

Comparative Outcomes of Power-Assisted and Ultrasound-Assisted (VASER) Liposuction in Abdominal Body Contouring: A Prospective Cohort Study

Khalid Khairi Hussein

Department of General Surgery, College of Medicine, Tikrit University, Iraq

Email: Drkhalidkhairi@tu.edu.iq

Abstract: Liposuction is one of the most popular cosmetic procedures worldwide. There are two methods that are commonly used, Power-Assisted Liposuction (PAL) involves a device that liquefies fat, and VASER liposuction utilizes ultrasonic energy to liquefy fat prior to its removal. Both methods are commonly used but there is a lack of good-quality research studies that directly compare their effectiveness and safety. A study was conducted on 300 adult patients in Iraq who had undergone abdominal liposuction. Half of the patients were treated with PAL, and the other half with VASER. All procedures were performed by the same highly experienced surgeon for uniformity. The researchers compared the amount of fat that was removed, the length of the surgery, the patients' experience of the surgery, their recovery time, and their satisfaction with the surgery. Objective to investigate and compare the surgical results, postoperative recovery and complications, and patient satisfaction between Power-Assisted Liposuction (PAL) and Ultrasound-Assisted Liposuction (VASER) in the abdominal body contouring surgery. The study was prospective cohort study performed in Al-Zohour Private Hospital, Tikrit, Iraq between February 2022 and May 2025. A total of 300 adults (BMI 18.5–32.0 kg/m²) were randomised equally to PAL (n = 150) or VASER (n = 150). The surgery was carried out by a single surgeon with standardised procedures. Primary outcome measures comprised fat aspirate volume, operating time and the intraoperative complications. Secondary outcomes were postoperative pain (VAS scale), recovery time, complications and patient satisfaction. Data were analysed using SPSS 23.0 and the mean differences were reported with 95% confidence intervals (CIs) and Cohen's d, risk ratios, and exact p-values. There were no differences in the baseline characteristics. VASER achieved greater mean fat removal (2800 ± 600 mL vs. 2400 ± 550 mL; mean difference 400 mL, 95% CI 270–530; p < 0.001; Cohen's d = 0.69) but required longer operative time (100 ± 18 vs. 90 ± 15 minutes; mean difference 10 minutes, 95% CI 6–14; p < 0.001; d = 0.60). The mean reduction in pain scores was significant for the VASER group at Day 1 (-0.7, 95% CI -1.0 to -0.4) and Day 7 (-0.6, 95% CI -0.9 to -0.3; both p < 0.001). Recovery was faster (8.5 vs. 10.2 days; mean difference -1.7, 95% CI -2.2 to -1.2; p < 0.001; d = 0.85). There were few complications and no differences between groups. All domains of patient satisfaction were significantly higher in VASER. VASER liposuction significantly outperformed PAL in terms of fat removal, less pain, quicker recovery, and patient satisfaction without incurring a higher risk of complications. VASER could thus be indicated for abdominal contouring.

Keywords: Liposuction, Ultrasonics, Body Contouring, Patient Satisfaction, Postoperative Pain

Introduction

Liposuction has been a popular cosmetic surgery procedure in the world for over 40 years. As minimally invasive body contouring has grown in popularity, new technologies have emerged with the goal of providing better results, quicker healing, and less downtime, or complications [1]. Of these innovations, two techniques have become widely used: Power-Assisted Liposuction (PAL) and Ultrasound-Assisted Liposuction using Vibration Amplification of Sound Energy at Resonance (VASER) [2]. Though both techniques are for cosmetic fat removal, they do have many differences in terms of how they work, how difficult they are and how they interact with surrounding tissues [3].

PAL uses a mechanically-powered reciprocating cannula to break up and aspirate adipose tissue. The method minimizes the surgeon's fatigue and it effectively works in fibrous areas like the upper abdomen, flanks and male chest [4]. For instance, a MicroAire PAL system has proven to be reliable in high volume liposuction and is appreciated for its tactile feedback and simplicity.

On the other hand, the VASER system has ultrasound devices with high frequency energy, which selectively emulsify fat prior to aspiration [5]. Proponents of VASER note that there is less connective tissue damage, skin retraction, bleeding during surgery and possibly less pain and bruising after surgery. VASER has also been linked to its aesthetic contour and high-definition, making it popular among surgeons and patients [6].

While numerous clinical studies have been performed, there is still limited data comparing PAL to VASER. Most of the published studies are retrospective, small in sample size, and performed in Western populations who have different cultural perceptions of beauty and expectations of patient outcomes [7]–[9]. There is a specific lack of well-

designed evidence in the Middle East region where skin and aesthetics preferences can vary. This void poses a problem for the surgeon in the region to choose the best technique for body contouring of the abdomen. The purpose of this study was to address this evidence gap by comparing the two types of liposuctions, PAL and VASER, in a prospective fashion.

Therefore, the present prospective cohort study was developed which compared PAL and VASER liposuction techniques in a single experienced surgeon's hands in a controlled hospital setting. Assessed outcomes included intra-operative performance, post-operative recovery, complication rate and patients' satisfaction.

Materials and Methods

Study Design and Setting

The study was prospective cohort study that was carried out at Al-zohour private hospital in Tikrit, Iraq. The recruitment of patients was carried out from February 2022 to May 2025. As at the time of writing, data collection is complete and all analyses are based on final results. The research study was made between the results of Power-Assisted Liposuction (PAL) and Ultrasound-Assisted Liposuction (VASER) in body contouring of the abdomen. Minimized operator-related variability by performing all procedures by one board-certified plastic surgeon.

Study Population

The adults (18–60 years) who had a BMI range of 18.5–32.0 kg/m² were eligible. Patients were enrolled consecutively from the outpatient surgical unit of plastic surgery at the hospital, and were to undergo elective abdominal liposuction. Exclusion criteria were pregnancy or lactation, systemic diseases that might affect wound healing, a history of surgery in the treatment area, and any contraindication to surgery or anaesthesia.

A pre-study power analysis was done by using G*Power software. Based on pilot data, an alpha of 0.05 and power of 0.80 were used to calculate that 150 patients per group were sufficient to detect clinically meaningful differences of 300 mL fat aspirate volume. Thirty patients were excluded because they did not meet the inclusion criteria, and 300 patients met the inclusion criteria and gave informed consent. A total of 150 patients were randomly divided into two groups – PAL (n = 150) and VASER (n = 150).

Randomisation and Blinding

Randomisation was performed using a computer-generated sequence. Allocation concealment was ensured by placing assignments in sequentially numbered opaque, sealed envelopes that were opened only after patient enrolment.

Blinding of the operating surgeon was not feasible due to the obvious differences in devices and technique. However, efforts were made to reduce assessment bias: postoperative outcome data (pain scores and satisfaction questionnaires) were collected by an independent nurse who was blinded to the intervention group. Patients were aware of their assigned procedure, which is acknowledged as a limitation for subjective measures.

Surgical Protocol

All procedures are carried out in standard conditions. Patients were given tumescent anaesthesia of 1000 mL of normal saline solution containing 1 mL of epinephrine (1:1000) and 20 mL of 2% lidocaine. The ratio of infiltration to aspiration was kept around 1.5:1.

PAL Group: MicroAire PAL system was applied with motorized reciprocating cannula that disrupted and aspirated fat.

VASER Group: The VASER Lipo System was used to safely and effectively target and emulsify adipose tissue at high frequency. The ultrasound probes were then applied at 60% amplitude in pulsed mode (3.7mm 3-groove probe) prior to aspiration using normal suction cannulas.

All patients were dressed in compression postoperatively for a minimum of four weeks. All patients received the same standard peri-operative fluid management and monitoring.

Outcome Measures

Primary outcomes included:

1. Intraoperative performance – total aspirated fat volume (mL), operative duration (minutes) and intraoperative complications. The intraoperative complications included were blood loss > 500 mL, injury to the viscera or vessels, and failure of the equipment.
2. Postoperative recovery – pain (Visual Analogue Scale [VAS]) on postoperative days 1 and 7, return to normal activity (days), length of follow-up.
3. Complications such as seroma, infection, hematoma, and wound dehiscence. A clinical diagnosis of seroma was made in all cases (palpable fluid collection), and if needed or when seroma was not easily identified (large, symptomatic or ambiguous collection), seroma was confirmed by ultrasound.

4. Patient satisfaction – This was measured at 1 and 3 months by a validated standardised questionnaire that included the overall satisfaction, aesthetic outcome, recovery experience, pain management and willingness to recommend the procedure.

Statistical Analysis

The IBM SPSS Statistics version 23.0 was used to analyse the data. Data for continuous variables were presented as mean $\pm$ standard deviation (SD), and compared between groups by the independent samples t-test and Mann–Whitney U test for normally and non-normally distributed data respectively. Data of categorical variables were summarized in frequencies and percentages and then analysed using the Chi-square test of Fisher's exact test.

Clinically relevant effect sizes (Cohen's d for continuous measures and risk ratios for categorical measures) with corresponding 95% confidence intervals (CIs) were computed. Exact p-values are given. The p-value was used for both tails, with <0.05 being significant.

There was almost no missing data ($<3\%$) and complete case analysis was used for the missing data. No imputation done.

Results

Baseline Characteristics

This was a total of 300 patients, equally randomized into PAL group (150 patients) and VASER group (150 patients). There were no subjects lost to follow up, and the data for all subjects were included in the final analysis. Demographic and clinical features were similar between both groups and no significant differences were observed for mean age, BMI or sex distribution (Table 1).

Table 1. Baseline Demographic Characteristics of Study Participants

Variable	PAL Group (n=150)	VASER Group (n=150)	Mean Difference (95% CI)	p-value
Age (years)	35.4 $\pm$ 8.1	34.9 $\pm$ 7.6	0.5 (–1.3 to 2.3)	0.53
BMI (kg/m ²)	26.8 $\pm$ 2.9	27.1 $\pm$ 3.1	–0.3 (–1.0 to 0.4)	0.27
Gender (Male/Female)	54/96	50/100	–	0.61

Intraoperative Outcomes

The VASER group was able to obtain significantly greater mean volumes of fat aspirated than PAL (2800 $\pm$ 600 mL vs. 2400 $\pm$ 550 mL). The mean difference was 400 mL (95% CI: 270–530 mL; $p < 0.001$; Cohen's d = 0.69), indicating a medium-to-large effect size. But the operative time was longer in the VASER group (100 $\pm$ 18 minutes vs. 90 $\pm$ 15 minutes). The mean difference was 10 minutes (95% CI: 6–14 minutes; $p < 0.001$; Cohen's d = 0.60). There were no significant differences in intra-operative complication rates (3.3% vs. 2.0%, $p = 0.39$). There were no cases of visceral or vascular injury. (Table 2)

Table 2. Intraoperative Outcomes

Outcome	PAL Group	VASER Group	Mean Difference (95% CI)	p-value	Effect Size (Cohen's d / RR)
Fat volume aspirated (mL)	2400 $\pm$ 550	2800 $\pm$ 600	400 (270–530)	<0.001	d = 0.69
Operative duration (min)	90 $\pm$ 15	100 $\pm$ 18	10 (6–14)	<0.001	d = 0.60
Intraoperative complications	3.30%	2.00%	RR = 0.61 (95% CI: 0.16–2.28)	0.39	RR = 0.61

Postoperative Recovery

The VASER patients reported less pain at both postoperative day 1 and day 7. There was no significant difference in rates of postoperative seroma and infection between both groups (Table 3).

Table 3. Postoperative Outcomes

Outcome	PAL Group	VASER Group	Mean Difference (95% CI)	p-value	Effect Size
Pain score (VAS, Day 1)	6.5 $\pm$ 1.2	5.8 $\pm$ 1.1	–0.7 (–1.0 to –0.4)	<0.001	d = 0.59
Pain score (VAS, Day 7)	3.2 $\pm$ 1.0	2.6 $\pm$ 1.1	–0.6 (–0.9 to –0.3)	<0.001	d = 0.55
Return to normal activities (days)	10.2 $\pm$ 2.1	8.5 $\pm$ 1.8	–1.7 (–2.2 to –1.2)	<0.001	d = 0.85

Seroma formation (%)	8	4.7	RR = 0.59 (95% CI: 0.27–1.29)	0.18	RR = 0.59
Infection rate (%)	2.7	2	RR = 0.74 (95% CI: 0.18–3.05)	0.62	RR = 0.74

Patient Satisfaction

The VASER group had significantly higher satisfaction scores in all domains at 3 months (Table 4). Overall satisfaction was the measure that showed the greatest differences and willingness to recommend the procedure was the second greatest difference.

Table 4. Patient Satisfaction Outcomes

Satisfaction Domain	PAL Group (%)	VASER Group (%)	Risk Ratio (95% CI)	p-value
Overall satisfaction	82	90.7	1.11 (1.02–1.21)	0.01
Aesthetic outcome satisfaction	79.3	88	1.11 (1.01–1.22)	0.02
Recovery experience	76.7	84.7	1.10 (1.00–1.22)	0.03
Pain management satisfaction	70	78.7	1.12 (1.01–1.25)	0.04
Would recommend the procedure	85.3	93.3	1.09 (1.02–1.17)	0.01

Complication Rates

Overall, the complication rates were low in both groups, and there were no statistically significant differences between the groups. The PAL group had a higher frequency of seroma formation (8.0% vs. 4.7%) but this was not statistically significant ($p = 0.18$). Hematoma, wound dehiscence and localised infection were rare events and were equally distributed among the groups (Table 5).

Table 5. Postoperative Complication Rates

Complication	PAL Group (%)	VASER Group (%)	Risk Ratio (95% CI)	p-value
Hematoma	1.3	0.7	0.54 (0.09–3.14)	0.56
Seroma	8	4.7	0.59 (0.27–1.29)	0.18
Wound dehiscence	2	1.3	0.65 (0.14–3.05)	0.65
Localized infection	2.7	2	0.74 (0.18–3.05)	0.62

Discussion

This prospective cohort study compared Power-Assisted Liposuction (PAL) and Ultrasound-Assisted Liposuction with the VASER system in abdominal body contouring. The findings demonstrate that VASER achieved significantly greater fat removal efficiency, reduced postoperative pain, and faster recovery times, while maintaining complication rates comparable to PAL. Patients in the VASER group also reported higher satisfaction across all evaluated domains.

The superior fat extraction observed with VASER (mean difference 400 mL) aligns with the results of Márquez-Gutiérrez et al. [10], who showed that ultrasound-assisted devices enhance adipose emulsification while preserving surrounding tissues. This mechanism likely explains both the greater fat yield and the improved patient-reported outcomes in our study. Although VASER procedures required an average of 10 minutes longer operative time, this modest increase appears clinically acceptable given the postoperative benefits.

Postoperative pain reduction and faster return to daily activities in the VASER group are consistent with the

proposed mechanism of selective tissue emulsification and reduced collateral trauma [11]. These advantages are particularly relevant in aesthetic practice, where patients place strong importance on rapid recovery and minimal discomfort.

Both techniques were associated with low complication rates, reflecting the safety of modern liposuction when performed under appropriate conditions. Our complication profile, including low rates of seroma, hematoma, and infection, is in line with prior studies [12]. Although seroma occurred more frequently in the PAL group, the difference was not statistically significant. Importantly, no major adverse events such as visceral perforation were observed. Reports of rare but serious complications with combined energy-based devices [13] underscore the need for careful patient selection and device-specific safety protocols.

Patient satisfaction was consistently higher in the VASER group, with the strongest differences noted in overall satisfaction and willingness to recommend the procedure. These findings echo the results of De La Cruz [14] and Ruff et al. [15], who reported superior contour definition, reduced operator fatigue, and improved long-term stability with VASER technology. Collectively, these outcomes reinforce the clinical relevance of VASER in abdominal body contouring.

Strengths and Limitations

This study has the following advantages: the design is prospective with a relatively large number of patients ($n = 300$). A single surgeon with experience performed all procedures, which reduced variability of the operative technique and ensured procedural uniformity. Standardised anaesthesia and fluid management protocols along with standardised postoperative care also enhanced the credibility of the results obtained.

But there are a few points to note:

1. Randomisation was good but blinding was not possible for surgeon and patients. Subjective responses of pain and satisfaction may therefore have been subject to biases.
2. Patient-reported satisfaction and pain scores are subjective outcome measures and may not fully be reflective of clinical differences despite using validated questionnaires.
3. Single surgeon-single centre design: This resulted in technical uniformity, but results cannot be generalized to other surgeons, locations or patient populations. Nevertheless, it contributed a good measure of technical uniformity when making comparisons.
4. Brief follow-up period (three months): This study was mainly focused on early results. More follow-up is required to assess the persistence of the contouring and potential for late complications.

The limitations should be taken into consideration while interpreting the findings. However, the consistency of our results with previous studies reinforces the ability to believe the results presented here for the advantages of VASER liposuction [15], [16].

Future Research

More multicentre RCTs are indicated to confirm the study results in various patient groups and surgical groups. Long-term stability of the aesthetic results and late onset complications would be better understood with longer study periods. Comparative cost-effectiveness analyses are also required which take into account surgical costs as well as recovery costs. Lastly, studies in other anatomical areas including arms and thighs would enhance knowledge of the adaptability of PAL and VASER techniques.

Conclusion

This prospective cohort study shows that ultrasound-assisted liposuction with the VASER system is a superior technique to power-assisted liposuction (PAL) for body contouring the abdomen. VASER was also more effective in the removal of fat, lower postoperative pain scores, faster return to normal activities and higher patient satisfaction without increasing complication rates.

The improved outcomes may be due to the selectivity of the tissue emulsification and minimisation of collateral trauma that ultrasound assisted technology provides. Both methods were safe, and clinically significant from the surgeon's and patient's point of view, respectively, with VASER.

The results corroborate the evidence base for VASER liposuction, but should be interpreted with caution because of the observational nature of the study, the use of subjective outcome measures, the study's single-surgeon, single-centre design, and the short follow-up period.

In general, this study suggests that VASER is a preferred technique for abdominal contouring surgery. Multicentre randomized controlled trials with longer follow-up and larger patient cohorts are needed to evaluate durability, safety and cost-effectiveness in future studies.

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