than that in the other two groups ($p < 0.001$) (See Table 3 for details).

3.3 Comparison of Clinical Characteristics Between Delayed and Non-Delayed Medical-Seeking Groups

Sixty-eight patients (60.71%) had delayed medical seeking (disease course >14 days). The disease course in the delayed medical-seeking group was significantly longer than that in the non-delayed group (24.5 days vs. 10.0 days; $p < 0.001$). No delayed medical-seeking was found in all diabetic patients ($p = 0.022$). There were no significant differences in age, BMI, platelet count, endometrial thickness, menstrual cycle, or gravidity and parity between the two groups (See Table 4 for details).

Table 2. Baseline clinical characteristics of patients.

Characteristics	All (N = 112)
Age (years, mean ± SD)	43.21 ± 5.91
Disease course (days, median (IQR))	16.5 (10.0, 27.25)
BMI (kg/m^2, mean ± SD)	26.45 ± 4.17
Hb (g/L, mean ± SD)	122.13 ± 20.57
PLT (×10^9/L, mean ± SD)	294.88 ± 68.25
Fasting blood glucose (mmol/L, mean ± SD)	5.07 ± 0.55
Endometrial thickness (mm, median (IQR))	8.5 (7.0, 13.0)
Gravidity, median (IQR)	3.0 (2.0, 4.0)
Parity, median (IQR)	2.0 (2.0, 3.0)
Abortion times, median (IQR)	0 (0, 1.0)
Complications, n (%)	-
Hypertension	8 (7.14%)
Diabetes mellitus	4 (3.57%)
Abnormal menstrual cycle	69 (61.61%)
Etiology, n (%)	-
Endometrial polyp	10 (8.93%)
Adenomyosis	9 (8.04%)
Leiomyoma	24 (21.43%)
Malignancy and atypical hyperplasia	1 (0.89%)
Systemic coagulation-related diseases	0
Ovulatory dysfunction	57 (50.89%)
Local endometrial abnormality	5 (4.46%)
Iatrogenic factors	6 (5.36%)
Other causes	0
Pathology, n (%)	-
Proliferative endometrium	17 (15.18%)
Secretory endometrium	5 (4.46%)
Atrophic endometrium	1 (0.89%)
Simple hyperplasia	17 (15.18%)
Complex hyperplasia	4 (3.57%)
Proliferative disorder	50 (44.64%)
Uterine leiomyoma	6 (5.36%)
Endometrial polyp	8 (7.14%)
Endometritis	3 (2.68%)
Endometrial carcinoma	1 (0.89%)

BMI, body mass index; PLT, platelets.

3.4 Comparison of Clinical Characteristics Between Different Age Groups

Compared to the <45 age group, women aged ≥45 years had significantly higher BMI, gravidity, and parity, but a lower platelet count (all $p < 0.05$). The older group (≥45 years) had a significantly higher BMI (27.58 ± 3.34 vs. 25.70 ± 4.50; $p = 0.014$) and higher median gravidity (3 vs. 2; $p = 0.019$) and parity (2 vs. 2; $p = 0.003$) compared to the younger group (<45 years). Conversely, platelet counts were significantly lower in the older cohort (278.91 ± 58.95 vs. 305.22 ± 72.18; $p = 0.037$).

Women aged ≥45 experienced a higher rate of abnormal menstrual cycles (75.00% vs. 52.94%; $p = 0.019$) and showed significant differences in pathological types ($p = 0.017$) compared to the younger group. Regarding etiology, the ≥45 age group showed a higher, although not statistically significant, proportion of uterine structural lesions (PALM) compared to the <45 group (50.00% vs. 32.35%; $p = 0.062$) (See Table 5 for details).

3.5 Comparison of Clinical Characteristics Between Anemic and Non-Anemic Groups

A total of 57 patients had anemia. The proportion of structural PALM etiologies in anemic patients was significantly higher than that in non-anemic patients (49.12% vs. 29.09%, $p = 0.030$). Multivariate logistic regression analyses were conducted to evaluate potential risk factors for anemia while controlling for confounding variables. The Hosmer-Lemeshow test yielded a p-value of 0.873 ($\chi^2 = 3.819$), indicating that the logistic regression model pro-

Table 3. Summary descriptives by pathological type groups.

Characteristics	Physiological Endometrium Group (N = 23)	Functional Endometrial Lesion Group (N = 71)	Organic Endometrial Lesion Group (N = 18)	F/H/χ^2	*p*-value
Age (years)	47.17 ± 5.77	41.82 ± 5.60	43.61 ± 5.15	8.096	<0.001
Disease course (days)	15 (10, 30)	17.5 (11, 27)	16 (11.25, 23)	0.268	0.875
Blood glucose (mmol/L)	5.04 ± 0.65	5.04 ± 0.51	5.24 ± 0.53	1.022	0.363
BMI (kg/m^2)	28.16 ± 3.77	25.96 ± 4.24	26.19 ± 3.99	2.543	0.080
Platelet count (×10^9/L)	268.00 ± 66.37	298.48 ± 61.84	315.06 ± 86.62	2.753	0.068
Hb (g/L)	121.48 ± 22.77	123.45 ± 20.51	117.78 ± 18.20	0.557	0.575
Endometrial thickness (mm)	8.0 (6.0, 15.0)	9.0 (7.0, 14.0)	8.0 (7.25, 10.0)	2.153	0.341
Hypertension*	-	-	-		0.575
No	21 (91.30%)	65 (91.55%)	18 (100.00%)		-
Yes	2 (8.70%)	6 (8.45%)	0 (0.00%)		-
Diabetes mellitus*	-	-	-		0.138
No	21 (91.30%)	70 (98.59%)	17 (94.44%)		-
Yes	2 (8.70%)	1 (1.41%)	1 (5.56%)		-
Menstrual cycle	-	-	-	3.669	0.160
Normal	6 (26.09%)	32 (45.07%)	5 (27.78%)		-
Abnormal	17 (73.91%)	39 (54.93%)	13 (72.22%)		-
Gravidity	3.0 (2.0, 3.5)	3.0 (2.0, 4.0)	3.0 (2.0, 4.0)	1.665	0.435
Parity	2.0 (2.0, 3.0)	2.0 (2.0, 3.0)	2.0 (2.0, 3.0)	0.696	0.706
Abortion times	0 (0, 2.0)	0 (0, 1.0)	0 (0, 1.75)	0.972	0.615
Delayed medical-seeking	-	-	-	0.582	0.748
No delay	10 (43.48%)	26 (36.62%)	8 (44.44%)		-
Delay	13 (56.52%)	45 (63.38%)	10 (55.56%)		-
Etiology	-	-	-	17.643	<0.001
PALM	8 (34.78%)	21 (29.58%)	15 (83.33%)		-
COEIN	15 (65.22%)	50 (70.42%)	3 (16.67%)		-

*Fisher's exact test. PALM, polyp, adenomyosis, leiomyoma, malignancy, and atypical hyperplasia; COEIN, coagulopathy, ovulatory dysfunction, endometrial causes, iatrogenic, and not otherwise classified.

vides an adequate fit to the observed data. All VIF values ranged between 1.06 and 1.16, confirming no Multicollinearity issues. The multivariate logistic analyses results showed that PALM remained independently associated with anemia (odds ratio = 2.624, 95% CI: 1.153–6.193; $p = 0.024$) (See Tables 6,7 for details).

4. Discussion

AUB is one of the most common clinical symptoms and diseases in gynecology, with complex etiologies that range from functional disorders to organic lesions. The manifestations of AUB are diverse, and its etiology is complex, with significant individual variation [19]. It is estimated that approximately 100 million people in China live in sub-plateau and plateau regions. The unique geographical conditions of plateau regions may lead to physiological differences between women in these areas and those in other regions. Moreover, plateau regions are inhabited by multiple ethnic groups, and different cultures and living habits also affect the presentation and treatment of AUB. Studying these factors may help optimize treatment strategies and provide references for other regions with similar geographical environments. This study focused on hospitalized Kyrgyz patients in a high-altitude region with a mean altitude of 3197 m, revealing the uniqueness of this population in clinical manifestations and conducting an in-depth analysis of multiple factors affecting healthcare-seeking behavior and disease composition.

The direct relationship between hypoxia and AUB has not been fully elucidated, but studies suggest that hypoxia may influence the pathological processes of the above etiologies through multiple pathways. The key mechanistic points are as follows. Regarding uterine fibroids, hypoxia may regulate the expression of endothelin and prostaglandin F2α (PGF2α) receptors, altering the contractility of endometrial blood vessels, which may be associated with increased menstrual blood loss. Regarding malignant tumors, the hypoxic microenvironment in tumor areas tends to induce abnormal angiogenesis, which may alter local blood supply and increase the risk of metastasis. Regarding endometrial diseases, local endothelial cell dysfunction and impaired metabolism or contraction of vascular smooth muscle cells can affect vasoconstriction and repair; in certain circumstances, hypoxia-inducible factor 1 alpha (HIF-1α) levels may be reduced, impairing menstrual repair. Regarding adenomyosis, overexpression of vascu-

Table 4. Summary descriptives by medical-seeking delay groups.

Characteristics	Nondelayed Medical-seeking (N = 44)	Delayed Medical-seeking (N = 68)	t/U/χ^2	p-value
Age (years)	44.30 ± 5.26	42.50 ± 6.24	1.638	0.104
Disease course (days)	10 (7.75, 11)	24.5 (18, 30)	0.0	<0.001
Blood glucose (mmol/L)	5.08 ± 0.67	5.06 ± 0.45	0.173	0.863
BMI (kg/m^2)	26.38 ± 3.99	26.49 ± 4.30	0.138	0.892
Platelet count (×10^9/L)	296.59 ± 70.10	293.78 ± 67.53	0.210	0.834
Hb (g/L)	118.84 ± 21.27	124.26 ± 19.96	1.350	0.181
Endometrial thickness (mm)	8.5 (7, 12)	8.5 (7, 13.25)	1497.0	0.995
Hypertension*	-	-		0.259
No	39 (88.63%)	65 (95.58%)		-
Yes	5 (11.36%)	3 (4.41%)		-
Diabetes mellitus*	-	-		0.022
No	40 (90.90%)	68 (100%)		-
Yes	4 (9.09%)	0 (0.00%)		-
Menstrual cycle	-	-	2.398	0.121
Normal	13 (29.54%)	30 (44.11%)		-
Abnormal	31 (70.45%)	38 (55.88%)		-
Gravidity	3.0 (2.0, 4.0)	3.0 (2.0, 4.0)	1542.0	0.778
Parity	2.0 (2.0, 2.5)	2.0 (2.0, 3.0)	1421.0	0.626
Abortion times	0 (0, 1.0)	0 (0, 1.0)	1663.5	0.255
Pathological type	-	-	0.582	0.748
Physiological	10 (22.72%)	13 (19.11%)		-
Functional	26 (59.09%)	45 (66.17%)		-
Organic	8 (18.18%)	10 (14.70%)		-
Etiology	-	-	1.156	0.282
PALM	20 (45.45%)	24 (35.29%)		-
COEIN	24 (54.54%)	44 (64.71%)		-

*Fisher's exact test.

lar endothelial growth factor and HIF-1α may enhance local angiogenesis, which is associated with abnormal bleeding [20].

Compared with survey data from some plain regions of China [21], the proportion of uterine structural abnormalities in this high-altitude region was as high as 39.29%, higher than the 33.1% reported in plain regions. In the high-altitude region, the main etiologies of local AUB were AUB-O, AUB-P, and AUB-L. By contrast, in plain regions, the main etiologies were AUB-O, AUB caused by endometrial dysfunction, and AUB-P, indicating regional differences in etiology [22]. The proportion of AUB-O was 37.07% in plain regions but reached 50.89% in the high-altitude region. The cause of this discrepancy is not fully understood. One hypothesis is that the hypoxic high-altitude environment may be associated with increased production of acidic metabolites, which may be related to reduced ovarian reserve and potential imbalance of female endocrine hormones. These factors may be associated with the high proportion of AUB-O observed in this population [23,24].

In this high-altitude region, the most frequent pathological type was endometrial proliferative disorder, accounting for 44.64% of cases. This finding is consistent with a study conducted in Nepal [18], in which endometrial proliferative disorder was observed in 27.8% of 240 patients and represented the most common pathological type of AUB. This phenomenon may be associated with ovarian dysfunction or decline under high-altitude hypoxia, resulting in infrequent or absent ovulation and insufficient progesterone supply. Consequently, the endometrium undergoes hyperplasia under continuous estrogenic stimulation.

In this study, overweight and obese patients accounted for 74.11%, significantly higher than the average level among adult women in China (approximately 37%) [25], indicating that the study population mainly consisted of middle-aged overweight or obese women. The dietary structure of the Kyrgyz population in this high-altitude region may be high in calories. In addition, the hypoxic environment exerts varying degrees of adverse effects on multiple systems in women, especially the heart, sleep, blood supply, and mucous membranes, which impair basal metabolism. These factors may be associated with the high prevalence of obesity in the local population [26]. Obesity is recognized as a risk factor for AUB, particularly AUB associated with ovulatory disorders [27]. Adipose tissue serves as a major site for peripheral estrogen conversion. Excessive adipose tissue may be associated with persistent,

Table 5. Baseline clinical characteristics of patients stratified by age.

Variables	<45 years (N = 68)	≥45 years (N = 44)	t/U/χ^2	p-value
Age (years)	39.51 ± 3.80	48.91 ± 3.59	13.202	<0.001
Disease course (days), median (IQR)	16.5 (10.75, 25.25)	17 (10, 30)	1440.0	0.759
Blood glucose (mmol/L)	5.02 ± 0.58	5.15 ± 0.48	1.288	0.201
BMI (kg/m^2)	25.70 ± 4.50	27.58 ± 3.34	2.506	0.014
Platelet count (×10^9/L)	305.22 ± 72.18	278.91 ± 58.95	2.109	0.037
Hemoglobin (Hb, g/L)	121.03 ± 19.72	123.84 ± 21.93	0.689	0.493
Endometrial thickness on admission (B-ultrasound, mm), median (IQR)	9.0 (7.0, 11.0)	8.0 (7.0, 14.25)	1327.5	0.314
Hypertension*				0.055
No	66 (97.06%)	38 (86.36%)		-
Yes	2 (2.94%)	6 (13.64%)		-
Diabetes mellitus*				0.941
No	65 (95.59%)	43 (97.73%)		-
Yes	3 (4.41%)	1 (2.27%)		-
Menstrual cycle			5.496	0.019
Normal	32 (47.06%)	11 (25.00%)		-
Abnormal	36 (52.94%)	33 (75.00%)		-
Gravidity, median (IQR)	2.0 (2.0, 3.0)	3.0 (2.0, 4.0)	1116.0	0.019
Parity, median (IQR)	2.0 (2.0, 2.0)	2.0 (2.0, 3.0)	1036.5	0.003
Abortion times, median (IQR)	0 (0, 1.0)	0 (0, 1.0)	1443.0	0.720
Delayed medical consultation			0.013	0.910
No delay	27 (39.71%)	17 (38.64%)		-
Delayed	41 (60.29%)	27 (61.36%)		-
Pathological type			8.165	0.017
Physiological endometrium	8 (11.76%)	15 (34.09%)		-
Functional endometrial lesions	48 (70.59%)	23 (52.27%)		-
Organic endometrial lesions	12 (17.65%)	6 (13.64%)		-
Etiological classification			3.488	0.062
PALM	22 (32.35%)	22 (50.00%)		-
COEIN	46 (67.65%)	22 (50.00%)		-

*Fisher's exact test. IQR, interquartile range.

unopposed high estrogen levels, which are related to endometrial hyperplasia and may be associated with a higher risk of malignant transformation [28]. This appears to be broadly consistent with the findings of the present study, in which ovulatory disorders (50.89%) and endometrial proliferative disorders (44.64%) were the main etiological and pathological changes.

Delayed healthcare-seeking is one of the key outcome measures of this study. Among the 112 patients, the duration of bleeding before seeking medical care varied considerably. The median disease duration in the delayed healthcare-seeking group was 24.5 days, which was significantly longer than the 10 days in the non-delayed group. It has been reported [29] that more than half of patients with AUB do not seek medical treatment, suggesting that awareness of this disease and healthcare-seeking behaviors still need improvement. The proportion of delayed healthcare-seeking among patients with AUB in this region was as high as 60.71%. A previous study has pointed out [30] that delayed healthcare-seeking is closely associated with factors such as the patient's education level, health awareness, economic status, and family or work environment. Therefore, further investigation into the reasons for delayed healthcare-seeking among patients in this region would be warranted, and targeted interventions should be implemented accordingly to improve the rate of early medical consultation, treatment outcomes, and quality of life. Additionally, all four patients with diabetes mellitus were in the non-delayed group. It is possible that the intensive, long-term management of diabetes fosters greater health awareness and more frequent patient–provider interactions. Consequently, these patients may be more vigilant regarding new symptoms such as AUB, potentially leading to earlier healthcare interventions. It is worth noting that due to the small sample size, these results may have certain limitations and may require further clarification.

Patients aged ≥45 years presented with significantly higher BMI, gravidity, and parity, suggesting a more stronger trend toward obesity in this older cohort. Given the role of adipose tissue as a major site of peripheral estrogen conversion, obesity may be associated with disruption of hormonal balance and may contribute to endocrine dis-

Table 6. Clinical characteristics of AUB patients stratified by anemia.

Characteristics	NO	YES	$t/U/\chi^2$	*p*-value
	N = 55	*N* = 57		
Age (years)	42.69 ± 6.16	43.70 ± 5.68	0.902	0.369
Disease course (days)	18 (11.5, 30)	15 (10, 25)	1862.5	0.086
Blood glucose (mmol/L)	5.05 ± 0.53	5.08 ± 0.56	0.278	0.781
BMI (kg/m^2)	27.07 ± 4.26	25.8 ± 4.02	1.562	0.121
Platelet count ($\times 10^9/L$)	287.85 ± 58.35	301.67 ± 76.52	1.077	0.284
Hemoglobin (Hb, g/L)	138.00 ± 9.22	106.82 ± 16.45	12.428	<0.001
Endometrial thickness on admission (B-ultrasound, mm), median (IQR)	8.0 (7.0, 11.0)	9 (7.0, 14.0)	1430.0	0.423
Hypertension*				0.486
No	50 (90.91%)	54 (94.74%)		
Yes	5 (9.09%)	3 (5.26%)		
Diabetes mellitus *				1.000
No	53 (96.36%)	55 (96.49%)		
Yes	2 (3.64%)	2 (3.51%)		
Menstrual cycle			0.188	0.664
Normal	20 (36.36%)	23 (40.35%)		
Abnormal	35 (63.64%)	34 (59.65%)		
Gravidity, median (IQR)	3.0 (2.0, 4.0)	3.0 (2.0, 3.0)	1551.5	0.925
Parity, median (IQR)	2.0 (2.0, 3.0)	2.0 (2.0, 3.0)	1576.5	0.957
Abortion times, median (IQR)	0 (0, 1.0)	0 (0, 1.0)	1573.0	0.973
Delayed medical consultation			1.018	0.313
No delay	19 (34.55%)	25 (43.86%)		
Delayed	36 (65.45%)	32 (56.14%)		
Pathological type			1.597	0.450
Physiological endometrium	10 (18.18%)	13 (22.81%)		
Functional endometrial lesions	38 (69.09%)	33 (57.89%)		
Organic endometrial lesions	7 (12.73%)	11 (19.30%)		
Etiological classification			4.709	0.030
PALM	16 (29.09%)	28 (49.12%)		
COEIN	39 (70.91%)	29 (50.88%)		

*Fisher's exact test.

Table 7. Multivariable logistic regression analyses associated with anemia.

Variable	β	SE	Wald χ^2	*p*-value	OR	95% CI
PALM	0.965	0.427	5.115	0.024	2.624	1.153–6.193
Age (years)	0.037	0.037	0.983	0.321	1.038	0.966–1.119
Disease course (days)	–0.004	0.003	1.047	0.306	0.996	0.986–1.001
BMI	–0.091	0.051	3.199	0.074	0.913	0.822–1.006
Menstrual cycle	–0.361	0.429	0.710	0.399	0.697	0.296–1.604
Delayed medical consultation	–0.165	0.434	0.145	0.703	0.848	0.361–1.998

Abbreviations: β, regression coefficient; SE, standard error; OR, odds ratio; CI, confidence interval.

Hosmer-Lemeshow test: $\chi^2 = 3.819$, $p = 0.873$.

$VIF\text{-}_{PALM} = 1.070$, $VIF\text{-}_{Age} = 1.158$, $VIF\text{-}_{Disease\ course} = 1.109$, $VIF\text{-}_{BMI} = 1.068$, $VIF\text{-}_{Menstrual\ cycle} = 1.101$, $VIF\text{-}_{Delayed\ medical\ consultation} = 1.134$.

orders. Meanwhile, the proportion of abnormal menstrual cycles was higher in the older group, which was closely related to ovulatory disorders caused by physiological decline in ovarian function in older women, consistent with the disruptive effect of high-altitude hypoxia on the endocrine system. Regarding pathological and etiological classification, the physiological endometrium group had the oldest mean age (47.17 years), whereas the functional endometrial lesion group had the youngest mean age (41.82 years). Patients aged 45 or older had a higher proportion of physiological endometrium appearing as the pathological type. However, previous studies reported no significant correla-

tion between pathological types of AUB and patient age [31]. The older age distribution in the physiological endometrium group may be attributed to menstrual disorders caused by a natural decline in ovarian function during the perimenopausal period. Functional pathologies predominated in the <45 age group, which may reflect hormone imbalances and hypoxia-mediated ovulatory dysfunction. Etiological classification revealed that the proportion of uterine structural lesions (PALM) in the ≥45 age group reached 50.0%, which was numerically higher than the 32.35% in the younger group, though this difference did not reach statistical significance. This finding suggests that advancing age may be associated with a higher observed proportion of structural reproductive system lesions, including leiomyoma, adenomyosis, and polyps. This is consistent with a previous study indicating that older patients require focused screening for structural lesions [32]. In addition, platelet counts were slightly higher in patients under 45 compared to those over 45, consistent with the reported pattern of decreasing platelet counts with age [33]. These age-related differences can provide a basis for targeted clinical diagnosis and treatment.

Among hospitalized Kyrgyz women with AUB in plateau regions, structural etiology (PALM) was identified as independently associated with anemia, whereas basic characteristics such as age, disease duration, or BMI did not show independent associations in the regression model. AUB is a clinical condition that may lead to iron-deficiency anemia. In particular, heavy menstrual bleeding is closely related to uterine fibroids and adenomyosis. Meanwhile, although endometrial polyps may present with less obvious symptoms, about 68% of women were reported to have concurrent AUB [34]. This finding may provide preliminary clues for early identification of patients at higher risk of anemia in clinical practice. For patients with AUB and anemia, clinicians may consider prioritizing the evaluation of PALM-type lesions to facilitate timely intervention and mitigate the systemic effects of persistent blood loss. In this exploratory analysis, PALM etiology was independently associated with anemia (OR = 2.624, 95% CI: 1.153–6.193). However, given the small sample size, single-center design, and exploratory nature of this study, this finding should be considered hypothesis-generating and requires validation in larger, multicenter prospective studies.

This study has several notable limitations. First, the single-center retrospective design and inclusion of patients solely from a specific plateau region may be susceptible to selection bias, limiting the generalizability of the findings to broader populations. Second, treatment choices were heavily influenced by clinician judgment and patient preferences, potentially introducing bias into the study outcomes. Third, this study exclusively included hospitalized patients, who tend to have more severe conditions, potentially introducing severity bias. Fourth, the relatively small sample size, particularly regarding the number of diabetic patients (n = 4), may limit the statistical power of subgroup analyses. Fifth, the exploratory nature of multiple subgroup comparisons increases the risk of type I error; therefore, findings from these analyses should be considered hypothesis-generating rather than confirmatory. Future studies should expand the sample size, recruit participants from additional plateau regions and diverse altitudes for comparative analysis, and incorporate multi-center data to enhance generalizability. Moreover, a multicenter prospective study has demonstrated that imaging ultrasound significantly enhanced the discrimination of uterine intracavitary pathologies in perimenopausal and postmenopausal women with AUB [35]. Despite the absence of an association between anemia and endometrial thickness or pathological type in this study, the small number of tumor cases and the lack of MRI examinations precluded a rigorous analysis of tumor size, histological type, and their relationship with anemia. Future investigations should prioritize integrating MRI and Doppler ultrasound to improve diagnostic precision and to explore the relationships between tumor characteristics, endometrial pathology, and anemia, particularly in high-altitude settings.

5. Conclusions

The majority of plateau-dwelling Kyrgyz women hospitalized with AUB are middle-aged, overweight, or obese. Ovulatory dysfunction is the primary etiology, and the most common pathological type is disordered endometrial proliferation. Longer disease duration was associated with delayed healthcare-seeking, while age showed associations with differences in pathological type distribution. In the exploratory multivariable analysis, PALM etiology was independently associated with anemia. However, given the single-center retrospective design and the exploratory nature of the subgroup and regression analyses, these findings should be considered hypothesis-generating rather than confirmatory, and they require validation in larger, multicenter, prospective studies.

Availability of Data and Materials

Raw data supporting the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

JM: Conceptualization, methodology, data collection, data analysis, literature review, original draft writing, review and editing, project management. YL: Methodology, data collection, formal analysis, original draft writing, review and editing. XY: Methodology, formal analysis, literature review, original draft writing, review and editing. JZ: Concept and design, data collection, review and editing. All authors have read and approved the final manuscript. All authors have been sufficiently involved in the work and agree to be responsible for all aspects of the work.

Ethics Approval and Consent to Participate

The design of this study was carried out in accordance with the guidelines of the Declaration of Helsinki. This study was approved by the Ethics Committee of People's Hospital of Wuqia County (Approval No. 2025012). Due to its retrospective nature, informed consent was waived.

Acknowledgment

We thank all participants who took part in our study.

Funding

Scientific Research Project of Kizilsu Kyrgyz Autonomous Prefecture, Xinjiang Uygur Autonomous Region (2015-No.15); Science and Technology Project of Changzhou Health Commission, 2022 (No. WZ202217).

Conflicts of Interest

The authors declare no conflicts of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/CEOG52320.

References

[1] Marret H, Fauconnier A, Chabbert-Buffet N, Cravello L, Golfier F, Gondry J, et al. Clinical practice guidelines on menorrhagia: management of abnormal uterine bleeding before menopause. European Journal of Obstetrics, Gynecology, and Reproductive Biology. 2010; 152: 133–137. https://doi.org/10.1016/j.ejogrb.2010.07.016

[2] Lebduska E, Beshear D, Spataro BM. Abnormal Uterine Bleeding. The Medical Clinics of North America. 2023; 107: 235–246. https://doi.org/10.1016/j.mcna.2022.10.014

[3] Hong Z, Huang Z, Li W, Liu Q. Abnormal Uterine Bleeding: Diagnostic Evaluation, Medical and Surgical Management, and Patient Blood Management — A Narrative Review. Clinical and Experimental Obstetrics & Gynecology. 2026; 53: 48894. https://doi.org/10.31083/CEOG48894

[4] Raberin A, Burtscher J, Citherlet T, Manferdelli G, Krumm B, Bourdillon N, et al. Women at Altitude: Sex-Related Physiological Responses to Exercise in Hypoxia. Sports Medicine (Auckland, N.Z.). 2024; 54: 271–287. https://doi.org/10.1007/s40279-023-01954-6

[5] Zhong Y, Liu F, Zhang X, Guo Q, Wang Z, Wang R. Research progress on reproductive system damage caused by high altitude hypoxia. Endocrine. 2024; 83: 559–570. https://doi.org/10.1007/s12020-023-03643-w

[6] Shaw S, Ghosh D, Kumar U, Panjwani U, Kumar B. Impact of high altitude on key determinants of female reproductive health: a review. International Journal of Biometeorology. 2018; 62: 2045–2055. https://doi.org/10.1007/s00484-018-1609-0

[7] Chambers D, Huang C, Matthews G. Altitude. Basic Physiology for Anaesthetists (pp. 431–433). Cambridge University Press: Cambridge, UK. 2019.

[8] Wuqia County Overview. Climate overview of Wuqia County. 2026. Available at: https://www.xjwqx.gov.cn/xjwqx/c102698/202110/aa5645c3d2e948e2a99103dd9f65cb92.shtml (Accessed: 9 May 2026). (In Chinese)

[9] Sinha S, Dutta A, Singh SN, Ray US. Protein nitration, lipid peroxidation and DNA damage at high altitude in acclimatized lowlanders and native highlanders: relation with oxygen consumption. Respiratory Physiology & Neurobiology. 2010; 171: 115–121. https://doi.org/10.1016/j.resp.2010.03.002

[10] Richalet JP, Hermand E, Lhuissier FJ. Cardiovascular physiology and pathophysiology at high altitude. Nature Reviews. Cardiology. 2024; 21: 75–88. https://doi.org/10.1038/s41569-023-00924-9

[11] Villafuerte FC, Simonson TS, Bermudez D, León-Velarde F. High-Altitude Erythrocytosis: Mechanisms of Adaptive and Maladaptive Responses. Physiology (Bethesda, Md.). 2022; 37: 175–186. https://doi.org/10.1152/physiol.00029.2021

[12] Wang SY, Gao J, Zhao JH. Effects of high altitude on renal physiology and kidney diseases. Frontiers in Physiology. 2022; 13: 969456. https://doi.org/10.3389/fphys.2022.969456

[13] National Institute for Health and Care Excellence (NICE). Suspected cancer: recognition and referral guidelines (NICE guideline [NG12]). 2015. Available at: https://www.nice.org.uk/guidance/ng12 (Accessed: 3 March 2026).

[14] Zhou BF, Cooperative Meta-Analysis Group of the Working Group on Obesity in China. Predictive values of body mass index and waist circumference for risk factors of certain related diseases in Chinese adults–study on optimal cut-off points of body mass index and waist circumference in Chinese adults. Biomedical and Environmental Sciences. 2002; 15: 83–96.

[15] Gassmann M, Mairbäurl H, Livshits L, Seide S, Hackbusch M, Malczyk M, et al. The increase in hemoglobin concentration with altitude varies among human populations. Annals of the New York Academy of Sciences. 2019; 1450: 204–220. https://doi.org/10.1111/nyas.14136

[16] Gynecologic Endocrinology Subgroup, Chinese Society of Obstetrics and Gynecology, Chinese Medical Association. Guidelines for diagnosis and treatment of abnormal uterine bleeding. Chinese Journal of Obstetrics and Gynecology. 2014; 49: 801–806. (In Chinese)

[17] Gynecologic and Obstetric Pathology, Volume 1. In Zheng WX, Fadare O, Quick CM, Shen DH, Guo DH (eds.). 1st edn. Springer: Singapore. 2019. https://doi.org/10.1007/978-981-13-3016-2

[18] Shrestha D, Aryal S, Tiwari A, Sharma R. Abnormal Uterine Bleeding among Women Visiting Gynecology Out- patient Department of a Tertiary Care Hospital: A Descriptive Cross- sectional Study. JNMA; Journal of the Nepal Medical Association. 2022; 60: 121–125. https://doi.org/10.31729/jnma.6954

[19] Tian QJ, Huang H. Definition, nomenclature, classification and diagnosis of abnormal uterine bleeding. Journal of Practical Obstetrics and Gynecology. 2016; 32: 881–883. (In Chinese)

[20] Martínez-Aguilar R, Kershaw LE, Reavey JJ, Critchley HOD, Maybin JA. HYPOXIA AND REPRODUCTIVE HEALTH: The presence and role of hypoxia in the endometrium. Reproduction (Cambridge, England). 2021; 161: F1–F17. https://doi.org/10.1530/REP-20-0268

[21] Fang MF, Wu CH. Etiological analysis and management of 661 cases of abnormal uterine bleeding. Journal of Nanjing Medical University (Natural Science). 2017; 37: 1310–1312. (In Chinese)

[22] Du DF, Wang RJ, Cha RQ, Jiang P, Wang LQ, Chen X, et al. Clinical characteristics and influencing factors of treatment modalities in hospitalized patients with abnormal uterine bleeding in sub-high altitude areas. Fudan University Journal of Medical Sciences. 2025; 3: 408–415, 423. (In Chinese)

[23] Aiken CE, Tarry-Adkins X JL, Spiroski AM, Nuzzo AM, Ashmore TJ, Rolfo A, et al. Chronic gestational hypoxia accelerates ovarian aging and lowers ovarian reserve in next-generation adult rats. FASEB Journal: Official publication of the Federa-

tion of American Societies for Experimental Biology. 2019; 33: 7758–7766. https://doi.org/10.1096/fj.201802772R

[24] Yue WL, Li YM, Wang YR, Liu ZL. Value of transvaginal Doppler ultrasound in ovulation prediction and ovarian reserve function assessment in infertile patients. Hainan Medical Journal. 2022; 33: 1282–1285. (In Chinese)

[25] Chen K, Shen Z, Gu W, Lyu Z, Qi X, Mu Y, et al. Prevalence of obesity and associated complications in China: A cross-sectional, real-world study in 15.8 million adults. Diabetes, Obesity & Metabolism. 2023; 25: 3390–3399. https://doi.org/10.1111/dom.15238

[26] Miele CH, Schwartz AR, Gilman RH, Pham L, Wise RA, Davila-Roman VG, et al. Increased Cardiometabolic Risk and Worsening Hypoxemia at High Altitude. High Altitude Medicine and Biology. 2016; 17: 93–100. https://doi.org/10.1089/ham.2015.0084

[27] Preethi L, Mylanikunathil Saji A, Chandran L, Suresh A, Indra S, Sabarathinam S. Pandemic-induced stress and obesity leading to abnormal uterine bleeding: A prospective study. Health Science Reports. 2022; 5: e508. https://doi.org/10.1002/hsr2.508

[28] Ordeanu IM, Busuioc CJ, Văduva CC, Pană RC, Petrescu AM, Văruț RM, et al. Obesity as a Catalyst for Endometrial Hyperplasia and Cancer Progression: A Narrative Review of Epidemiology, Molecular Pathways, and Prevention. Biomedicines. 2025; 13: 2612. https://doi.org/10.3390/biomedicines13112612

[29] Ono M, Hiraike O, Kitahara Y, Maekawa R, Ota I, Yoshino O, et al. Text mining in a literature review of abnormal uterine bleeding according to the FIGO classification. The Journal of Obstetrics and Gynaecology Research. 2023; 49: 1827–1837. https://doi.org/10.1111/jog.15669

[30] Critchley HOD, Babayev E, Bulun SE, Clark S, Garcia-Grau I, Gregersen PK, et al. Menstruation: science and society. American Journal of Obstetrics and Gynecology. 2020; 223: 624–664. https://doi.org/10.1016/j.ajog.2020.06.004

[31] Ma LP, Zhang CC, Xu FX. Analysis of related factors in 265 cases of abnormal uterine bleeding. AnhuiMedical and Pharmaceutical Journal. 2020; 24: 689–692. (In Chinese)

[32] Dreisler E, Frandsen CS, Ulrich L. Perimenopausal abnormal uterine bleeding. Maturitas. 2024; 184: 107944. https://doi.org/10.1016/j.maturitas.2024.107944

[33] Faria AVS, Andrade SS, Peppelenbosch MP, Ferreira-Halder CV, Fuhler GM. Platelets in aging and cancer-"double-edged sword". Cancer Metastasis Reviews. 2020; 39: 1205–1221. https://doi.org/10.1007/s10555-020-09926-2

[34] Donnez J, Carmona F, Maitrot-Mantelet L, Dolmans MM, Chapron C. Uterine disorders and iron deficiency anemia. Fertility and Sterility. 2022; 118: 615–624. https://doi.org/10.1016/j.fertnstert.2022.08.011

[35] Nguyen PN, Nguyen VT. Additional value of Doppler ultrasound to B-mode ultrasound in assessing for uterine intracavitary pathologies among perimenopausal and postmenopausal bleeding women: a multicentre prospective observational study in Vietnam. Journal of Ultrasound. 2023; 26: 459–469. https://doi.org/10.1007/s40477-022-00732-w