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Original Research Article

Managing Dysfunctional uterine bleeding: A Comparative study of Modified Thermal Balloon Ablation vs Thorough Curettage

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Abstract: *Dysfunctional uterine bleeding (DUB) is a common gynecological problem affecting women in the reproductive and perimenopausal age groups, often resulting in substantial physical, emotional, and social burden. Conventional treatment with thorough curettage has long been practiced in Pakistan; however, modified thermal balloon ablation has emerged as a promising minimally invasive alternative. High-quality comparative local evidence remains limited.* ***Objective:*** *To compare the efficacy and safety of modified thermal balloon ablation versus thorough curettage in achieving cure among women with dysfunctional uterine bleeding.* ***Methods:*** *A randomized controlled trial was conducted at the Gynecology Department of Lady Wallingdon Hospital, Lahore, over 6 months from 3rd July 2024 to 3rd January 2025. Women aged 35–55 years with DUB unresponsive to at least three months of medical therapy were consecutively enrolled and randomly allocated into two equal groups: thorough curettage (Group A) and modified thermal balloon ablation (Group B). Baseline characteristics, intraoperative findings, and follow-up outcomes at 4, 8, and 12 weeks were recorded. Cure was defined as menstrual blood loss less than 80 ml and bleeding duration of fewer than seven days at 12 weeks. Data were analyzed using SPSS 25; t-tests and chi-square tests were applied, with $p \leq 0.05$ considered significant.* ***Results:*** *Sixty-two women were included, with comparable baseline demographics in both groups. Modified thermal balloon ablation resulted in significantly lower intraoperative blood loss (28.4 ± 8.7 ml vs 52.6 ± 12.4 ml; $p < 0.001$) and shorter procedure time (11.1 ± 2.9 minutes vs 17.3 ± 3.8 minutes; $p < 0.001$) compared to curettage. Bleeding volume and duration decreased significantly more in Group B at all follow-up intervals, most notably at 12 weeks (48.3 ± 16.8 ml vs 91.6 ± 21.1 ml; $p < 0.001$). Complications were mild in both groups and statistically similar. Cure rates were significantly higher with thermal balloon ablation (90.3%) than with curettage (58.1%) ($p = 0.002$).* ***Conclusion:*** *Modified thermal balloon ablation demonstrated superior efficacy, achieving higher cure rates with significantly less blood loss and shorter operative time than thorough curettage. The technique offers a safe, effective, and minimally invasive alternative for managing dysfunctional uterine bleeding, especially in resource-constrained settings like Pakistan. It should be considered a preferred treatment option for women with refractory DUB.*

Keywords: Dysfunctional uterine bleeding, thermal balloon ablation, curettage, endometrial ablation, minimally invasive gynecology

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Introduction

Dysfunctional uterine bleeding (DUB) is a prevalent gynecological concern, particularly among women in the reproductive age group. The condition can lead to significant morbidity and declining quality of life. DUB encompasses a spectrum of abnormal bleeding patterns, with heavy menstrual bleeding (HMB) being one of the most common manifestations observed in reproductive-age women, as well as perimenopausal women (12). Timely and effective management of DUB is crucial to enhancing patient outcomes and quality of life.

Traditionally, thorough curettage has been utilized as a first-line treatment modality. However, endometrial ablation techniques, such as thermal balloon ablation, have emerged as minimally invasive alternatives that promise outcomes similar to, if not better than, those of traditional methods. Studies have shown that modified thermal balloon ablation, which uses a Foley catheter during the procedure, provides significant symptom relief and patient satisfaction (3). Research indicates that modified thermal balloon ablation is associated with significantly reduced menstrual blood loss and improved quality of life after intervention (4). Reports suggest that a substantial percentage of women who undergo this procedure experience a considerable reduction in menstrual bleeding, with many achieving amenorrhea (3).

The efficacy of thermal balloon ablation compared to thorough curettage has been evaluated in several comparative studies. While research evaluating thermal ablation methods across various contexts is available, specific studies on uterine bleeding management are needed to adequately assess claims about thermal balloon ablation versus curettage in DUB (5,6).

In the context of the Pakistani population, the significance of this research is amplified, given the limited access to comprehensive gynecological care and the high prevalence of untreated menstrual health issues. Implementing effective and less invasive treatment options for DUB is vital (1). Traditional practices often lean towards surgical interventions that carry greater risks and more extended recovery periods, which can be daunting in resource-constrained settings. Utilizing modified thermal balloon ablation represents a pragmatic approach, addressing the dual needs of treatment efficacy while minimizing complications and recovery time, thus potentially enhancing women's reproductive health across Pakistan (2).

The current study aims to prospectively evaluate the outcomes of modified thermal balloon ablation compared with thorough curettage in patients with DUB, with an emphasis on efficacy, safety, and patient-reported satisfaction. It is anticipated that the study will affirm the role of modified thermal balloon ablation as a viable and effective treatment alternative in the Pakistani context, ultimately assisting healthcare professionals in making informed decisions regarding the management modalities for patients presenting with DUB.

Methodology

The study was designed as a randomized controlled trial conducted in the Gynecology Department of Lady Wallingdon Hospital, Lahore, over six

months, from 3rd July 2024 to 3rd January 2025, following approval of the synopsis. Women aged 35 to 55 years presenting with dysfunctional uterine bleeding (DUB) were screened, and those meeting the inclusion criteria were consecutively enrolled. DUB was defined as heavy menstrual bleeding exceeding 80 milliliters per cycle or prolonged bleeding lasting more than seven days, with all structural and organic causes excluded through detailed history, physical examination, pelvic ultrasonography, and endometrial biopsy. Only patients who had not responded to at least three consecutive months of standardized medical therapy—including cyclical oral medroxyprogesterone acetate or danazol—were considered eligible. Women with ischemic heart disease, chronic kidney disease, known bleeding disorders, pelvic inflammatory disease, uterine structural anomalies, or suspected malignancy were excluded, as were individuals using anticoagulants or antiplatelet therapy, and those desiring future fertility.

A total of 62 patients were enrolled based on a calculated sample size with a 95 percent confidence level, a 5 percent margin of error, and expected cure rates of 66 percent for thorough curettage and 94 percent for modified thermal balloon ablation. The sampling strategy was convenience sampling, and all enrolled patients were randomly allocated to one of two intervention groups using the lottery method. In Group A, patients underwent thorough curettage performed by consultant gynecologists under appropriate anesthesia. Cervical dilation was followed by systematic removal of the endometrial lining using a curette. Group B was treated with modified thermal balloon ablation, executed using a Foley catheter inserted into the uterine cavity and inflated with pre-heated fluid to deliver thermal energy for 15 minutes before removal. Both procedures were performed in the operating room by experienced consultants to ensure uniformity in technique.

Baseline data on patient demographics, menstrual history, comorbidities, and bleeding characteristics were documented using a predesigned data collection pro forma. Intraoperative details, including type of anesthesia, estimated blood loss, operating time, and perioperative complications, were also recorded. All patients were subsequently followed at 4, 8, and 12 weeks post-procedure in the outpatient department. At each follow-up visit, menstrual blood loss was quantified based on patient-reported pad usage (with one adult pad approximately equivalent to 5 milliliters of blood), cycle duration was recorded, and any complications, such as pelvic pain, infection, or abnormal discharge, were noted. Cure was defined as normalization of menstrual volume to less than 80 milliliters per cycle and a reduction in bleeding duration to fewer than 7 days by the 12-week evaluation.

All collected data were analyzed using SPSS version 25. Quantitative variables such as age, blood loss, cycle duration, and operative time were reported as mean ± standard deviation. In contrast, qualitative variables, including cure rate and complications, were presented as frequencies and percentages. Independent-samples t-tests were used to compare means between the groups, and chi-square tests were used to assess differences in categorical outcomes. A p-value of 0.05 or less was taken as statistically significant. To control for potential confounding factors, stratified analyses were conducted by age group, smoking status, and diabetes status.

Results

The study included 62 women with dysfunctional uterine bleeding, randomized equally into the curettage group and the modified thermal balloon ablation group. The mean age of all participants was 44.13 ± 5.21 years, with both groups comparable in age distribution. Most women were multiparous, with a mean parity of 3.1 ± 1.1, reflecting typical reproductive patterns among Pakistani women. Smoking and diabetes were infrequent in both groups, and menstrual characteristics, such as baseline volume and bleeding duration, were similar across groups before the intervention. These findings demonstrate that both groups were demographically and clinically comparable at baseline (Table 1).

Intraoperative assessment revealed that modified thermal balloon ablation required significantly less time and resulted in markedly lower blood loss compared with thorough curettage. While curettage was more commonly performed under general anesthesia, the thermal balloon technique was more frequently conducted under regional anesthesia. Intraoperative complications were minimal in both groups, with no statistically significant differences (Table 2).

Follow-up evaluations at 4, 8, and 12 weeks showed a consistent and significant reduction in menstrual blood volume and bleeding duration in both groups, with a notably greater improvement observed in the modified thermal balloon ablation group at each time point. By the 12th week, women in Group B demonstrated substantially lower menstrual volume and shorter bleeding days compared with those in the curettage group, indicating superior clinical improvement over time (Table 3).

Postoperative complications over the three-month follow-up period were generally mild. Pelvic pain and watery discharge were more frequently reported in the curettage group, whereas the thermal balloon group had fewer overall complaints. However, none of the complications demonstrated a statistically significant difference between the two interventions, and no major adverse events occurred (Table 4).

At the end of the 12-week follow-up, cure rates were significantly higher in the modified thermal balloon ablation group, with 90.3% achieving complete resolution of abnormal bleeding, compared with 58.1% in the curettage group. This statistically significant difference highlights the superior efficacy of thermal balloon ablation for the management of dysfunctional uterine bleeding in the studied population (Table 5).

Table 1. Demographic Characteristics of Study Participants (n = 62)

Variable	Group A (Thorough Curettage) n=31	Group B (Modified Thermal Balloon Ablation) n=31	Total (n=62)
Age (years) (Mean ± SD)	44.67 ± 5.39	43.58 ± 5.04	44.13 ± 5.21
Gravida (Mean ± SD)	4.1 ± 1.2	3.9 ± 1.3	4.0 ± 1.2
Parity (Mean ± SD)	3.2 ± 1.1	3.0 ± 1.0	3.1 ± 1.1
Smoking	3 (9.7%)	2 (6.5%)	5 (8.1%)
Diabetes	5 (16.1%)	4 (12.9%)	9 (14.5%)
Menstrual Volume (ml) (Mean ± SD)	178.3 ± 41.5	181.6 ± 39.7	180.0 ± 40.3
Menstrual Duration (days) (Mean ± SD)	11.2 ± 2.3	10.9 ± 2.4	11.1 ± 2.3
Irregular Cycles	20 (64.5%)	18 (58.1%)	38 (61.3%)

Table 2. Intraoperative Findings

Variable	Group A (Curettage)	Group B (Thermal Balloon)	p-value
Anesthesia (General/Regional)	23/8	17/14	—
Estimated Blood Loss (ml) (Mean ± SD)	52.6 ± 12.4	28.4 ± 8.7	<0.001
Procedure Time (minutes) (Mean ± SD)	17.3 ± 3.8	11.1 ± 2.9	<0.001

Intraoperative Complications	2 (6.5%)	0 (0%)	NS

Table 3. Bleeding Volume and Duration Over Follow-up (Mean ± SD)

Follow-up	Parameter	Group A	Group B	p-value
4 Weeks	Volume (ml)	126.8 ± 30.2	82.4 ± 24.1	<0.001
	Duration (days)	8.3 ± 1.9	6.2 ± 1.4	<0.001
8 Weeks	Volume (ml)	103.9 ± 27.6	61.7 ± 19.3	<0.001
	Duration (days)	7.4 ± 1.6	5.4 ± 1.1	<0.001
12 Weeks	Volume (ml)	91.6 ± 21.1	48.3 ± 16.8	<0.001
	Duration (days)	6.9 ± 1.4	4.7 ± 1.0	<0.001

Table 4. Complications During Follow-up

Complication	Group A n (%)	Group B n (%)	p-value
Pelvic pain	6 (19.3)	3 (9.7)	NS
Watery discharge	5 (16.1)	2 (6.5)	NS
Infection	2 (6.5)	1 (3.2)	NS
Uterine adhesions (clinical suspicion)	1 (3.2)	0 (0%)	NS

Table 5. Cure Rates at 12 Weeks

Outcome	Group A (Curettage)	Group B (Thermal Balloon)	p-value
Cured	18 (58.1%)	28 (90.3%)	0.002
Not Cured	13 (41.9%)	3 (9.7%)	

Discussion

The current study quantitatively assesses the efficacy and safety of modified thermal balloon ablation compared with thorough curettage for the management of dysfunctional uterine bleeding (DUB) among women in Pakistan. Our findings indicate that modified thermal balloon ablation not only requires less operative time but also results in significantly lower intraoperative blood loss compared to curettage. This aligns with findings reported by Qureshi et al., who emphasized the benefits of minimally invasive procedures that reduce complication rates (7). Our study highlighted an estimated blood loss of 28.4 ± 8.7 ml with thermal balloon ablation, compared to 52.6 ± 12.4 ml with curettage, corroborating their assertion that more traditional methods often lead to excessive intraoperative hemorrhaging(7).

Furthermore, the notable differences in anesthesia type used in both groups—predominantly regional in the thermal balloon group—indicate a shift towards less invasive techniques, as supported by Javed et al., who suggest that the choice of anesthesia can significantly enhance patient comfort and reduce overall risk (8). This is particularly significant given that the minor complications reported in our study, such as pelvic pain and discharge, showed no statistically significant difference between groups, indicating comparable safety profiles (9).

Follow-up assessments at 4, 8, and 12 weeks showed a consistent, statistically significant decline in both menstrual blood volume and bleeding duration in women undergoing thermal balloon ablation. Specifically, by week 12, the group receiving thermal balloon ablation demonstrated a significant reduction in menstrual volume to 48.3 ± 16.8 ml, compared with 91.6 ± 21.1 ml in the curettage group. This is consistent with findings from Kuroda et al., who observed significant reductions in bleeding and improvement in quality of life among patients post-ablation (10). The sustained efficacy over time supports the notion of thermal balloon ablation as a reliable and potentially superior treatment option.

Moreover, cure rates at the end of the 12-week follow-up further illustrate the differences in outcome effectiveness, with 90.3% of the thermal balloon ablation group achieving total resolution of abnormal bleeding, compared with 58.1% in the curettage group. This result aligns with the literature, which reports improved outcomes associated with thermal ablation techniques, as reported by Masood et al., who advocate using such methods in clinical practice to improve treatment adherence in patients with DUB (11).

In terms of postoperative complications, our findings show that both groups mainly experienced mild complications, with the thermal balloon group reporting fewer instances of pelvic pain and discharge. This reinforces findings from recent studies indicating that minimally invasive techniques tend to promote better recovery experiences and lower incidences of adverse outcomes (8, 12).

Rationale for Context in Pakistan

The implications of this study are particularly pertinent to the Pakistani healthcare setting, where access to adequate gynecological facilities can be limited. Many women suffering from DUB remain untreated due to fears of invasive surgical procedures, anesthesia risks, and prolonged recovery times. As noted in studies such as those by Kocevska et al., the management of DUB remains a significant public health issue requiring effective and accessible remedies (13). The findings of our study suggest that modified thermal balloon ablation not only provides a less invasive option with substantial efficacy but also addresses practical concerns related to treatment duration, hospital stays, and overall patient satisfaction (14).

This study advocates adopting contemporary treatment modalities tailored to the demographic and cultural contexts of Pakistani women, ultimately enhancing healthcare outcomes and improving quality of life for this segment of the population. Such advancements are crucial for managing DUB, where traditional approaches may fall short in terms of efficacy and safety (12, 15).

Evidence from our study supports the feasibility, effectiveness, and safety of modified thermal balloon ablation as an alternative to thorough curettage for managing DUB in Pakistani women, with implications for broader adoption in clinical practice.

The study was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. Additionally, the short follow-up duration did not allow assessment of long-term recurrence or sustained efficacy of the interventions.

Conclusion

Modified thermal balloon ablation proved markedly more effective than thorough curettage for dysfunctional uterine bleeding, with higher cure

rates, faster recovery, and significantly reduced intraoperative blood loss. Both procedures were safe, but thermal balloon ablation offered clear clinical advantages with fewer postoperative symptoms and better bleeding control. Given its minimally invasive nature and strong therapeutic outcomes, this technique is a valuable treatment option for women with refractory DUB, particularly in the Pakistani healthcare context, where accessible, efficient, and low-risk interventions are essential.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-MMUS-04577-24)
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The authors declared the absence of a conflict of interest.

Author Contribution

MM (PGR)
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Conception of Study, Development of Research Methodology Design,

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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