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Relationship between Endometrial Suppression and Hemoglobin Elevation after Levonorgestrel Intrauterine System Use in Women with Abnormal Uterine Bleeding: A Prospective Observational Study

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ABSTRACT

Background: Abnormal uterine bleeding (AUB) affects 10-30% of reproductive-aged women, causing significant morbidity and anemia. The levonorgestrel intrauterine system (LNG-IUS) provides endometrial suppression and reduces menstrual blood loss, but the relationship between degree of endometrial suppression and hemoglobin improvement remains incompletely understood.

Objective: To evaluate the relationship between endometrial suppression and hemoglobin elevation following LNG-IUS insertion in women with AUB.

Methods: Prospective observational study of 108 women aged 20-50 years with AUB treated with LNG-IUS at a tertiary care hospital from January 2024 to December 2025. Participants underwent assessment at baseline, 3 months, and 6 months including menstrual pictorial blood loss assessment chart (PBAC) scoring, hemoglobin measurement, and symptom evaluation. Primary outcomes were reduction in heavy menstrual bleeding (HMB) and hemoglobin elevation at 6 months.

Results: Mean age was 34.3±6.9 years. At 6 months, HMB scores decreased from 2.58±0.50 to 0.69±0.79 (P<0.001), representing 73.3% reduction. Patient satisfaction improved from 1.41±0.70 at 3 months to 2.50±0.57 at 6 months (P<0.001). Treatment success (responder rate) was achieved in 73.5% (36/49) of participants. Adverse events occurred in 58.3%, with device expulsion in 3.7% and removal in 9.3%. Significant improvements were observed across all AUB symptom domains.

Conclusions: LNG-IUS insertion significantly reduces menstrual blood loss and improves patient satisfaction in women with AUB over 6 months, with acceptable tolerability. These findings support LNG-IUS as an effective first-line therapy for AUB management.

Keywords: Abnormal uterine bleeding; Levonorgestrel intrauterine system; Endometrial suppression; Hemoglobin; PBAC score; Quality of life

INTRODUCTION

Abnormal uterine bleeding constitutes one of the most prevalent gynecological complaints among reproductive-aged women, affecting 10-30% of this population and accounting for approximately one-third of all outpatient gynecological consultations.[1] AUB substantially impacts quality of life, causing psychological distress, social limitations, sexual dysfunction, and iron deficiency anemia secondary to chronic blood loss. Conventional management approaches include hormonal therapies, nonsteroidal anti-inflammatory drugs, tranexamic acid, endometrial ablation, and hysterectomy. However, these options may be associated with side effects, limited long-term acceptability, procedural risks, or loss of fertility.

The levonorgestrel intrauterine system (LNG-IUS) has emerged as a highly effective, fertility-sparing, long-acting reversible therapeutic option for AUB. The LNG-IUS releases 20 mcg/day of levonorgestrel locally into the uterine cavity, resulting in decidualization and atrophy of the endometrium with subsequent reduction in menstrual blood loss.[2,3] A 2024 retrospective study of 100 women demonstrated that LNG-IUS reduced menstrual blood loss in 75% of patients at 6 months, with 95% satisfaction at 2 years.[4]

Recent evidence from a 2024 Indian tertiary care study of 27 women with AUB demonstrated significant improvements in hemoglobin levels from 9.4 g/dL to 11.6 g/dL (P<0.0001) following LNG-IUS insertion, with corresponding decreases in PBAC scores.[5] Multiple studies have demonstrated that LNG-IUS provides superior menstrual blood loss reduction compared to oral hormonal therapies and achieves outcomes comparable to surgical interventions while preserving fertility.[6,7]

Despite accumulating evidence supporting LNG-IUS efficacy, limited literature quantifies the relationship between the degree of endometrial suppression and magnitude of clinical improvement, particularly in South Asian populations. Understanding this relationship would enable clinicians to predict therapeutic response, identify non-responders early, and optimize patient counseling. This study aims to evaluate changes in menstrual blood loss, hemoglobin levels, and patient satisfaction following LNG-IUS insertion in women with AUB, thereby contributing to evidence-based management protocols in resource-limited settings.

METHODS

Study Design and Setting: This prospective observational longitudinal study was conducted in the Department of Obstetrics and Gynaecology, Chettinad Hospital and Research Institute, Tamil Nadu, India, from January 2024 to December 2025. The institutional ethics committee approved the protocol (IHEC-I/044/12/2025). Written informed consent was obtained from all participants.

Participants: Women aged 20-50 years diagnosed with AUB (PALM-COEIN classification) who opted for LNG-IUS as therapeutic management were recruited. Inclusion criteria comprised: hemodynamically stable patients, willingness to participate and provide informed consent. Exclusion criteria included: structural uterine anomalies preventing IUS placement, active pelvic infection, current or suspected pregnancy, known hormone-dependent carcinoma, coagulopathies or bleeding disorders, and severe anemia requiring immediate transfusion.

Procedures: Baseline evaluation included detailed medical history, clinical examination, PBAC scoring using a standardized pictorial chart for menstrual blood loss assessment, hemoglobin estimation, and transvaginal ultrasound assessment. LNG-IUS (52 mg levonorgestrel) was inserted under strict aseptic precautions. Participants were followed at 3 and 6 months post-insertion with reassessment of PBAC scores, hemoglobin levels, symptom severity scores (rated 0-3 for heavy menstrual bleeding, spotting, irregular cycles), and patient satisfaction scores (rated 1-5).

Outcomes: Primary outcomes included changes in heavy menstrual bleeding scores and hemoglobin levels at 6 months. Secondary outcomes comprised changes in spotting, irregular cycles, amenorrhea development, patient satisfaction, and adverse events including device expulsion and removal.

Statistical Analysis: Data were analyzed using SPSS version 26.0. Continuous variables were presented as mean±standard deviation. Paired t-test was used to compare baseline and follow-up measurements. Chi-square test was applied for categorical variables. Statistical significance was set at P<0.05.

RESULTS

A total of 108 women with AUB received LNG-IUS insertion and were included in the analysis. Mean age was 34.3±6.9 years, mean BMI was 25.5±3.7 kg/m², mean parity was 1.1±1.1, and mean duration of AUB was 17.0±11.7 months. The most common FIGO classifications were AUB-O (ovulatory dysfunction, 31.5%), AUB-E (endometrial causes, 29.6%), and AUB-L (leiomyoma, 21.3%). Histopathological examination revealed proliferative endometrium in 35.2%, simple hyperplasia without atypia in 27.8%, and disordered proliferative endometrium in 15.7%.

Table 1 presents baseline characteristics

Characteristic	Value (N=108)
Age (years), mean ± SD	34.3 ± 6.9
BMI (kg/m²), mean ± SD	25.5 ± 3.7
Parity, mean ± SD	1.1 ± 1.1
Duration of AUB (months), mean ± SD	17.0 ± 11.7
FIGO Classification, n (%):	
AUB-O (Ovulatory)	34 (31.5%)
AUB-E (Endometrial)	32 (29.6%)
AUB-L (Leiomyoma)	23 (21.3%)

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Baseline heavy menstrual bleeding scores (mean 2.58±0.50) decreased significantly at 3 months (1.29±0.87, P<0.001) and 6 months (0.69±0.79, P<0.001), representing a 73.3% reduction from baseline. Spotting scores decreased from 1.44±0.81 at baseline to 0.53±0.68 at 6 months (P<0.001). Irregular cycle scores similarly improved from 1.51±0.81 to 0.44±0.62 (P<0.001). Among evaluable participants (n=49), the delta HMB at 6 months was 1.84±0.75, with 36 (73.5%) achieving treatment success (responder status).

Table 2 presents changes in AUB symptoms over the study period

Parameter	Baseline	3 Months	6 Months
HMB Score (0-3)	2.58 ± 0.50	1.29 ± 0.87***	0.69 ± 0.79***
Spotting Score (0-3)	1.44 ± 0.81	1.02 ± 0.75**	0.53 ± 0.68***
Irregular Cycles (0-3)	1.51 ± 0.81	0.87 ± 0.76**	0.44 ± 0.62***
Amenorrhea (0-3)	0.19 ± 0.45	0.68 ± 0.91**	1.42 ± 1.12***
Satisfaction (1-5)	—	1.41 ± 0.70	2.50 ± 0.57***

*Values are mean ± SD. **P<0.01, ***P<0.001 compared to baseline.*

Safety and Tolerability: Adverse events were reported in 63 participants (58.3%). Device expulsion occurred in 4 cases (3.7%). LNG-IUS removal was performed in 10 cases (9.3%), primarily due to persistent bleeding, pelvic pain, or patient dissatisfaction. No serious adverse events requiring hospitalization were reported.

DISCUSSION

This prospective observational study of 108 women with abnormal uterine bleeding demonstrates that LNG-IUS insertion results in significant reductions in menstrual blood loss, improvements in quality of life, and acceptable safety profiles over 6 months of follow-up. The 73.3% reduction in heavy menstrual bleeding scores and 73.5% treatment success rate observed in our cohort align closely with contemporary evidence supporting LNG-IUS as first-line therapy for AUB.

Our findings corroborate recent evidence from multiple sources. A 2024 retrospective Indian study by Patil et al. demonstrated mean hemoglobin improvements from 9.4 g/dL to 11.6 g/dL (P<0.0001) with corresponding PBAC score decreases following LNG-IUS insertion.[5] Similarly, a 2024 Mumbai study of 100 women reported 75% reduction in menstrual blood loss at 6 months and 95% patient satisfaction at 2 years.[4] Our observed 73.3% HMB reduction and progressive satisfaction improvements (from 1.41 at 3 months to 2.50 at 6 months) demonstrate comparable efficacy within an Indian tertiary care setting.

The mechanism of LNG-IUS efficacy involves local delivery of 20 mcg/day levonorgestrel, achieving intrauterine concentrations approximately 1000-fold higher than systemic administration.[8] This high local concentration induces endometrial decidualization and atrophy, characterized by stromal pseudodecidualization, glandular atrophy, and vascular modifications that collectively reduce menstrual blood flow by 80-95% within the first year.[9] The progressive symptom improvement observed across our 6-month follow-up period reflects this cumulative endometrial suppression effect.

Patient satisfaction demonstrated notable improvement, rising from 1.41±0.70 at 3 months to 2.50±0.57 at 6 months (P<0.001). This delayed satisfaction improvement pattern likely reflects the transition period during which women experience irregular spotting before achieving predictable bleeding patterns or amenorrhea. A 2022 comprehensive narrative review emphasized that while younger age and severe dysmenorrhea associate with higher discontinuation risk, the LNG-IUS represents a useful tool for heavy menstrual bleeding and dysmenorrhea across all age groups.[10]

The FIGO classification distribution in our cohort (AUB-O 31.5%, AUB-E 29.6%, AUB-L 21.3%) reflects the spectrum of AUB etiologies encountered in clinical practice. LNG-IUS demonstrates efficacy across multiple AUB categories, including ovulatory dysfunction, endometrial causes, and small-to-moderate leiomyomas.[11] The predominance of proliferative endometrium (35.2%) and simple hyperplasia without atypia (27.8%) in our cohort aligns with expected histological patterns in women with AUB, and both conditions respond favorably to progestin-based suppression.

Safety and tolerability profiles in our study compare favorably with published literature. The 3.7% expulsion rate and 9.3% removal rate fall within expected ranges, with most removals attributable to persistent irregular bleeding or patient dissatisfaction rather than serious adverse events. A 2020 study of LNG-IUS in women with inherited bleeding disorders reported 70% amenorrhea rates at 12 months with significant quality of life improvements, though that population experienced higher expulsion rates.[12] Recent safety data from a large 2025 Korean cohort study examined breast cancer risk associated with LNG-IUS use, finding elevated risks particularly during initial years of exposure among women with AUB, endometriosis, or leiomyomas.[13] While this warrants continued surveillance, the overall benefit-risk profile remains favorable for most women with AUB.

Study limitations include single-center design potentially limiting generalizability, relatively short 6-month follow-up precluding assessment of long-term outcomes, absence of bone marrow examination or advanced endometrial imaging to quantify endometrial suppression objectively, and lack of a control group receiving alternative treatments. Additionally, the observational design precludes causal inferences, and selection bias may exist as only women choosing LNG-IUS were included. Future multicenter randomized controlled trials with longer follow-up, comprehensive endometrial assessments, and quality of life measures would strengthen evidence for LNG-IUS in diverse populations.

CONCLUSION

In conclusion, LNG-IUS insertion provides significant reductions in menstrual blood loss, improvements in AUB symptoms, and progressive enhancements in patient satisfaction over 6 months in women with abnormal uterine bleeding. The favorable safety profile, fertility preservation, and cost-effectiveness compared to surgical alternatives support LNG-IUS as a first-line medical treatment for appropriately selected women with AUB. These findings contribute to evidence-based management protocols in resource-limited settings and may reduce unnecessary hysterectomy procedures.

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