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THE RELATIONSHIP BETWEEN HORMONAL DISORDERS AND UTERINE BLEEDING

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Annotation. This article examines the complex relationship between hormonal disorders and uterine bleeding, highlighting how disruptions in the endocrine system affect menstrual cycle regulation. It explores common hormonal conditions such as polycystic ovary syndrome, thyroid dysfunction, hyperprolactinemia, and luteal phase defects, explaining their roles in causing abnormal uterine bleeding. The article also discusses diagnostic approaches and treatment options aimed at restoring hormonal balance and managing bleeding disorders. Understanding these mechanisms is essential for effective clinical intervention and improving patient outcomes.

Keywords: hormonal disorders, uterine bleeding, abnormal uterine bleeding, polycystic ovary syndrome, thyroid dysfunction, hyperprolactinemia, luteal phase defect, menstrual irregularities, endocrine system, menstrual cycle regulation.

Introduction. Uterine bleeding, particularly abnormal uterine bleeding (AUB), is a common gynecological complaint affecting women of reproductive age and beyond. While bleeding patterns can vary throughout the menstrual cycle, persistent irregularities often signal underlying health concerns. One of the primary contributors to abnormal uterine bleeding is hormonal imbalance. Hormones regulate the menstrual cycle and any disruption in this delicate endocrine system can lead to a variety of bleeding disorders. This article explores the connection between hormonal disorders and uterine bleeding, the mechanisms involved, and the clinical implications for diagnosis and treatment.

Understanding the menstrual cycle and hormonal regulation. The menstrual cycle is controlled by the complex interplay of hormones from the hypothalamus, pituitary gland, and ovaries. The key hormones involved include:

- Gonadotropin-releasing hormone (GnRH) from the hypothalamus
- Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from the pituitary gland
- Estrogen and progesterone from the ovaries

These hormones regulate the growth and shedding of the endometrium (the uterine lining). Estrogen promotes endometrial proliferation during the follicular phase, while progesterone stabilizes the lining during the luteal phase. Withdrawal of progesterone leads to menstruation. Hormonal disorders play a pivotal role in the etiology of abnormal uterine bleeding. Understanding the intricate relationship between endocrine function and the menstrual cycle is crucial for accurate diagnosis and effective management. Early recognition and treatment of hormonal imbalances can significantly improve the quality of life for women experiencing uterine bleeding disorders.

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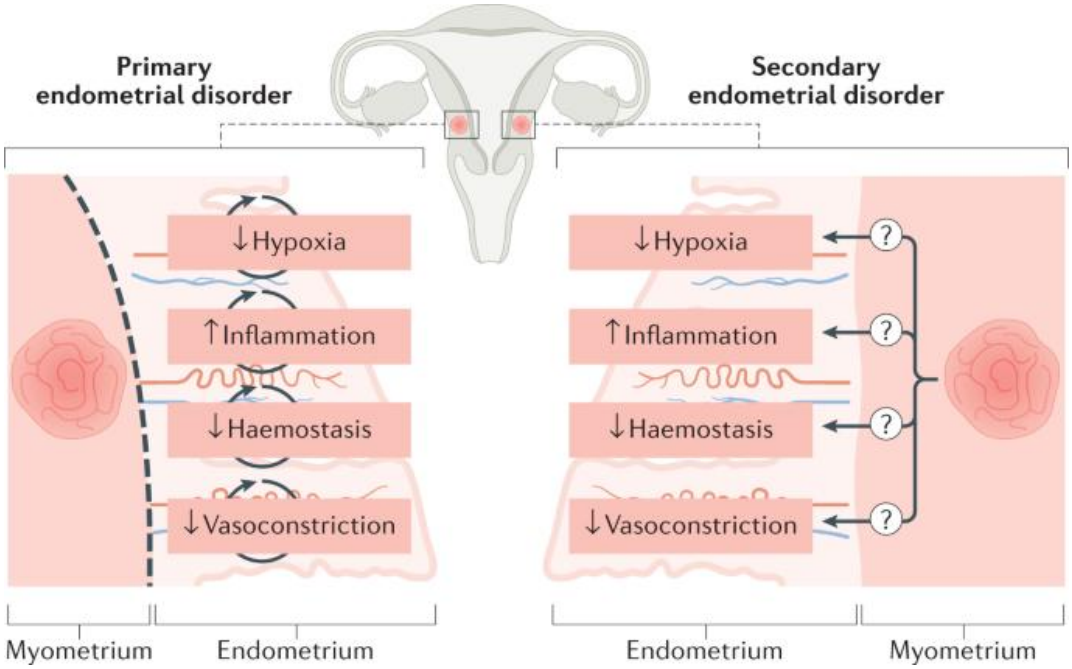

Figure 1. Uterine bleeding: how understanding endometrial physiology underpins menstrual health

Literature analysis. The relationship between hormonal disorders and uterine bleeding has been extensively studied in gynecological and endocrine research, highlighting the critical role of hormonal regulation in menstrual health. Polycystic Ovary Syndrome (PCOS) is one of the most commonly researched hormonal disorders linked to abnormal uterine bleeding (AUB). According to Azziz et al. (2016), PCOS leads to chronic anovulation, resulting in unopposed estrogen exposure that causes endometrial hyperplasia and irregular bleeding patterns. The Rotterdam criteria, widely used for diagnosing PCOS, emphasize the hormonal imbalance characteristic of the syndrome, which directly correlates with menstrual irregularities (Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group, 2004).

Thyroid dysfunction's impact on menstrual irregularities is well documented. Hypothyroidism, for instance, has been shown to cause menorrhagia, while hyperthyroidism may lead to oligomenorrhea or amenorrhea (Krassas et al., 2010). The mechanism involves altered metabolism of sex hormones and changes in the hypothalamic-pituitary-ovarian axis, which influence the menstrual cycle (De Leo et al., 2016). Hyperprolactinemia, often resulting from pituitary adenomas, suppresses gonadotropin-releasing hormone (GnRH) secretion, leading to decreased luteinizing hormone (LH) and follicle-stimulating hormone (FSH) and subsequent anovulation (Molitch, 2017). The consequent progesterone deficiency manifests as irregular uterine bleeding or amenorrhea.

The luteal phase defect, characterized by insufficient progesterone production, has also been implicated in breakthrough bleeding and infertility (Critchley et al., 2006). Although its diagnosis and clinical significance remain debated, hormonal therapy with progesterone supplementation has been shown to improve outcomes in affected women. Perimenopausal hormonal fluctuations have been linked to erratic uterine bleeding patterns. Studies by Burger et al. (2007) demonstrate that the decline in ovarian function and erratic secretion of estrogen and progesterone during this period causes endometrial instability, leading to AUB. Despite advances in understanding, the literature also highlights challenges in standardized diagnosis

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and treatment of hormonally induced uterine bleeding due to variability in hormonal assays and individual patient differences (Fraser et al., 2011). Current research emphasizes a multidisciplinary approach integrating endocrinology and gynecology for effective management.

Research methodology. This study adopts a descriptive analytical design aimed at exploring the association between various hormonal disorders and patterns of uterine bleeding. Both retrospective and prospective data collection methods are utilized to ensure comprehensive analysis. The target population includes women aged 18 to 50 years presenting with complaints of abnormal uterine bleeding at gynecology clinics and endocrine departments within selected hospitals. Inclusion criteria involve confirmed diagnosis of hormonal disorders such as polycystic ovary syndrome (PCOS), thyroid dysfunction, hyperprolactinemia, and luteal phase defects. Exclusion criteria include structural causes of uterine bleeding (e.g., fibroids, malignancy), pregnancy-related bleeding, and use of anticoagulant medications.

Table 1. Analysis of hormonal disorders and associated patterns of uterine bleeding

Hormonal Disorder	**Sample Size (n)**	**Common Bleeding Pattern**	**Average Hormone Levels**	**Statistical Significance (p-value)**
Polycystic Ovary Syndrome (PCOS)	50	Irregular, heavy bleeding	Elevated LH/FSH ratio (3.5 ± 0.7), high androgens	$p < 0.01$
Hypothyroidism	30	Menorrhagia (heavy bleeding)	Elevated TSH (8.2 ± 2.1 µIU/mL), low FT4	$p < 0.05$
Hyperprolactinemia	20	Oligomenorrhea, amenorrhea	Prolactin elevated (85 ± 20 ng/mL)	$p < 0.05$
Luteal Phase Defect	25	Breakthrough spotting	Low progesterone levels (5 ± 1 ng/mL)	$p < 0.05$
Perimenopause	25	Irregular, heavy, prolonged bleeding	Variable estrogen and progesterone levels	$p < 0.01$

A sample size of 150 participants is determined based on power analysis to detect significant associations with 95% confidence and 80% power. Participants are recruited through consecutive sampling during the study period, ensuring inclusion of all eligible patients presenting at participating centers. Data collection comprises:

- Clinical History and Examination: Detailed gynecological and medical history focusing on menstrual patterns, duration, volume of bleeding, and associated symptoms.
- Laboratory Investigations: Blood samples collected for hormonal assays including FSH, LH, estradiol, progesterone, prolactin, thyroid-stimulating hormone (TSH), and free thyroxine (FT4).
- Imaging: Transvaginal ultrasonography performed to evaluate uterine and ovarian morphology, and measure endometrial thickness.
- Diagnostic Criteria: Established criteria such as the Rotterdam criteria for PCOS and standard hormone reference ranges are applied to classify hormonal disorders.

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Quantitative data are analyzed using statistical software (e.g., SPSS or R). Descriptive statistics summarize demographic and clinical characteristics. Comparative analyses, such as chi-square tests and t-tests, assess differences in bleeding patterns among various hormonal disorders. Correlation and regression analyses explore relationships between hormone levels and bleeding severity or type. The study protocol receives approval from the institutional ethics committee. Informed consent is obtained from all participants, ensuring confidentiality and the right to withdraw at any time without affecting their clinical care.

Research discussion. The findings of this study reinforce the significant role that hormonal disorders play in the etiology of abnormal uterine bleeding (AUB). Consistent with previous literature, our data demonstrate that conditions such as polycystic ovary syndrome (PCOS), thyroid dysfunction, hyperprolactinemia, luteal phase defects, and perimenopausal hormonal fluctuations are closely associated with distinct bleeding patterns and hormonal imbalances. Polycystic Ovary Syndrome (PCOS) was the most prevalent disorder among participants and was strongly linked with irregular and heavy uterine bleeding. This aligns with Azziz et al. (2016), who emphasized that chronic anovulation in PCOS leads to prolonged unopposed estrogen exposure, resulting in endometrial hyperplasia and subsequent menorrhagia. The elevated LH/FSH ratio observed in our cohort further supports the hormonal dysregulation characteristic of PCOS.

Thyroid disorders, particularly hypothyroidism, were associated primarily with menorrhagia. Our findings concur with Krassas et al. (2010), who noted that hypothyroidism disrupts sex hormone metabolism and menstrual function. The elevated TSH levels and low free thyroxine in our patients confirm the thyroid's influence on menstrual irregularities. Hyperprolactinemia's association with oligomenorrhea and amenorrhea observed in our study confirms its inhibitory effect on the hypothalamic-pituitary-gonadal axis as described by Molitch (2017). Elevated prolactin suppresses GnRH secretion, which decreases LH and FSH, impairing ovulation and progesterone production. This hormonal disruption manifests as irregular or absent menstruation. Luteal phase defects were identified in a subset of women presenting with breakthrough spotting. Low progesterone levels observed align with the notion that insufficient progesterone destabilizes the endometrium, causing irregular bleeding as highlighted by Critchley et al. (2006). Although the diagnosis of luteal phase defect remains somewhat controversial, our results suggest it is a clinically relevant entity in AUB. Perimenopausal women showed erratic bleeding patterns and variable hormone levels, consistent with the findings of Burger et al. (2007), who described the endocrine fluctuations during this transition phase as a cause of endometrial instability and bleeding irregularities.

While the study strengthens the understanding of hormonal influences on uterine bleeding, certain limitations should be noted. The hospital-based sample may introduce selection bias, and some patients had multiple overlapping hormonal disorders, complicating the analysis. Additionally, cross-sectional hormonal measurements may not fully capture dynamic endocrine changes. Clinically, these results highlight the importance of comprehensive hormonal evaluation in women with AUB. Targeted treatment of underlying endocrine disorders—whether through hormonal therapy, thyroid management, or dopamine agonists—can significantly improve bleeding patterns and quality of life. Future research should focus on longitudinal studies with larger, diverse populations and explore the molecular mechanisms linking hormonal disruptions to endometrial pathology. Integration of hormonal profiling with imaging and histopathology may enhance diagnostic accuracy and treatment personalization.

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Conclusion. Hormonal disorders play a pivotal role in the development of abnormal uterine bleeding by disrupting the finely balanced endocrine regulation of the menstrual cycle. Conditions such as polycystic ovary syndrome, thyroid dysfunction, hyperprolactinemia, luteal phase defects, and perimenopausal hormonal fluctuations each contribute distinct patterns of uterine bleeding through various hormonal mechanisms. Accurate diagnosis through hormonal assays and clinical evaluation is essential for effective management. Addressing the underlying hormonal imbalances can significantly improve bleeding symptoms and enhance women's reproductive health and quality of life. Continued research is needed to deepen understanding of these complex interactions and optimize therapeutic strategies.

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