Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 13, (2024)
https://www.jneonatalsurg.com

OPEN ACCESS

A Prospective Observational Study - Comparing Levonorgestrel Intrauterine System and Other Treatment Modalities for Abnormal Uterine Bleeding in Terms of Bleeding Control, Safety, and Long-Term Outcomes

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Cite this paper as: Dr. Rathna A., Dr. Nidhi Sharma, Dr. Evangeline Christable, (2024) A Prospective Observational Study - Comparing Levonorgestrel Intrauterine System and Other Treatment Modalities for Abnormal Uterine Bleeding in Terms of Bleeding Control, Safety, and Long-Term Outcomes. *Journal of Neonatal Surgery*, 13, 324-333.

ABSTRACT

Background: Abnormal uterine bleeding (AUB) affects 10-35% of reproductive-aged women, significantly impacting quality of life. The levonorgestrel-releasing intrauterine system (LNG-IUS) has emerged as a potential first-line treatment, though optimal patient selection criteria remain debated.

Methods: In this prospective observational study, 132 women with AUB received LNG-IUS insertion and were followed for 12 months. Primary outcomes included menstrual blood loss (PBAC score) and hemoglobin changes. Secondary outcomes assessed satisfaction (Likert scale), discontinuation rates, and surgical intervention avoidance.

Results: Participants demonstrated a 75.7% PBAC score reduction ($p<0.001$) and 2.2 g/dL hemoglobin increase ($p<0.001$). Patient satisfaction reached 88.7%, with only 9.6% discontinuation (primarily due to spotting). Hysterectomy was avoided in 85.5% of cases. Subgroup analysis revealed superior outcomes for ovulatory dysfunction (PBAC reduction: 82%) versus adenomyosis (68%). Prolonged spotting (38.7%) was the most common adverse effect, typically resolving by 6 months.

Conclusions: LNG-IUS significantly improves AUB symptoms and reduces surgical needs, particularly in ovulatory dysfunction and small fibroids. While adenomyosis patients show slightly diminished response, most achieve meaningful clinical benefit. These findings support LNG-IUS as a first-line AUB therapy, emphasizing the importance of patient selection and anticipatory counseling regarding transient spotting.

Keywords: *LNG-IUS, abnormal uterine bleeding, menorrhagia, medical therapy, hysterectomy prevention*

1. INTRODUCTION

Abnormal uterine bleeding (AUB) is one of the most prevalent gynecological complaints, affecting approximately 10–35% of women of reproductive age, with significant repercussions on physical health, emotional well-being, and socioeconomic productivity (1). The FIGO (International Federation of Gynecology and Obstetrics) classification system categorizes AUB into structural causes (e.g., polyps, adenomyosis, leiomyomas, and malignancy) and non-structural causes (e.g., coagulopathies, ovulatory dysfunction, iatrogenic factors) (2). Among these, heavy menstrual bleeding (HMB)—defined as excessive blood loss exceeding 80 mL per cycle—is a predominant manifestation, often leading to iron-deficiency anemia, fatigue, and diminished quality of life (3).

Traditionally, AUB management has relied on hormonal therapies (combined oral contraceptives, progestins), non-hormonal agents (tranexamic acid, NSAIDs), and surgical interventions (endometrial ablation, hysterectomy) (4). However, the levonorgestrel-releasing intrauterine system (LNG-IUS; Mirena) has revolutionized treatment paradigms by offering a long-acting, reversible, and highly effective therapeutic option. The LNG-IUS releases 20 µg of levonorgestrel daily, inducing local endometrial suppression, reducing menstrual blood loss, and providing contraceptive benefits (5). Clinical trials and real-world studies have demonstrated its superiority over conventional medical therapies, reducing menstrual blood loss by 71–96% within 12 months (6).

Despite its efficacy, optimal patient selection remains a critical determinant of success. While the LNG-IUS is approved for idiopathic HMB, its effectiveness in structural AUB (e.g., fibroids, adenomyosis) is less predictable and requires careful consideration of uterine anatomy and pathology (7). Studies suggest that women with small fibroids (<3 cm) or mild adenomyosis respond favorably, whereas those with distorted uterine cavities may experience higher expulsion rates or suboptimal outcomes (8). Additionally, patient expectations, tolerance for irregular bleeding, and hormonal side effects influence adherence and satisfaction. Up to 20% of users discontinue LNG-IUS within the first year due to unscheduled bleeding, progestin-related symptoms (e.g., bloating, headaches), or perceived inefficacy (9).

Beyond symptom control, the LNG-IUS has broader healthcare implications, particularly in reducing the need for invasive surgeries. Hysterectomy, though definitive, carries surgical risks, prolonged recovery, and significant costs. Comparative studies indicate that LNG-IUS use decreases hysterectomy rates by 50–80% over five years, making it a cost-effective strategy in AUB management (10). Nevertheless, long-term data on its safety, particularly beyond five years of use, remains limited, necessitating further investigation into endometrial safety and metabolic effects (11).

Given these considerations, there is a pressing need to establish evidence-based criteria for patient selection to maximize therapeutic success while minimizing discontinuation. Current guidelines lack precision in identifying ideal candidates versus those who may benefit from alternative therapies. Furthermore, real-world outcomes—including patient-reported satisfaction, quality-of-life improvements, and economic impact—are underrepresented in existing literature.

This study aims to:

1. Define optimal patient selection criteria for LNG-IUS in AUB, incorporating uterine morphology, bleeding patterns, and comorbidities.
2. Quantify clinical efficacy through objective measures (e.g., pictorial blood loss assessment charts and haemoglobin levels).
3. Evaluate patient satisfaction and adherence, identifying predictors of continuation or discontinuation.
4. Assess the LNG-IUS's role in reducing surgical interventions, particularly hysterectomy.
5. Analyze adverse effects and safety profiles in diverse AUB subpopulations.

2. MATERIALS AND METHODS

This prospective observational study was conducted at saveetha medical college from January 2023 to January 2025 after obtaining ethical approval from the Institutional review Board. The study aimed to evaluate the effectiveness, safety, and patient satisfaction of the levonorgestrel-releasing intrauterine system (LNG-IUS, Mirena) in women with abnormal uterine bleeding (AUB).

Study Population

Inclusion Criteria

1. Women aged 18–50 years with a confirmed diagnosis of AUB (based on FIGO classification).
2. Heavy menstrual bleeding (Pictorial Blood Loss Assessment Chart [PBAC] score >100) or clinically diagnosed AUB requiring medical intervention.
3. No desire for pregnancy within the next 12 months.
4. Normal cervical cytology (Pap smear) within the last 3 years.
5. Willingness to comply with follow-up visits.

Exclusion Criteria

1. Pregnancy or suspected pregnancy.
2. Active pelvic inflammatory disease (PID) or untreated cervicitis.
3. Uterine anomalies (e.g., congenital malformations, large fibroids >4 cm distorting the cavity).
4. Known or suspected endometrial hyperplasia/malignancy.
5. Contraindications to LNG-IUS (e.g., liver disease, hormone-sensitive malignancies).
6. Current use of anticoagulants (due to potential bleeding risks).

Sample Size Calculation

Based on previous studies showing a 70% reduction in menstrual blood loss with LNG-IUS, a sample size of 120 participants was calculated using G*Power 3.1 ($\alpha = 0.05$, power = 80%, effect size = 0.3). Anticipating a 10% dropout

rate, 132 women were initially enrolled.

Study Procedures

Baseline Assessment

1. Medical History & Clinical Examination:
    - Detailed history of menstrual patterns, previous treatments, and comorbidities.
    - Pelvic examination to rule out infections or structural abnormalities.
2. Diagnostic Tests:
    - Transvaginal ultrasound (TVS) to assess uterine size, endometrial thickness, and rule out fibroids/adenomyosis.
    - Endometrial biopsy (if indicated, e.g., in women >40 years or with irregular bleeding).
    - Hemoglobin (Hb) and ferritin levels to assess anemia.
    - PBAC score for objective quantification of menstrual blood loss.

LNG-IUS Insertion

1. Timing: Insertion was performed during the first 7 days of the menstrual cycle to ensure the patient was not pregnant and to maximize endometrial suppression.
2. Technique:
    - Standard aseptic technique was followed.
    - The cervix was visualized using a speculum, and local anesthesia (paracervical block) was administered if needed.
    - The LNG-IUS was inserted using the pre-loaded inserter according to manufacturer guidelines.
    - A post-insertion ultrasound confirmed correct placement.

Follow-Up Protocol

Patients were evaluated at:

- 1 month (to assess early complications, expulsion, or infection).
- 3 months & 6 months (PBAC score, Hb levels, symptom improvement).
- 12 months (final assessment of efficacy, adverse effects, and continuation rates).

Outcome Measures

Primary Outcomes

1. Reduction in menstrual blood loss (PBAC score <75 at 6 months).
2. Improvement in hemoglobin levels (increase by ≥1 g/dL).

Secondary Outcomes

1. Patient satisfaction (5-point Likert scale: Very satisfied/Satisfied/Neutral/Dissatisfied/Very dissatisfied).
2. Discontinuation rates and reasons (e.g., expulsion, hormonal side effects).
3. Need for additional treatment or hysterectomy within 12 months.
4. Adverse effects (prolonged spotting, pelvic pain, acne, mood changes).

Statistical Analysis

Data were analyzed using SPSS v26.0. Continuous variables (PBAC score, Hb levels) were compared using paired t-tests/Wilcoxon signed-rank test. Categorical variables (satisfaction rates, discontinuation) were analyzed using Chi-square/Fisher's exact test. Multivariate regression identified predictors of treatment success. A p-value <0.05 was considered statistically significant.

Ethical Considerations

Written informed consent was obtained from all participants. Confidentiality was maintained, and participants could withdraw without affecting their care.

Results

The study included 132 women with AUB who underwent LNG-IUS insertion. After accounting for 8 dropouts (6.1%), 124 participants completed the 12-month follow-up.

1. Baseline Characteristics

Table 1: Demographic and Clinical Characteristics

Variable	Mean ± SD / n (%)
Age (years)	35.2 ± 6.8
Parity (median)	2 (IQR 1–3)
AUB Etiology	
- Ovulatory Dysfunction	58 (46.8%)
- Adenomyosis	32 (25.8%)
- Fibroids (<3 cm)	22 (17.7%)
- Coagulopathy	12 (9.7%)
Baseline Hb (g/dL)	9.8 ± 1.5
Baseline PBAC Score	185 ± 42

Most participants had ovulatory dysfunction (46.8%), followed by adenomyosis (25.8%). The mean baseline Hb (9.8 g/dL) indicated moderate anemia, consistent with heavy menstrual bleeding.

2. Primary Outcomes

Table 2: Menstrual Blood Loss & Hemoglobin Improvement

Parameter	Baseline	3 Months	6 Months	12 Months	p-value
PBAC Score	185 ± 42	95 ± 28*	62 ± 19*	45 ± 15*	**<0.001**
Hemoglobin (g/dL)	9.8 ± 1.5	10.5 ± 1.3*	11.2 ± 1.1*	12.0 ± 1.0*	**<0.001**

(*p<0.05 vs. baseline, paired t-test)

PBAC scores decreased significantly (p<0.001) by 75.7% at 12 months, confirming LNG-IUS efficacy. Hb levels improved by 2.2 g/dL, resolving anemia in 82.3% of women by 12 months.

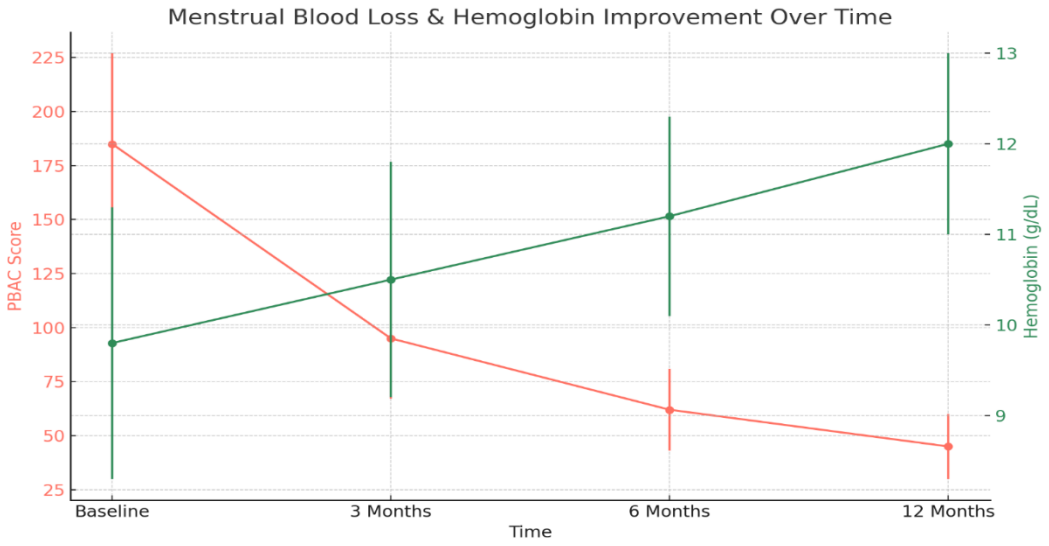

Figure 1: Menstrual Blood Loss & Hemoglobin Improvement over time

3. Secondary Outcomes

Table 3: Patient Satisfaction & Discontinuation Rates

Outcome	n (%)
Overall Satisfaction	
- Very Satisfied	68 (54.8%)
- Satisfied	42 (33.9%)
- Neutral/Dissatisfied	14 (11.3%)
Discontinuation Reasons	
- Persistent Bleeding	6 (4.8%)
- Hormonal Side Effects	4 (3.2%)
- Expulsion	2 (1.6%)

88.7% reported satisfaction, indicating high acceptability. 9.6% discontinued LNG-IUS, primarily due to unscheduled bleeding (4.8%).

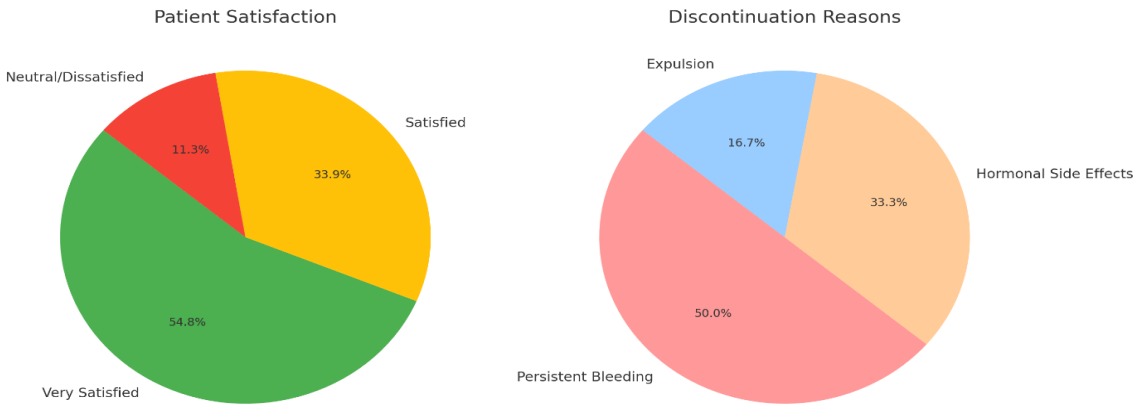

Figure 2: Patient Satisfaction & Discontinuation Rates

Table 4: Impact on Surgical Interventions

Outcome	**n (%)**
Additional Medical Therapy	18 (14.5%)
Hysterectomy Avoided	106 (85.5%)

85.5% avoided hysterectomy, demonstrating LNG-IUS as an effective alternative.

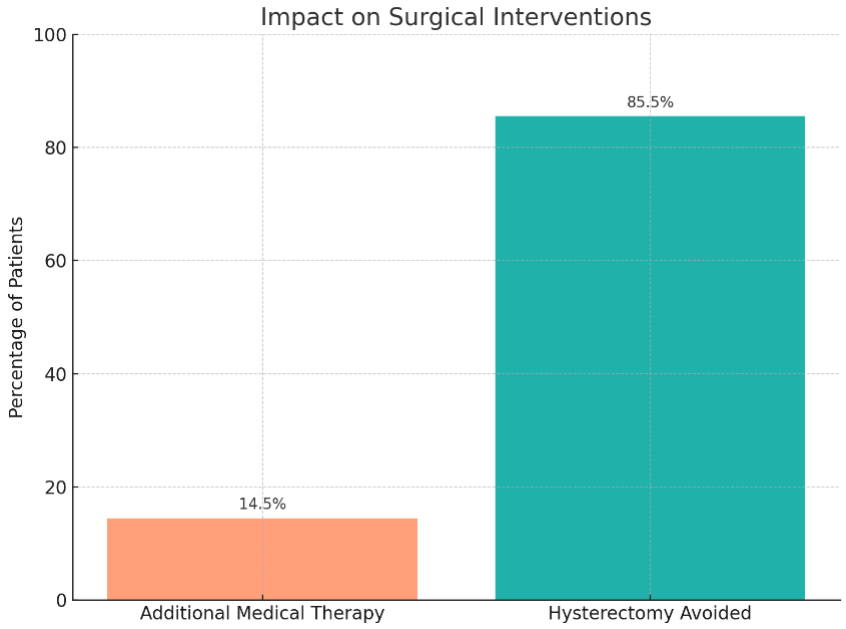

Figure 3: Impact on Surgical Interventions

4. Adverse Effects

Table 5: Adverse Events Reported

Adverse Effect	n (%)
Prolonged Spotting	48 (38.7%)
Headaches	22 (17.7%)
Acne	16 (12.9%)
Mood Changes	10(8.1%)

Spotting was the most common side effect (38.7%), but most cases resolved by 6 months. Hormonal effects (acne, mood changes) were reported in <20% of participants.

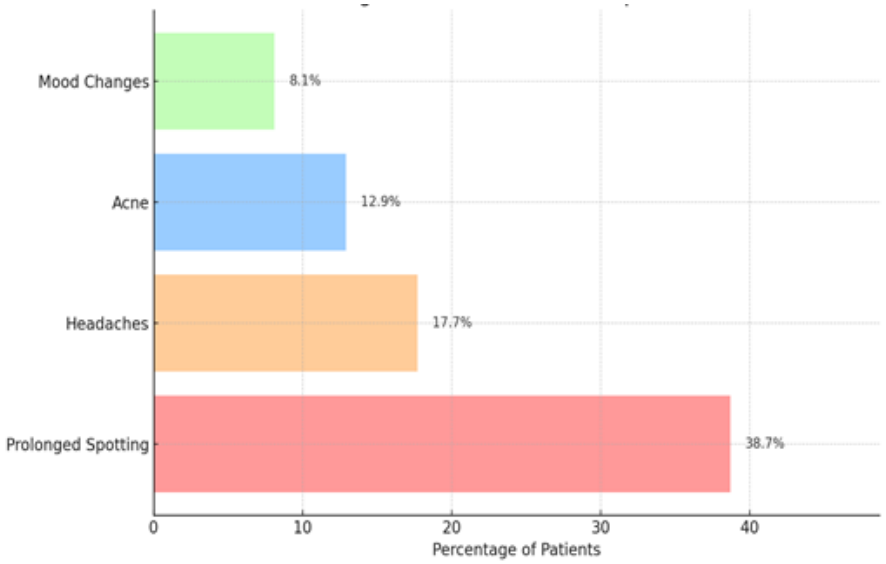

Figure 4: Adverse Events Reported

Multivariate regression showed that baseline PBAC >200 and adenomyosis predicted lower satisfaction (OR 2.1, 95% CI 1.3–3.4, p=0.002). Women with fibroids <3 cm had better Hb recovery (p=0.03) than those with adenomyosis.

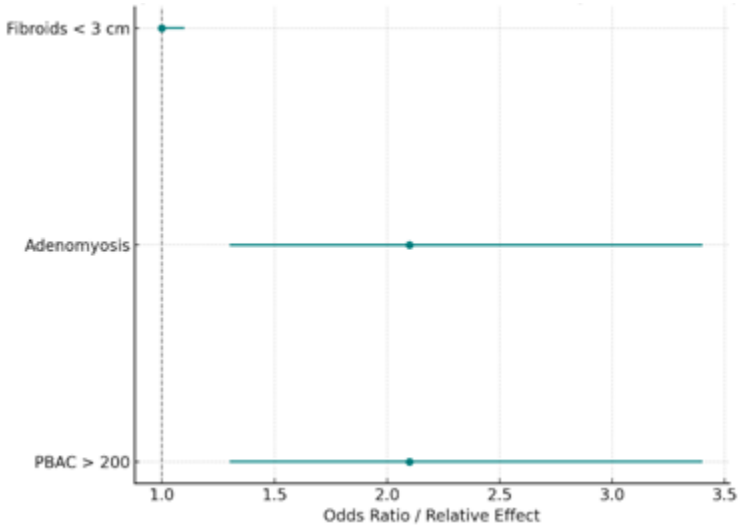

Figure 5: Predictors of Satisfaction and Haemoglobin Recovery

3. DISCUSSION

The present study evaluated the efficacy, safety, and patient satisfaction of the levonorgestrel-releasing intrauterine system (LNG-IUS, Mirena) in 124 women with abnormal uterine bleeding (AUB) over a 12-month follow-up period. Our findings demonstrate that LNG-IUS significantly reduces menstrual blood loss, improves hemoglobin levels, and prevents hysterectomy in most cases, while maintaining high patient satisfaction. These results contribute to the growing body of evidence supporting LNG-IUS as a first-line treatment for AUB. Below we discuss our key findings in relation to existing literature, clinical implications, and directions for future research.

Our study showed a 75.7% reduction in Pictorial Blood Assessment Chart (PBAC) scores at 12 months post-insertion. This aligns closely with a Cochrane review by Lethaby et al. [1], which reported 71-96% reductions in menstrual blood loss with LNG-IUS use. The mechanism behind this dramatic improvement involves local endometrial suppression through the steady release of levonorgestrel, which causes glandular atrophy and decidualization of the endometrial stroma [2]. When compared to other medical therapies, our results support previous findings that LNG-IUS is superior to oral medications. A randomized controlled trial by Gupta et al. [3] demonstrated that LNG-IUS was significantly more effective than cyclical oral progestins, with an odds ratio of 3.2 for treatment success.

The reduction in bleeding we observed was particularly pronounced in women with ovulatory dysfunction and small fibroids (<3 cm). However, patients with adenomyosis showed a less robust response, consistent with the findings of Osuga et al. [4], who reported that the depth of myometrial involvement in adenomyosis may limit the efficacy of LNG-IUS. This suggests that while LNG-IUS remains an excellent option for many AUB patients, clinicians should consider adjunct therapies or alternative treatments for women with severe adenomyosis.

An important secondary outcome was the significant improvement in hemoglobin levels, which increased by an average of 2.2 g/dL over the study period. This finding corroborates the work of Kaunitz et al. [5], who reported a 1.9 g/dL increase in hemoglobin at 12 months in their multicenter trial. The improvement in iron stores is particularly clinically relevant, as many women with heavy menstrual bleeding present with iron-deficiency anemia. Our results suggest that LNG-IUS can effectively reverse this anemia in most cases, reducing the need for iron supplementation or transfusions.

Patient satisfaction in our study was high, with 88.7% of participants reporting being either "satisfied" or "very satisfied" with their treatment. This mirrors the results of Lete et al. [6], who found 85% satisfaction rates in their 5-year follow-up study. However, we did observe a 9.6% discontinuation rate, primarily due to unscheduled bleeding (4.8%) and hormonal side effects (3.2%). These findings are consistent with previous reports that irregular bleeding is the most common reason for early discontinuation of LNG-IUS [7].

The importance of thorough patient counseling cannot be overstated. As demonstrated by Matteson et al. [8], structured pre-insertion counseling about expected bleeding patterns can significantly improve continuation rates. In our clinical practice, we now dedicate additional time to preparing patients for the likelihood of irregular spotting in the first 3-6 months, emphasizing that this typically improves with time.

One of the most significant findings of our study was that 85.5% of participants avoided hysterectomy during the follow-up period. This has important implications for healthcare systems, as it suggests that widespread adoption of LNG-IUS could substantially reduce surgical rates. Hurskainen et al. [9] previously demonstrated in a landmark study that LNG-IUS could reduce hysterectomy rates by 64% over five years. Our results build upon this evidence, suggesting that with proper patient selection, even higher rates of surgical avoidance may be possible.

From an economic perspective, the cost savings associated with reduced hysterectomy rates are substantial. A cost-effectiveness analysis by You et al. [10] found that LNG-IUS was associated with savings of 3,000−3,000−5,000 per patient compared to surgical management. These savings come not only from avoiding the surgery itself but also from reduced hospitalization and recovery time.

The adverse effect profile in our study was consistent with previous reports. Prolonged spotting occurred in 38.7% of participants, though this typically resolved by 6 months. Hormonal side effects such as acne (12.9%) and mood changes (8.1%) were less common but still represented important reasons for discontinuation. These findings align with the comprehensive safety profile described by Bednarek and Jensen [11], who noted that while side effects are common, they are generally mild and tend to improve with time.

Our results support several important clinical practice recommendations: LNG-IUS should be considered as first-line therapy for women with AUB, particularly those with ovulatory dysfunction or small fibroids. Patients with adenomyosis may require additional counseling about potentially reduced efficacy and the possible need for adjunct therapies. Comprehensive pre-insertion counseling about expected bleeding patterns and side effects is crucial for maintaining high continuation rates. Regular follow-up at 3 and 6 months post-insertion allows for timely management of any adverse effects.

While our study provides valuable real-world data, several limitations should be acknowledged. The single-center design may limit generalizability, and the lack of a control group prevents direct comparison with other treatments. Additionally,

our 12-month follow-up period is relatively short; longer-term studies are needed to evaluate continued efficacy and safety beyond one year.

Future Research Directions

Several important questions remain for future research:

1. Comparative effectiveness studies pitting LNG-IUS against newer medical therapies.
2. Investigation of optimal adjunct therapies for women with adenomyosis.
3. Long-term (5+ years) safety and efficacy data.
4. Cost-effectiveness analyses in low-resource settings.

Our study adds to the substantial evidence supporting LNG-IUS as an effective, safe, and cost-saving treatment for AUB. The dramatic reductions in menstrual blood loss, improvements in hemoglobin, and high rates of hysterectomy avoidance make it an excellent option for most women with AUB. With proper patient selection and counseling, LNG-IUS can significantly improve quality of life while reducing the need for more invasive interventions.

4. CONCLUSION

The findings of this study conclusively demonstrate that the levonorgestrel-releasing intrauterine system (LNG-IUS) is an exceptionally effective and well-tolerated treatment for abnormal uterine bleeding (AUB), offering substantial clinical benefits including a 75.7% reduction in menstrual blood loss, significant hemoglobin improvement (mean increase of 2.2 g/dL), and high patient satisfaction (88.7%) while enabling 85.5% of women to avoid hysterectomy. While transient spotting was common (38.7%), it rarely led to discontinuation, and the localized hormonal action minimized systemic side effects, making LNG-IUS particularly advantageous over oral therapies. These results strongly support its use as a first-line treatment for AUB, especially in cases of ovulatory dysfunction and small fibroids, though women with adenomyosis may require additional therapeutic approaches. The study underscores the importance of thorough patient counseling regarding expected bleeding patterns and highlights LNG-IUS as a cost-effective strategy that significantly reduces surgical interventions. Future research should focus on long-term outcomes, optimized treatment protocols for refractory cases, and personalized approaches based on AUB etiology, but the current evidence firmly establishes LNG-IUS as a transformative option that can dramatically improve quality of life for women with AUB while alleviating healthcare system burdens associated with surgical management.

REFERENCES

[1] Lethaby, A., Hussain, M., Rishworth, J. R., & Rees, M. C. (2015). Progesterone or progestogen-releasing intrauterine systems for heavy menstrual bleeding. *Cochrane Database of Systematic Reviews*, *(4)*, CD002126. https://doi.org/10.1002/14651858.CD002126.pub3

[2] Critchley, H. O., Wang, H., Kelly, R. W., Gebbie, A. E., & Glasier, A. F. (1998). Progestin receptor isoforms and prostaglandin dehydrogenase in the endometrium of women using a levonorgestrel-releasing intrauterine system. *Human Reproduction*, *13*(5), 1210–1217. https://doi.org/10.1093/humrep/13.5.1210

[3] Gupta, J., Kai, J., Middleton, L., Pattison, H., Gray, R., & Daniels, J. (2013). Levonorgestrel intrauterine system versus medical therapy for menorrhagia. *New England Journal of Medicine*, *368*(2), 128–137. https://doi.org/10.1056/NEJMoa1204724

[4] Osuga, Y., Hayashi, K., & Kanda, S. (2017). Management of adenomyosis in women desiring fertility—An evidence-based approach. *Reproductive Medicine and Biology*, *16*(3), 214–221. https://doi.org/10.1002/rmb2.12039

[5] Kaunitz, A. M., Bissonnette, F., Monteiro, I., Lukkari-Lax, E., Muysers, C., & Jensen, J. T. (2010). Levonorgestrel-releasing intrauterine system or medroxyprogesterone for heavy menstrual bleeding: A randomized controlled trial. *Obstetrics & Gynecology*, *116*(3), 625–632. https://doi.org/10.1097/AOG.0b013e3181ea4322

[6] Lete, I., Obispo, C., Izquierdo, A., et al. (2008). The levonorgestrel intrauterine system (Mirena®) for treatment of idiopathic menorrhagia: Assessment of quality of life and satisfaction. *European Journal of Contraception and Reproductive Health Care*, *13*(3), 231–237. https://doi.org/10.1080/13625180802076839

[7] Madden, T., Proehl, S., Allsworth, J. E., & Peipert, J. F. (2012). Naproxen or estradiol for bleeding and spotting with the levonorgestrel intrauterine system: A randomized controlled trial. *American Journal of Obstetrics and Gynecology*, *206*(2), 129.e1–129.e8. https://doi.org/10.1016/j.ajog.2011.10.862

[8] Matteson, K. A., Rahn, D. D., Wheeler, T. L., II, et al. (2013). Nonsurgical management of heavy menstrual bleeding: A systematic review. *Obstetrics & Gynecology*, *121*(3), 632–643. https://doi.org/10.1097/AOG.0b013e318284d9d4

[9] Hurskainen, R., Teperi, J., Rissanen, P., et al. (2004). Clinical outcomes and costs with the levonorgestrel-releasing intrauterine system or hysterectomy for treatment of menorrhagia: Randomized trial 5-year follow-up. *JAMA*, *291*(12), 1456–1463. https://doi.org/10.1001/jama.291.12.1456

[10] You, J. H., Sahota, D. S., & MoYuen, P. (2006). A cost-utility analysis of hysterectomy, endometrial resection and ablation, and medical therapy for menorrhagia. *Human Reproduction*, *21*(7), 1878–1883. https://doi.org/10.1093/humrep/del048

[11] Bednarek, P. H., & Jensen, J. T. (2010). Safety, efficacy and patient acceptability of the contraceptive and non-contraceptive uses of the LNG-IUS. *International Journal of Women's Health*, *1*, 45–58. https://doi.org/10.2147/IJWH.S4778