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Original Article

Correlation between BMI, amount of aspirated fat and post-operative complications in VASER liposuction: A single centre experience

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ABSTRACT

Background: Vibration amplification of sound energy at resonance (VASER) liposuction is an innovative technique that allows surgeons to selectively remove fat and shape desired areas of the body, resulting in more precise and controlled outcomes compared to traditional liposuction techniques. VASER liposuction offers several advantages, including targeted action that reduces trauma to the surrounding tissues, limiting pain, swelling and recovery time.
Purpose: This study compared the complication rates among patients who underwent VASER liposuction in relation to their body mass index (BMI) and the amount of fat aspirated.
Methods: The authors reviewed the medical records of all patients who underwent VASER liposuction at Scalera Clinic in Naples, dividing them into two groups: the first with BMI < 24.9 kg/m^2 and second with BMI >25.0 kg/m^2.
Results: The authors examined 117 patients who were operated on within a year (2022/2023), with 48 of them having BMIs < 24.9 kg/m^2 and 69 showing BMIs >25.0 kg/m^2. In patients with a BMI >25 kg/m^2, the most common complications were contusion, hematomas and abnormal skin retraction, whereas no complications were observed in the patients with normal-weight.

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Conclusions: To minimise post-operative complications and maximise results, it is advisable to select patients based on their BMI assessment, the anatomy of the treated body area and the volume of fat to be removed. This approach aims to ensure that the patients are suitable for the procedure and the achieved results align with their aesthetic expectations.

Introduction

Vibration amplification of sound energy at resonance (VASER) liposuction is an advanced technique for fat removal that uses ultrasonic energy to fragment and eliminate unwanted adipose tissue. Once the fat is subjected to cavitation and liquefaction, it is aspirated through a thin tube called a cannula. This targeted fat removal method allows surgeons to precisely sculpt desired areas of the body, yielding more accurate and controlled outcomes compared to the traditional liposuction techniques.[1] VASER liposuction offers a range of advantages over conventional methods. Its targeted action reduces trauma to the surrounding tissues and does not damage arterial and venous vessels, lymphatics and fibrous septa that anchor the dermis to muscle fascia. Additionally, the ultrasonic energy stimulates collagen production, improving skin tightness and contributing to enhanced results.[2] In this study, we evaluated the outcomes of VASER liposuction by comparing the body mass index (BMI) of patients and litres of fat aspirated to establish measurable parameters that will help achieve the lowest rate of complications.

Patients and methods

We conducted a study on 117 patients, consisting of 12 men and 105 women, who underwent VASER liposuction at Scalera Clinic in Naples during the year 2022-2023. We carefully reviewed their medical records and analysed the results over the course of several months. The patients were then divided into two categories: those with BMI < 24.9 kg/m^2 and those with BMI >25.0 kg/m^2. The rationale for dividing patients based on their BMI values was to categorise patients into normal-weight and overweight or obese groups. Exclusion criteria were patients who were heavy smokers and patients with connective tissue diseases, body dysmorphic disorder, moderate skin laxity and severe obesity (BMI >35 kg/m^2). An analysis of the complication rates and evaluation of variables (BMI and litres of fat aspirated) were performed for each group. The demographics and surgical data are presented in Table 1.

Ethical consideration

Each patient who actively choose to participate in the study signed an informed consent form. This form was provided voluntarily, signifying full understanding of the provided information and voluntary acceptance to participate in the study. Each patient was made aware of their right to refuse participation or to withdraw their consent at any time without facing retaliation or penalty. Every patient was fully and comprehensively informed about the purpose of the study, methods employed, sources of funding involved, any conflicts of interest, institutional affiliations of the authors, expected benefits, potential risks and any discomfort that may arise. Additionally, information was provided regarding the arrangements that will be made after the conclusion of the study and expected outcomes. All these measures were undertaken in accordance with the principles outlined in the Declaration of Helsinki.[3]

Table 1
Patient demographics and surgical data of patients with BMI < 24.9 kg/m^2 and overweight/obese patients undergoing VASER liposuction.

Characteristics	BMI (kg/m^2) <24.9 n=48 (tot=117)	BMI (kg/m^2) >25.0 n=69 (tot=117)
Gender, n %		
Female	48	57
Male	2	10
HCT pre-procedure (mg/dL), median	39.9	39.9
HCT post-procedure (mg/dL), median	38.5	38.6
Hb pre-procedure (mg/dL), median	13.6	13.5
Hb post-procedure (mg/dL), median	12.4	12.3
Extraction volume (cc), median	1.8	4.4

BMI= body mass index; Hb=haemoglobin; HCT=haematocrit.

Statistical analysis

Descriptive analysis was conducted by evaluating the means and medians for quantitative variables. Counts and percentages were used for qualitative variables.

Surgical technique

VASER liposuction

VASER has emerged as an effective technology for reshaping the superficial fat layer while reducing the risks of skin necrosis and scarring. VASER is the third-generation of ultrasound-assisted liposuction that employs ultrasonic energy to aspirate localised fat. The third-generation ultrasound-assisted lipoplasty technique involves three main phases: tumescent fluid infiltration, emulsification of adipose tissue with solid probes and aspiration of the emulsified fat. Solid metal probes are vibrated at ultrasonic frequencies (>20 kHz) to produce a cavitation effect on the subcutaneous fat. The standard procedure developed by A. Hoyos consists of three phases[4,5]:

1. Infiltration: Each area to be treated is infiltrated with a standard tumescent solution composed of 1000 cc of saline solution, 10 cc of 1% lidocaine and 1 ml of 1:1000 epinephrine, in the deep and superficial layers. Infiltration begins with the deep layer, followed by the superficial layer.[6]
2. Emulsification: For fat emulsification, 3.7 mm three-ring probes were used for the lower abdomen and 3.7 mm two-ring probes were used for the upper abdomen. The VASER technique was applied in pulsed mode at 80% power for the superficial and intermediate layers, and in continuous mode at 80% power for the deep layers. In particularly fibrous tissues, a single-ring 3.7 mm probe was used as ultrasound energy is more concentrated at the tip where it is needed.
3. Extraction: Long cannulas measuring 3.7 mm and 4.6 mm were used to aspirate the lateral and central abdominal regions. Gradually smaller cannulas were used in the more superficial regions to preserve the subcutaneous vascular plexus.[7–9] With the VASER technology, it was possible to operate on overweight or obese patients, with BMIs > 25 kg/m^2 and remarkable results have been achieved. This technique allows surgeons to treat superficial and deep layers of fat, with an average surgical time of approximately 3 hours. The surgical times can vary, depending on the amount of adipose tissue and the litres of fat to be removed from the patient.[10,11]

Figure 1[12] shows a 38-year-old woman with a BMI > 25 kg/m^2 who underwent VASER liposuction. The preoperative photograph (left) demonstrates abundant skin laxity and an increased abdominal circumference, whereas the post-operative photograph (right) shows improved natural definition and lipid improvement in the abdominal areas. The woman, who exhibited visceral fat accumulation, returned to normal-weight values in the post-operative period, with improved blood values and a reduced risk of cardiovascular diseases. Figure 2 depicts a woman with a BMI < 24.9 kg/m^2, indicating normal-weight. The post-operative photograph demonstrates how a person with normal-weight

Figure 1. A 38-year-old woman with a BMI > 25 kg/m^2 underwent VASER liposuction for fat reduction in the abdominal and flank areas. The preoperative photograph (left) shows abundant fat deposits in the central abdominal region and on the lateral aspects of the flanks, which is in contrast with the slimmer and more youthful contour observed in the post-operative photograph (right).

can achieve enhanced definition following VASER liposuction. There is a reduction in abdominal circumferences with improved definition of the semilunar line and enhanced definition of the inner thigh circumference in the post-operative period compared to the preoperative period. Even though the volume of aspirated fat is lower in women with BMIs < 24.9 kg/m^2, the muscular definition is greater.

Current safety protocol

Preoperative protocol

During the initial patient consultation, several considerations were made regarding the skin conditions, previous surgical interventions, underlying medical conditions, smoking habits, BMI and body anatomy. The main contraindications considered were heavy smoking (more than 10 cigarettes per day), connective tissue diseases, body dysmorphic disorder, moderate skin laxity and severe obesity (BMI > 35 kg/m^2). The patients underwent consultation with the anaesthesiologist, who reviewed the prescribed haematological and biochemical tests, as well as any requested imaging. Following this, the patient's classification was determined according to the American Society of Anaesthesiologists' physical status classification system. The risk of thromboembolism (TEV) was assessed using the Caprini scoring system.

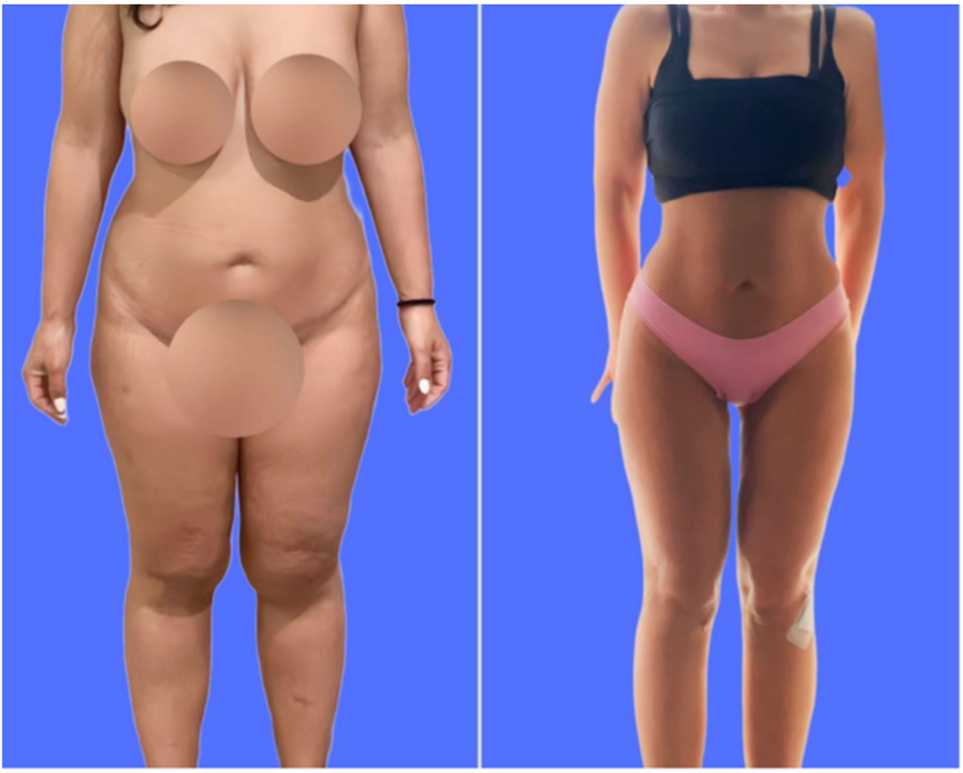

Figure 2. A 35-year-old woman with a BMI <24.9 kg/m^2 underwent VASER liposuction for fat reduction in the abdominal, flank, inner thigh and calf areas. In the preoperative photograph (left), moderate fat deposits can be observed in all mentioned areas. In the post-operative photograph (right), a new athletic and slender appearance is evident, with a pronounced definition of the semilunar line compared to the preoperative photograph.

Intraoperative protocol

To ensure patient well-being during the procedure, specific perioperative measures were implemented. External pre-warming using a thermal blanket was performed one hour prior to the surgery and throughout the entire procedure. Additionally, intravenous fluids were warmed to approximately 40°C before administration to the patients. The Blanketrol system was used / to and during the entire procedure to prevent hypothermia. For haemorrhage control, infiltration of tumescent solution with adrenaline (1 mg/L of solution) was performed to enhance vasoconstriction. Intravenous administration of 1 g tranexamic acid was given 30 minutes before the procedure.[13]

Post-operative protocol

The average post-operative temperature with the Blanketrol system was 35.2°C, which aligns with common international standards.[6,14] Immediately after the surgery, the patient was provided with high compression stockings and strongly encouraged to engage in ambulation. For a period of 4 weeks, a specific compressive garment from the Marena Group Lipo Revèe REV.0105 was worn. This sequential garment system allows proper adherence of the skin to the underlying tissues, reducing contour deformities and abnormal skin folds. Enoxaparin was administered subcutaneously at a dose of 0.5 mg/kg/day for 7 consecutive days following the surgery, based on the Caprini scoring.[15] This measure helps prevent complications related to blood coagulation. Drains were placed during the surgery and

Table 2
Comparison of post-operative complications between patients with BMI < 24.9 kg/m^2 and overweight/obese patients undergoing VASER liposuction.

Complications	BMI (kg/m^2) <24,9 n=48 (tot=117)	BMI(kg/m^2) >25.0 n=69 (tot= 117)
Seroma %	0.8%	1.8%
Hematoma %	0.8%	3.4%
Ecchymosis %	0.0%	6.8%
Post-operative anemia %	1.8%	2.5%
Local and distal burns %	0.0%	0.8%
Skin retraction %	0.8%	7.7%

typically removed after the first post-operative week unless the fluid drainage is <50 cc within 24 hours. Drains are preferably positioned in hidden areas such as inguinal and intergluteal folds. Ensuring proper drainage is essential for promoting lymphatic drainage. In cases where the volume of aspirated fat exceeds 4000 cc, patients were admitted to the clinic for observation. Follow-up visits were scheduled at 24-48 hours, 1 week, 1 month, 3 months, 6 months, 12 months and 24 months after the surgery. During each of these visits, photographs were taken to monitor progress.[16–18]

Results

The study included 117 patients, comprising 12 men and 105 women. The patients underwent VASER liposuction procedures at the Scalera Clinic over the course of one year (2022/2023). From the data reported in Table 2, the reported complication percentages were relatively low for patients with BMI < 24.9 kg/ m^2 and those with BMI >25.0 kg/ m^2. In both groups, the most common complications appeared to be seroma, hematoma and post-operative anaemia, although the percentage differences between the two groups are generally small. A greater difference was seen in the occurrence of abnormal skin retraction, defined as contour irregularities due to abnormal healing of the skin and deeper tissues, which was 0.8% in normal-weight patients and increased to 7.7% in overweight/obese individuals.

Discussion

Based on the data collected from the clinical records of 117 patients who underwent VASER liposuction at the Scalera Clinic over the course of one year (2022/2023), it is evident that VASER liposuction yields excellent results across a wide range of patients. As shown in Figures 1 and 2, significant transformations can be achieved in normal-weight and overweight/obese patients. The post-operative complication rates were relatively low in patients with BMI < 24.9 kg/m^2 and those with BMI > 25.0 kg/m^2, despite longer operative times and larger volumes of fat aspirated in patients with higher BMI. Notably, the percentage of patients who experienced abnormal skin retraction was higher among those with BMI >25.0 kg/m^2 compared to those with BMI < 24.9 kg/m^2 (Table 2). This can be explained by considering the average volume of fat aspirated, which is approximately 1800 cc in patients with BMI < 24.9 kg/m^2, compared to an average volume of 4400 cc in patients with BMI > 25.0 kg/m^2. All the values of aspirated fat are reported in Table 1. However, abnormal skin retraction is influenced by individual factors such as skin elasticity and age.[19] Therefore, to minimise the complications associated with VASER liposuction, it is advisable to perform the procedure on patients with BMI < 24.9 kg/m^2, although the complication rate in overweight/obese patients remains relatively low. To expedite the recovery process for all patients, areas affected by bruising and hematoma were treated with Dye laser (CANDELA) or Excel V Plus (CUTERA) approximately 10 days after the procedure, leading to immediate improvements. In the following 90 days, patients with abnormal skin retraction received additional treatment with pressotherapy, ultrasound therapy, lymphatic drainage massages and radiofrequency treatment, Venus Legacy, to further enhance skin retraction in the treated areas.

Conclusion

For VASER liposuction to be performed safely and effectively, it is crucial that the surgeons practicing it are experts in the field of plastic and cosmetic surgery. Owing to the complex technical steps involved, surgeons must receive adequate training to promptly recognise and manage any complications that may arise during the post-operative period (21). Despite the significant progress achieved in the VASER liposuction technique over time, it is important to emphasise that further studies and research are still necessary to improve the aesthetic outcomes and minimise complications. The ultimate goal is to achieve a 'complication rate of zero', which requires constant commitment to the education and ongoing training of specialists performing VASER liposuction, as well as the sharing of experiences and knowledge within the medical community. Only through a rigorous and evidence-based approach can we ensure safe practice and continuously enhance the aesthetic results obtained with this procedure.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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Human or animal rights

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Scalera Private Clinic Research Ethics Committee has released its ethical approval for the present study.

Informed consent

Informed consent was obtained from all patients.

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