Zagazig University Medical Journal
www.zumj.journals.ekb.eg
https://doi.org/10.21608/zumj.2025.419106.4144 Volume 31, Issue 11 November. 2025
Manuscript ID:ZUMJ-2508-4144
DOI:10.21608/zumj.2025.419106.4144

ORIGINAL ARTICLE

Evaluation of Adding Customized Plication in Lipoabdominoplasty: A preliminary Pilot Study in Zagazig University Hospitals

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Submit Date: 31-8-2025
Revise Date: 5-10-2025
Accept Date: 11-10-2025

ABSTRACT

Background: Musculoaponeurotic laxity is a key contributor to abdominal wall deformities, particularly in postpartum women. While vertical (midline) plication remains the standard approach in abdominoplasty, it often falls short in achieving optimal waist definition and contour. This study evaluates the aesthetic and clinical outcomes of adding customized musculoaponeurotic plications, such as transverse, oblique, or multidirectional, to vertical plication in lipoabdominoplasty. Thus, we aimed to achieve better aesthetic body contouring.

Methods: This is a preliminary pilot study conducted at Zagazig University Hospitals and included 12 healthy multiparous female patients undergoing lipoabdominoplasty. Patients were divided based on plication technique: vertical-only (n=6), vertical + lateral (n=2), vertical + oblique (n=3), and crossbow (multidirectional) (n=1). Aesthetic outcomes were evaluated pre- and post-operatively using photographic documentation and waistline by tape measure and a five-point Likert scale assessing abdominal contour, waistline definition, and overall satisfaction. Complications, drain output, and recovery profiles were also analyzed.

Results: The addition of oblique and multidirectional plications resulted in greater waist circumference reduction ($p = 0.045$) and higher patient satisfaction, despite not reaching statistical significance in satisfaction scores (early $p = 0.786$; late $p = 0.643$). No significant differences in complication rates or drain duration were observed among groups. Vertical-only plication showed a higher incidence of minor complications, such as dog ears and scar hypertrophy. All patients remained hemodynamically and metabolically stable throughout the perioperative period.

Conclusion: Customized musculoaponeurotic plication techniques, especially oblique and multidirectional approaches, may offer superior aesthetic outcomes in lipoabdominoplasty without increasing complication rates or recovery time.

Keywords: Lipoabdominoplasty, Musculoaponeurotic Plication, Waist Contouring, Vertical Plication, oblique Plication.

INTRODUCTION

In recent decades, the popularity of abdominoplasty has grown dramatically. According to updated data from the Aesthetic Society, the number of abdominoplasty procedures has increased by over 400% since the late 1990s, underscoring the continuous demand for improved body contouring techniques and compelling plastic surgeons to refine and innovate their surgical approaches [1]. Historically, abdominoplasty has undergone significant evolution. The earliest recorded surgical attempt to address abdominal wall deformities dates back to 1899, when Kelly performed a horizontal mid-abdominal excision to remove excess skin and subcutaneous fat, reportedly resecting a

panniculus weighing more than 7 kg [2]. In 1924, Thorek introduced a more refined technique involving a lower transverse incision that preserved the umbilicus, an important aesthetic milestone [3]. Vernon later advanced the procedure in 1957 by integrating umbilical transposition and midline plication of the musculoaponeurotic layer, thus laying the foundation for modern abdominoplasty [4]. Incorporating correction of the musculoaponeurotic layer not only improves the waistline contour but also reinforces the functional integrity of the abdominal wall. It aids in restoring the natural convexity of the rectus abdominis muscles while reducing central laxity [4]. Vertical (midline) plication, extending from the xiphoid process to the pubis, remains the standard approach for managing rectus diastasis. However, its effectiveness in correcting lateral abdominal wall laxity, especially around the waist, is limited [5]. As such, surgeons have introduced alternative or adjunctive methods, including transverse and oblique plications, to enhance contouring outcomes and better address multidirectional musculoaponeurotic laxity. These techniques target regions inadequately supported by vertical plication alone, thereby refining the waist and improving the transition between the abdomen and flanks [6]. The evolution of abdominoplasty also accelerated with the integration of liposuction in the 1980s, which enabled more precise fat removal and improved aesthetic refinement. In 1985, Dellon proposed a novel approach combining vertical and horizontal excisions, resulting in the "fleur-de-lis" pattern, now reserved for cases with significant excess skin in both vertical and horizontal vectors [7].

METHODS

This preliminary pilot study was conducted at the plastic surgery department of Zagazig University Hospitals and included 12 healthy multiparous female patients undergoing lipoabdominoplasty. The study was approved by the ethical committee of the Faculty of Medicine, Zagazig University (IRB number 596-13-Aug-2024). Female patients aged 22–48 years with excess abdominal skin, adipose tissue, and musculoaponeurotic laxity (Types III, IV, or V deformities) and a BMI < 35 and HB >11 were included in the study. Patients were excluded if they had a BMI > 35, a history of major ventral hernia (≥5 cm in diameter, repaired or unrepaired), a history of massive weight loss (>50 pounds or >22.7 kg) or post-bariatric surgery, subcostal scars, were undergoing redo abdominoplasty, had significant comorbidities (e.g., regular use of anticoagulants), unrealistic expectations, psychiatric disorders, or were active smokers, or had HB<11.

Data Collection Tools

All patients underwent standardized preoperative assessment and surgical intervention. After obtaining informed consent, a complete medical evaluation was performed, including personal and family history, current complaints, and past medical and surgical history. General examination included vital signs and body mass index (BMI), followed by focused abdominal assessment for diastasis, hernia, and lipodystrophy. Routine laboratory investigations were conducted, and standardized preoperative color photographs (anterior, posterior, lateral, and oblique views) were taken, and the waistline was measured by tape measure.

Surgical Technique

Under general anesthesia, patients were positioned supine, followed by abdominal dermolipectomy with dissection above the umbilicus in a central tunnel approach until full exposure of the rectus muscles was achieved. Vertical (midline) plication served as the primary technique, optionally combined with lateral, transverse, or oblique plication based on intraoperative findings. Excess skin was excised, a neoumbilicus was created, suction drains were inserted, and the wound was closed in layers without tension. Postoperatively, patients were positioned in a flexed (V) position and wore abdominal corsets and antithrombotic

stockings. Discharge occurred at 48 hours post-surgery.

Follow-up and Evaluation

Patients were reviewed 48 hours post-discharge, and follow-up photographs were obtained. Aesthetic outcomes were evaluated based on five criteria: abdominal contour, linea alba definition, waistline definition, and hip-to-waist transition. Each was scored on a 5-point Likert scale (1 = worse than preoperative, 5 = marked improvement), with a global score calculated as the average.

Patient Satisfaction Assessment

Satisfaction was measured using a two-tiered subjective approach: A five-point Likert scale (1 = very dissatisfied to 5 = very satisfied). A semantic differential scale assessing perception across opposing descriptors (e.g., "Unpleasant – Pleasant", "Ineffective – Effective") rated on a 7-point continuum.

Additional Outcome Measures

Complications were recorded throughout the postoperative period. Waist circumference was measured using a standard tape measure to quantify changes in contour.

Statistical Methodology

Baseline data obtained from the 20 participants who completed the study were analyzed using analysis of variance, the chi-square test, and the Fisher test. The mean and 95% confidence interval of differences were evaluated using analysis of variance. Data were presented as the mean standard deviation. The c2 test, or Fisher test, was used to analyze our results. Data were presented, and suitable analysis was done according to the type of data (parametric and non-parametric) obtained for each variable. P-value less than 0.05 (5%) was considered to be statistically significant.

RESULTS

There is a homogeneous sample of 12 married women (mean age 28.3 ± 6.61 years) with previous pregnancies (mean 2.08 ± 1.24). The complete uniformity in marital status and pregnancy history may limit generalizability, and the small sample size should be considered when interpreting results (Table 1). There were significant differences in waist circumference outcomes across four surgical techniques in a small cohort. The "Vertical Only" group had the largest preoperative measurements (108.0 ± 1.41 cm) and showed the most modest reduction, while the "Crossbow" technique achieved the greatest circumference reduction despite having only one patient. All techniques with adequate sample sizes ($n \geq 2$) showed statistically significant within-group improvements ($p<0.05$), and between-group differences were significant both pre- and postoperatively ($p<0.01$). However, the extremely small and uneven group sizes, particularly the single patient in the Crossbow group, severely limit statistical power and clinical interpretation of these comparative results (Table 2). Table 3 compared postoperative complications across surgical techniques, but the findings should be interpreted with extreme caution due to severe statistical limitations. While Fisher's exact test is appropriately used for small sample sizes, none of the p-values reach statistical significance, likely reflecting insufficient power rather than true equivalence between techniques. The "Vertical Only" group shows the highest absolute complication rates (17% each for dog ears, wound dehiscence, hypertrophy, contour irregularity, and infection), while the "Vertical + Oblique" group had a concerning 33% rate of both wound dehiscence and infection. However, with group sizes ranging from 1 to 6 patients, these percentages represent single cases and cannot reliably inform clinical decision-making or technique selection. Table 4 showed patient satisfaction outcomes across surgical techniques at early and late follow-up periods, though the small sample sizes limit meaningful statistical interpretation. The "Crossbow" technique achieved 100% "very satisfied" ratings at both time points, but this represents only one patient. The "Vertical + Oblique" group showed improvement over time, with no dissatisfied patients and 67% "very satisfied" at late follow-up compared to 33% early. The "Vertical Only" group maintained consistent

dissatisfaction rates (33%) but showed improved "very satisfied" ratings from 17% to 33% over time. Neither early (p=0.786) nor late (p=0.643) satisfaction differences reached statistical significance, likely due to inadequate power from the small, uneven group sizes rather than true equivalence between techniques.

Table 1. Demographic data among the studied patients.

Variables		All patients (n=12)
Age (years)	Mean ± SD	28.3 ± 6.61
Marital status (n. %)	Single	0 (0%)
	Married	12 (100%)
Previous pregnancies (n. %)	No	0 (0%)
	Yes	12 (100%)
Number of pregnancies	Mean ± SD	2.08 ± 1.24
History of Surgical weight loss (n. %)	No	12 (100%)
	Yes	0 (0%)

Table 2. Comparison of Anthropometric Measurements by Surgical Technique

Variables	Vertical Only (n=6)	Vertical+ Lateral (n=2)	Vertical+ Oblique (n=3)	Crossbow (n=1)	P1 Value (Between groups)
Waist Preoperativeat the level of umbilicus (cm) Mean ± SD	108.0 ± 1.41	99.5 ± 0.71	98.0 ± 1.00	96.0	0.0024 *
Waist Postoperative at the level of umbilicus (cm) Mean ± SD	99.7 ± 5.75	91.5 ± 0.71	90.7 ± 1.15	89.0	0.0018 *
P2 Value (Within group)	0.019 *	0.017 *	0.011 *	—	—

*: significant

Table 3. Comparison of Post-operative findings and Post-operative complications among the studied patients regarding surgical techniques.

Variable	Vertical Only (n=6)	Vertical + Lateral (n=2)	Vertical + Oblique (n=3)	Crossbow (n=1)	P-value	Test Used
Dog Ears (n)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0.727	Fisher's Exact Test
Wound Dehiscence (n)	1 (17%)	0 (0%)	1 (33%)	0 (0%)	0.545	Fisher's Exact Test
Hypertrophy (n)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0.545	Fisher's Exact Test
Contour Irregularity (n)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0.545	Fisher's Exact Test
DVT (n)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1.000	Fisher's Exact Test
Infection	1 (17%)	0 (0%)	1 (33%)	0 (0%)	0.545	Fisher's Exact Test

Table 4. Patient satisfaction regarding the surgical techniques.

Variables	Vertical Only(n=6)	Vertical +Lateral(n=2)	Vertical +Oblique (n=3)	Crossbow (n=1)	P Value
Satisfaction (early)					
Dissatisfied	**2 (33.3%)**	**1 (50%)**	**0 (0%)**	**0 (0%)**	**0.786**
Satisfied	**3 (50%)**	**1 (50%)**	**2 (66.7%)**	**0 (0%)**	
Very satisfied	**1 (16.7%)**	**0 (0%)**	**1 (33.3%)**	**1 (100%)**	
Satisfaction (late)					
Dissatisfied	**2 (33.3%)**	**0 (0%)**	**0 (0%)**	**0 (0%)**	**0.643**
Satisfied	**2 (33.3%)**	**1 (50%)**	**1 (33.3%)**	**0 (0%)**	
Very satisfied	**2 (33.3%)**	**1 (50%)**	**2 (66.7%)**	**1 (100%)**	

DISCUSSION

Musculoaponeurotic plication is a central component in abdominoplasty, particularly for correcting abdominal wall laxity and diastasis recti. Traditionally, this has been achieved through midline plication to restore anterior abdominal wall integrity. However, with advances in surgical anatomy and aesthetic concepts, contemporary techniques have evolved to incorporate lateral and multi-vector plication approaches [8]. The rationale behind lateral or oblique plication stems from the recognition that midline repair alone may inadequately address lateral tension and waist contouring. Studies by Villegas-Alzate [9] and Borille et al. [10] support the inclusion of transverse or oblique plication to improve lateral abdominal control and refine silhouette, especially in patients with diffuse muscular laxity or pronounced lateral bulging. Despite these theoretical advantages, the clinical efficacy of expanded plication strategies remains under investigation. Matarasso & Matarasso [11] emphasized that surgical outcomes often depend more on anatomical variation and technical proficiency than on the direction of plication alone. In our study, we evaluated aesthetic and satisfaction outcomes among 12 multiparous female patients with abdominal deformities, none of whom had undergone massive weight loss or bariatric surgery. The cohort was divided into four groups according to the plication technique: Vertical (midline) plication only: 6 patients, Vertical + lateral plication: 2 patients, Vertical + oblique plication: 3 patients and Crossbow (multi-vector) plication: 1 patient. This distribution allowed a targeted comparison of outcomes across different reinforcement strategies. The findings from Younes et al. [12] were particularly influential, demonstrating that midline plication alone often falls short in achieving ideal waist narrowing, and suggesting that multi-vector techniques may yield more favorable aesthetic results. In our study, 12 patients had distinctive characteristics compared to typical abdominoplasty series. The mean age of 28.3±6.6 years was notably younger than commonly reported ranges of mid-30s to mid-40s [13, 14]. All patients were married and multiparous (mean pregnancies 2.08±1.24), which aligns with abdominoplasty being frequently sought for post-pregnancy abdominal changes including diastasis recti and excess skin [15]. All surgical techniques achieved significant waist circumference reduction ($p<0.05$ within each group). However, important differences emerged between techniques. The vertical-only group had the highest preoperative waist measurements (108.0±1.41 cm) and achieved substantial reduction to 99.7±5.75 cm. especially, combination techniques produced superior final outcomes: vertical + lateral (91.5±0.71 cm), vertical + oblique (90.7±1.15 cm), and crossbow (89.0 cm) achieved lower absolute postoperative measurements despite starting from

lower baselines. These findings support the anatomical rationale that lateral and multi-directional plication better address waist contour than midline repair alone, consistent with recent studies by Villegas-Alzate [9] and Borille et al. [10] emphasizing multi-vector reinforcement for enhanced flank control and refined silhouettes. Overall complication rates were acceptable with no statistically significant differences between groups ($p>0.05$ for all complications). The vertical-only group showed numerically higher minor complications (17% each for dog ears, wound dehiscence, hypertrophic scarring, contour irregularity, and infection) compared to combination techniques. Notably, no cases of DVT or major complications occurred across any group. Our wound dehiscence rate (16.7% overall, 17% in vertical-only group) was higher than some reported series [16], which may reflect the higher tissue tension in our uniformly obese, multiparous population. The absence of major complications suggests effective surgical technique and prophylaxis protocols. Satisfaction outcomes demonstrated clear improvement over time and technique-related differences. Early postoperative satisfaction showed 58.3% satisfied and 16.7% very satisfied overall, improving to 41.7% satisfied and 50% very satisfied at late follow-up, with dissatisfaction decreasing from 25% to 8.3%. Technique-specific analysis revealed that vertical-only procedures had the highest dissatisfaction rates both early and late (33.3%), while combination techniques showed superior satisfaction profiles. The crossbow technique achieved 100% very satisfied results, though this represents only one patient. These trends, while not statistically significant due to small group sizes ($p=0.786$ early, $p=0.643$ late), align with emerging evidence supporting individualized multi-vector approaches for enhanced aesthetic outcomes [17].

CONCLUSIONS

This study demonstrated that all abdominoplasty plication techniques achieve significant waist circumference reduction with acceptable complication profiles. However, multi-vector approaches (vertical + lateral/oblique, crossbow) produced superior final contour measurements and enhanced patient satisfaction trends compared to vertical-only plication. The younger, uniformly multiparous cohort with elevated BMI achieved meaningful aesthetic improvement across all techniques, with combination methods showing particular promise for comprehensive abdominal wall correction. While small sample sizes limit statistical power, the observed trends support individualized technique selection based on patient anatomy and laxity patterns. Future large-scale prospective studies are needed to establish definitive comparative efficacy and optimize patient selection criteria for different plication approaches.

Conflict of Interest:
None
Financial Disclosures:
None

Availability of the data:
The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author's contribution:
All the listed authors contributed significantly to the conception and design of study, acquisition, analysis, and interpretation of data and drafting of the manuscript, to justify authorship.

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Citation

Nasr, M., Abbas, E., Nasr, S., Awaad, Y. Evaluation of Adding Customized Plication in Lipoabdominoplasty: A preliminary Pilot Study in Zagazig University Hospitals. *Zagazig University Medical Journal*, 2025; (5474-5480): -. doi: 10.21608/zumj.2025.419106.4144