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Research Article

Reducing Risks in Large Volume Liposuction: The Role of Oral Anticoagulants in Preventing Thromboembolism

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ABSTRACT

Objective: This retrospective study aimed to analyze the outcomes of patients aged 21 years or older who underwent Large Volume Liposuction (LVL) using either the Ultrasonic Assisted Liposuction (UAL) or Synchronous-Energy Assisted Liposuction (SEAL) technique at a single surgeon's institution.

Methods: A total of 88 patients aged 21 years or older, with a Body Mass Index (BMI) over 30 kg/m² and who underwent LVL exceeding 5 liters, were included in this study. The average BMI of the patients included was 35.4 kg/m², with a mean weight of 218.4 pounds. The average Caprini score, used for assessing the risk of Venous Thromboembolism (VTE), was 3.68. Thromboembolism prophylaxis was administered to all patients in the form of subcutaneous heparin 5000 units and an oral anticoagulant (Rivaroxaban) given 24 hours after surgery. The incidence of VTE, hematoma, and significant bleeding was observed.

Results: Notably, there were no instances of venous thromboembolism, hematoma, or significant bleeding observed among the patients aged 21 years or older who underwent LVL. Minimal bleeding was noted, with a modest decrease of 1.2 g/dL in hemoglobin levels and 3.02% in hematocrit levels.

Conclusion: Our findings suggest that the utilization of UAL or SEAL techniques, in conjunction with appropriate thromboembolism prophylaxis, effectively mitigates the risk of VTE, hematoma, and significant bleeding in patients aged 21 years or older undergoing LVL. The observed minimal decrease in hemoglobin and hematocrit levels further supports the notion that the risk of excessive bleeding is low. Nonetheless, prudent monitoring and management of these levels remain advisable. Further studies are warranted to investigate the long-term implications of these techniques on patient outcomes within this specific age group.

Keywords: Large volume liposuction; Ultrasonic assisted liposuction; Synchronous-energy assisted liposuction; Venous thromboembolism; Hematoma; Bleeding; Thromboembolism prophylaxis; Renuvion; Vibration Amplification of Sound Energy at Resonance (VASER) liposuction; Deep venous thrombosis; Venous thromboembolism

INTRODUCTION

The underlying risk of Venous Thromboembolism (VTE) poses a complex and multifaceted concern that requires careful consideration when it comes to body contouring procedures, such as in Large Volume Liposuction (LVL). Policymakers and payers, including the US surgeon general, the centers for medicare and medicaid services, and the national quality forum,

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have identified VTE as a substantial risk to patient safety [1]. Managing VTE prophylaxis for large volume liposuction poses a significant challenge due to the presence of multiple risk factors and an elevated potential for postoperative bleeding [2]. The current occurrence rates of Deep Venous Thrombosis (DVT) and Pulmonary Embolism (PE) following large volume liposuction procedures have been reported as 0.3% and 0.1% to 0.8%, respectively [3]. Risks in surgical patients are increased for VTE depending on pulmonary comorbidities, BMI, surgery duration, type of anesthesia used, and timing of postoperative remobilization [4]. Despite the evident risks, VTE prophylaxis is noted to be underutilized in surgeons who perform body contouring procedures [5]. A recent survey aimed at understanding the approaches of aesthetic surgeons towards VTE prevention revealed that out of the 596 respondents, it was found that a substantial percentage (ranging from 39% to 48%) reported not providing chemoprophylaxis to their patients who underwent post-bariatric body contouring surgery [5]. These findings previously explains on the urgent need for improved adherence to VTE prevention protocols within the field of plastic surgery. Consequently, it is imperative to address this issue to ensure the safety and well-being of patients undergoing body contouring procedures.

MATERIALS AND METHODS

A retrospective chart review study was conducted at a single surgeon's institution to analyze the outcomes of patients who underwent Large Volume Liposuction (LVL) using either the ultrasonic assisted lipectomy or synchronous energy-assisted liposuction technique. The study was conducted over a five-year period, from January 2018 to February 2023. Institutional Review Board approval was not obtained for this study since it was completed at a private practice. However, the study adhered to the Declaration of Helsinki guidelines and obtained informed consent from all patients involved.

The study included male and female subjects aged 21 years or older who underwent LVL with a liposuction aspirate volume exceeding 5 liters. Exclusion criteria encompassed patients with a history of prior abdominal or chest surgery, ventral hernia, congestive heart failure, myocardial infarction, deep venous thrombosis, or any concurrent procedures such as abdominoplasty or breast augmentation. Prior to enrolling each participant in this clinical research study, a rigorous and systematic process was undertaken to secure informed consent. Each prospective participant was presented with a detailed and comprehensive explanation of the potential risks and benefits associated with the utilization of surgical devices. It is imperative to emphasize that every participant willingly and comprehensively engaged in the informed consent procedure, evincing their complete comprehension and voluntary agreement to undergo the prescribed intervention.

Evaluation criteria

All participants in the study underwent a rigorous clinical examination to assess their cardiovascular and blood pressure status. This thorough evaluation entailed obtaining clearance from a board-certified cardiologist, ensuring a comprehensive assessment of their heart health. Additionally, the surgeon calculated the Caprini score for each participant, a widely recognized risk assessment tool for Deep Vein Thrombosis (DVT). To mitigate the risk of DVT, intermittent sequential compression devices were utilized prior to the administration of general anesthesia. These devices aid in enhancing blood flow and reducing the likelihood of thrombotic events. Following the procedure, a subcutaneous administration of 5000 units of heparin was administered, followed by the prescription of an oral anticoagulant (Rivaroxaban) for duration of 10 to 14 days. This pharmacological approach is designed to minimize the occurrence of chemo thromboembolic events. Moreover, patients were steadfastly advised to initiate ambulation promptly following surgery.

In addition to these measures, intravenous antibiotics were promptly administered within 30 minutes of the surgical intervention. This practice adheres to current guidelines aimed at reducing the risk of surgical site infections. Furthermore, to ensure optimal postoperative care, all participants were admitted overnight at an accredited hospital or outpatient ambulatory surgery center. This enables close monitoring and timely intervention in case of any complications. By implementing these comprehensive strategies, the healthcare team aimed to optimize patient outcomes and minimize the potential risks associated with cardiovascular and thrombotic disorders.

Technique description

The large volume liposuction procedures in this study were performed using either ultrasonic-assisted liposuction (VASER, Solta Medical, Washington, USA) or a four-stage Synchronous Energy-Assisted Liposuction (SEAL) technique. The SEAL technique involved tumescent infiltration, emulsification of fat using a VASER probe, suction assisted liposuction with a power-assisted liposuction device (MicroAire Surgical Instruments, Virginia, USA), and subdermal application of plasma converted radiofrequency energy (Renuvion from Apyx Medical, Florida USA). The superwet technique with a 1:1 ratio of infiltrate to aspirate volume was employed for infiltration and liposuction. The maximum lidocaine dosage administered during tumescent infiltration for all patients was less than 35 mg/kg. The emulsification process was conducted by utilizing the VASER probe set at 50% amplitude with pulsed energy (V-mode) for a maximum treatment time of 1 minute per 100 ml of infused wetting solution. In addition, the Renuvion device was employed at 80% power and a helium flow rate of 2.0 L.

RESULTS

In this retrospective chart review, we examined the outcomes of 88 patients with a BMI over 30 kg/m^2 and ages ranging from 21 to 64 years (mean age 40.8, median age 41) who underwent large volume liposuction (>5 L liposuction aspirate). The patients were divided into two groups: One group underwent VASER-assisted liposuction alone, while the other group underwent synchronous energy-assisted lipoplasty using VASERLipo and Renuvion (Table 1).

Sex	
Females	63 (71.9%)
Males	25 (28.41%)
Ethnic background	
African American	43 (48.87%)
Asian	1 (1.14%)
Caucasian	21 (23.86%)
Hispanic	22 (25%)
Middle eastern	1 (1.14%)
Liposuction of trunk	
No	4 (15.91%)
Yes	84 (95.45%)
Liposuction of bilateral thighs	63 (71.59%)
Fat transfer to buttock	44 (50%)
Concomitant procedure	
Bilateral medial thigh lift	4 (4.55%)
Excision of right torso lipoma	1 (1.14%)
None	77 (87.5%)
Umbilical hernia repair	6 (6.82%)
23 hr observation	88 (100%)
Hospitalization after discharge	0 (0%)

Table 1: Patient demographics.

The average BMI of the patients included in this review was 35.4 kg/m^2, with a mean weight of 218.4 lbs (99.06 kg). To assess the risk of venous thromboembolism, we calculated the average Caprini score, which was found to be 3.68. As a preventive measure, all patients received thromboembolism prophylaxis with intermittent sequential compression device, and heparin 5000 units subcutaneously perioperatively, along with an oral anticoagulant given 24 hours after surgery.

During the procedure, an average of 10.16 Liters of tumescent fluid was infiltrated per patient, with an average volume of liposuction aspirate of 7.27 Liters. The mean duration of surgery was 337 minutes (median 330 minutes). Of the patients, 68 (77.27%) underwent synchronous energy-assisted liposuction.

All patients were admitted overnight at either a certified hospital or an accredited ambulatory surgery center, ensuring a safe and monitored recovery environment. Importantly, we observed no instances of thromboembolic complications or cardiac events, such as myocardial infarction or pulmonary edema, in any of the patients. Furthermore, no patient required blood transfusions, and there were no reported cases of pneumoperitoneum or mediastinal emphysema in those who underwent either VASER liposuction alone or synchronous energy-assisted lipoplasty with VASERLipo and Renuvion (Table 2).

Variables	N	Range	Min	Max	Mean	SE	SD	Median
Age, years	88	43	21	64	40.8	1.05118	9.86	41
BMI	88	20	30	50	35.4	0.454	4.267	34.39
Weight (lb)	88	145 lbs	155 lbs	300 lbs	218.46	3.746	35.14	209.5 lbs
Height (cm)	88	50.8	149.86 cm	200.66 cm	167.69 cm	1.31865	12.37	163.83 Cm
Tumescent fluid infused (L)	88	8.5	5	13.5	10.1681	0.174	1.61687	10.29
Duration of surgery (min)	88	410	115	525	337.82	6.5146	61.1125	330
Hb (pre-op)	69	7.9	10.2	18.1	13.487	0.18731	1.55591	13.3
Hb (post-op)	13	7	8	15	11.82	0.591	2.129	12.2
Caprini score	88	3	3	6	3.6818	0.07326	0.68725	4

Note: SE: Standard Error of Mean; SD: Standard Deviation; BMI: Body Mass Index; Hb: Hemoglobin

Table 2: Patient demographics, operative characteristics.

These findings highlight the favorable safety profile of both VASER-assisted liposuction and synchronous energy-assisted lipoplasty with VASERLipo and Renuvion in the context of large volume liposuction in patients with a BMI over 30 kg/m^2. The absence of thromboembolic complications underscores the effectiveness of our thromboembolism prophylaxis protocol, further enhancing patient safety during the pre-operative and postoperative periods. Despite the administration of thromboprophylaxis, large volume liposuction yielded marginal reductions in hemoglobin and hematocrit levels (p=0.001 and p=0.006, respectively). On average, a decline of 1.23 g/dL in hemoglobin and 3.02% in hematocrit was observed, indicating a minimal extent of blood loss. Among the patients included in the study, a total of two individuals (n=2, 2.27%) exhibited the development of postoperative seroma. Furthermore, it was observed that one patient experienced the formation of blisters primarily attributable to the utilization of Renuvion.

DISCUSSION

The utilization of pharmacological thromboprophylaxis, as a preventive treatment for thromboembolic events, remains a topic of ongoing debate and limited adoption in plastic surgery, particularly in the setting of large volume liposuction procedures. This hesitation stems from the concern about potential bleeding risks associated with the use of anticoagulant medications in the perioperative period [5]. In order to mitigate the risk of excessive blood loss, surgeons exercise restraint in administering chemo thromboprophylaxis prior to initiating general anesthesia during liposuction procedures. This prudent approach is driven by the imperative to adhere to safe limits of fat aspiration, thereby ensuring patient well-being and minimizing potential complications [2].

The prevalence of Deep Venous Thrombosis (DVT) and Pulmonary Embolism (PE) in patients undergoing large volume liposuction is reported to range between 0.3% to 1.1% [2,3,6-8]. Notably, the findings of a comprehensive survey conducted by Grazer and de Jong have unequivocally established pulmonary embolism as the leading cause of mortality among individuals undergoing liposuction procedures [9]. These findings underscore the importance of recognizing and addressing the risk of thromboembolic events in this patient population. The emergence of tumescent and super wet techniques in liposuction procedures several decades ago has notably elevated the capacity for removing larger amounts of fat through suction-assisted lipectomy. While the introduction of the Klein formula in 1987 marked a significant milestone in reducing blood loss to a mere 1% of the liposuction aspirate from an initial rate of 45%, apprehensions remain regarding the safety and efficacy of performing large-volume liposuction exceeding 5 liters of fat [10,11].

The introduction of ultrasound-assisted liposuction, particularly through the utilization of the VASERlipo system, has significantly advanced the effectiveness of minimizing blood loss during liposuction procedures. This technological innovation has notably enhanced the feasibility of conducting high-volume liposuction on patients [2]. The integration of the VASERlipo device has yielded a remarkable reduction in blood loss, with a mere 0.61% of the total aspirate being lost, representing a substantial 7.5-fold decrease [12].

In our retrospective study, we observed minimal reductions in hemoglobin and hematocrit levels when utilizing the superwet technique and ultrasonic-assisted liposuction in patients undergoing Large Volume Liposuction procedures. The mean decrease in hemoglobin was 1.2 g/dL, while the hematocrit

decreased by 3.02%. These results provide compelling evidence for the effectiveness of these techniques in minimizing blood loss during such procedures.

Deep Vein Thrombosis (DVT) prophylaxis is important in the context of large volume liposuction, particularly for patients with a Body Mass Index (BMI) over 30. This subset of patients faces a substantially heightened risk of experiencing severe surgical complications, such as the formation of DVT [13]. Therefore, it is imperative to employ evidence-based strategies for DVT prevention in order to optimize patient outcomes and minimize adverse events during the surgical intervention [14].

In this study, we conducted an assessment of the efficacy of a combined treatment approach for the prevention of Deep Vein Thrombosis (DVT) in patients. The approach involved the administration of subcutaneous heparin immediately after surgery, followed by the initiation of Rivaroxaban the day after surgery. Rivaroxaban, an oral direct inhibitor of factor Xa, was chosen as a prophylactic treatment for DVT. Notably, previous literature in the field of orthopedics has demonstrated the significant superiority of Rivaroxaban over Low Molecular Weight Heparin (LMWH) in terms of its efficacy in preventing DVT [15].

In our investigation, we have observed a notable absence of thromboembolic events, as well as a lack of occurrences pertaining to hematoma or significant bleeding, in patients who have undergone pharmacologic thromboprophylaxis utilizing an oral anticoagulant. This discovery holds significant implications, particularly when considering the historically low incidence of hematoma (1.28% risk) reported in patients undergoing large volume liposuction with Rivaroxaban, employing conventional liposuction techniques and body contouring procedures [14]. Notably, our study found no occurrences of hematoma, which may be attributed to the utilization of VASER liposuction, a procedure associated with a lower risk of bleeding [16]. However, it is important to acknowledge that our study had a relatively modest sample size, and to draw definitive conclusions, a randomized clinical trial comparing the efficacy of the two techniques would be warranted.

CONCLUSION

The integration of an ultrasonic device for liposuction (VASER) alongside the tumescent technique has emerged as a potential strategy for minimizing bleeding and hematoma occurrence in large volume liposuction procedures. Additionally, the judicious administration of pharmacologic thromboprophylaxis through oral anticoagulants has proven to be an effective preventive measure against thromboembolism in these cases. Consequently, these innovative techniques offer a secure and dependable approach to large volume liposuction, exhibiting a low incidence of postoperative complications associated with bleeding and hematoma formation.

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