Long-Term Outcomes and Complication Profile After Modern Liposuction: A Multicenter Prospective Cohort Study With 5-Year Follow-Up

Pietro Gentile, MD, PhD; and Aris Sterodimas, MD, PhD

Aesthetic Surgery Journal
2026, Vol 00(0) 1–8
Accepted date: August 05, 2026; online publish-ahead-of-print September 11, 2026.
© The Author(s) 2026. Published by Oxford University Press on behalf of The Aesthetic Society.
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.
https://doi.org/10.1093/asj/sjag193
www.aestheticsurgeryjournal.com
OXFORD UNIVERSITY PRESS

Abstract

Background: Liposuction is among the most frequently performed aesthetic surgical procedures worldwide. Although short-term safety has improved with modern technologies and protocols, robust long-term prospective data regarding contour durability, weight stability, satisfaction, and complications remain limited.

Objectives: This study evaluated long-term aesthetic outcomes, body contour stability, patient satisfaction, weight changes, and complications after modern liposuction using standardized clinical, photographic, and patient-reported assessments.

Methods: A prospective multicenter cohort study was conducted across 8 tertiary plastic surgery centers. Patients undergoing abdominal, flank, thigh, back, or circumferential liposuction were enrolled between January 2016 and December 2019 and followed through December 2024. Primary endpoints included contour improvement, maintenance, and complication rates. Secondary outcomes included BODY-Q scores, revision surgery, weight variation, skin quality changes, and predictors of complications. Standardized photography and anthropometric measurements were obtained at baseline, 6 months, 1 year, 3 years, and 5 years. Statistical analyses included Kaplan–Meier analysis, multivariate logistic regression, and repeated-measures mixed models.

Results: A total of 1248 patients were included, with a mean follow-up of 52.4 ± 11.6 months. Mean aspirated fat volume was 3180 ± 920 mL. Stable contour improvement was maintained in 78.6% at 5 years. BODY-Q scores improved significantly from baseline ($P < .001$). Overall complication rate was 14.8%, with major complications in 1.9%. The most frequent complications were contour irregularities (5.8%), edema (4.9%), seroma (2.6%), and fibrosis (2.3%). Revision surgery was required in 8.7%. High BMI, smoking, aspirate volume >5 L, and combined procedures predicted complications.

Conclusions: Modern liposuction provides durable improvement and high satisfaction with low major complication rates.

Level of Evidence: 2 (Therapeutic)

Liposuction remains one of the most commonly performed aesthetic surgical procedures worldwide and continues to represent a cornerstone of modern body-contouring surgery. Since its introduction by Illouz and the subsequent development of the tumescent technique by Klein, significant advances in surgical techniques and perioperative management have substantially improved procedural safety and aesthetic outcomes.[1-4]

Over the past 3 decades, several technological innovations, including power-assisted (PAL), ultrasound-assisted (UAL), and laser-assisted liposuction, have expanded treatment options and improved operative efficiency.[5-8] Although these technologies are widely used, available evidence suggests that long-term outcomes remain primarily dependent on patient selection, surgical planning, and postoperative weight stability rather than on the specific device employed.[9-11]

Lipedema should not be confused with lipodystrophy. Lipedema is a chronic disorder characterized by disproportionate, symmetrical deposition of painful subcutaneous adipose tissue, predominantly affecting the lower extremities, whereas lipodystrophy refers to a heterogeneous group of disorders characterized by partial or generalized loss

Dr Gentile is an associate professor of plastic surgery, Department of Surgical Science, University of Rome Tor Vergata, Rome, Italy. Dr Sterodimas is the chief, Department of Plastic and Reconstructive Surgery, Metropolitan General Hospital, Athens, Greece.

Corresponding Author:
Dr Pietro Gentile, Via Montpellier 1, 00173 Rome, Italy.
E-mail: pietrogentile2004@libero.it; Instagram: @prof.pietrogentile; Facebook: Pietro Gentile—Chirurgo Plastico

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

or abnormal redistribution of adipose tissue. Although the present study primarily evaluated patients undergoing aesthetic liposuction, a limited number of patients with lipedema who fulfilled the same inclusion criteria were also included.

Modern liposuction is generally associated with low complication rates when performed under standardized protocols. Nevertheless, contour irregularities, prolonged edema, seroma formation, fibrosis, and thromboembolic events remain important concerns.[12-15] Despite widespread adoption of liposuction, most available evidence is limited to short-term outcomes, with scarce prospective data evaluating long-term contour stability, complication profiles, and patient-reported outcomes.[10-15] The BODY-Q questionnaire, which has become a widely adopted patient-reported outcome measure in body-contouring research, provides a validated assessment of body image, satisfaction, psychosocial well-being, and quality of life following aesthetic surgery procedures.[16-18] However, few large prospective studies have evaluated long-term BODY-Q outcomes after liposuction. Therefore, this study aimed to evaluate long-term aesthetic outcomes, patient-reported outcomes, weight stability, revision rates, and complications after modern liposuction in a multicenter prospective cohort with up to 5 years of follow-up.

METHODS

Study Design and Patient Population

This prospective multicenter cohort study was conducted by 18 board-certified plastic surgeons across 8 tertiary referral plastic surgery centers. Patient enrollment occurred between January 2016 and December 2019, with follow-up continuing through December 2024. Participating centers were high-volume academic or tertiary referral institutions specializing in aesthetic and body-contouring surgery. Patient enrollment began after local ethical approvals had been obtained at each participating center. Data collected before the coordinating-center approval were obtained under local IRB approvals at participating centers and were subsequently incorporated into the multicenter database according to institutional regulations and data-sharing agreements. The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. IRB approval was obtained at all participating centers, and all patients provided written informed consent before enrollment. Adult patients (≥18 years) undergoing elective liposuction of the abdomen, flanks, thighs, back, or circumferential trunk were eligible for inclusion. Patients undergoing reconstructive procedures, isolated fat grafting, revision liposuction, or with incomplete baseline data were excluded. A total of 1487 patients were assessed for eligibility. Of the 239 excluded patients, 131 did not meet the predefined inclusion criteria, including severe systemic comorbidities ($n = 48$), BMI outside the eligible range (<20 or >35 kg/m^2; $n = 62$), or previous major abdominal surgery that could affect outcome assessment ($n = 21$). Eighty-two eligible patients declined participation, either without providing a specific reason ($n = 57$) or because of logistical or scheduling constraints ($n = 25$). An additional 26 patients withdrew before surgery or were lost before the procedure, including 19 who changed their decision after enrollment and 7 who could no longer be contacted before surgery. Consequently, 1248 patients were included in the final study cohort and followed for up to 5 years postoperatively (Figure 1).

Ethical Approval

The study protocol, which was the object of 2 university master's degrees titled "Regenerative Surgery and Medicine in Wound Care Management," was approved with Rectoral Decree (D.R. n. 1794/2018) of September 19, 2018, and the Ethics on Research Committee of the School of Medicine, "Tor Vergata" University, Rome, Italy, with registration number #0031036/2018. The investigation protocol was developed in agreement with an associate professor contract #13489/2021. Participating centers obtained local ethical approvals before patient enrollment, and all patients provided written informed consent before inclusion in the study.

Surgical Technique

All procedures were performed by board-certified plastic surgeons using standardized tumescent infiltration protocols. Liposuction techniques included conventional suction-assisted liposuction (SAL; $n = 212$), PAL ($n = 552$), UAL ($n = 358$), and laser-assisted liposuction ($n = 126$) according to surgeon preference and patient characteristics. The mean aspirated fat volume was 3180 ± 920 mL. Large-volume liposuction was defined as aspirate volumes exceeding 5000 mL. Combined procedures, including abdominoplasty ($n = 274$, 22.0%), mastopexy ($n = 52$, 4.2%), brachioplasty ($n = 39$, 3.1%), thigh lift ($n = 27$, 2.2%), for a total of 392 patients (31.4%) performed during the same operative session, were recorded. Treatment areas were abdomen ($n = 955$, 76.5%), flanks ($n = 742$, 59.5%), thighs ($n = 411$, 32.9%), back ($n = 267$, 21.4%), and circumferential trunk ($n = 272$, 21.8%). Radiofrequency-assisted liposuction, helium plasma-assisted skin tightening, and other adjunctive energy-based technologies were not used in this cohort.

Clinical Evaluation and Follow-Up

Patients underwent standardized clinical assessments preoperatively and at 6 months, 1 year, 3 years, and 5 years postoperatively.

Outcome evaluation included:

- Standardized digital photography
- Anthropometric measurements
- Body-weight assessment
- Skin retraction assessment
- Documentation of adverse events
- Patient-reported outcome measures

Long-term contour improvement was defined as maintenance of postoperative contour correction as assessed by independent blinded evaluation of standardized photographs and clinical examination. Representative clinical cases were selected to illustrate the range of outcomes observed within the study cohort, including both cosmetic liposuction and lipedema patients. Weight stability was defined as body-weight variation within ±5% of postoperative weight. Stable contour improvement was defined as a score ≥4 on a standardized 5-point blinded photographic Likert scale previously used in body-contouring outcome assessments. The photographic assessment scale had been previously validated for aesthetic outcome evaluation in body-contouring procedures and was applied using standardized image acquisition protocols. Inter-rater reliability between the 2 surgeons was assessed using Cohen's coefficient. Definitions such as contour improvement, stable contour improvement, and skin retraction were standardized before data analysis to minimize inter-center variability.

Patient-Reported Outcomes

Patient satisfaction was assessed using the BODY-Q questionnaire, a validated patient-reported outcome instrument for body-contouring procedures. Four domains were analyzed:

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

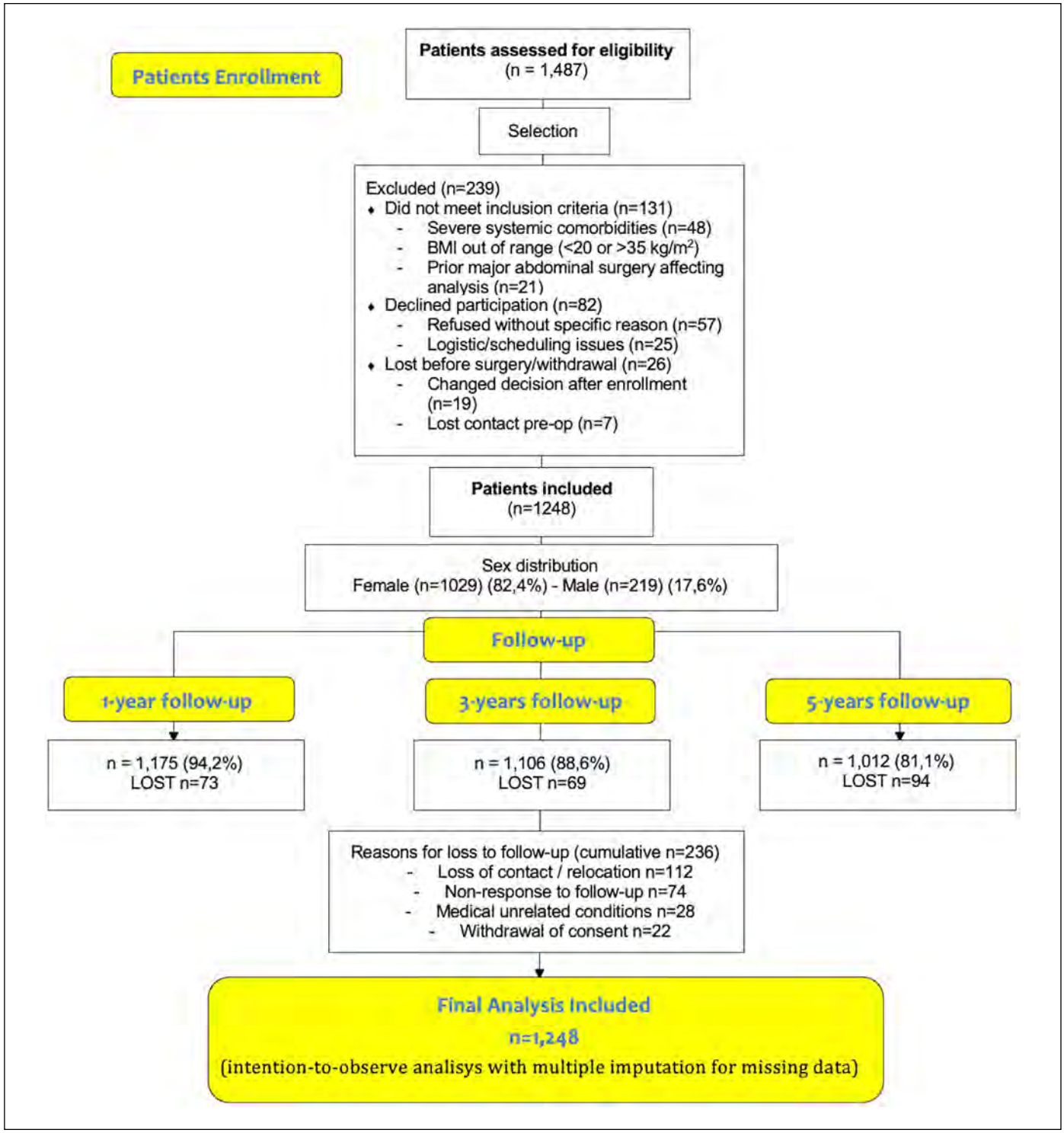


Figure 1. STROBE flow diagram of patient enrollment, eligibility assessment, exclusions, and follow-up throughout the study according to the STROBE guidelines.

- Body satisfaction
- Psychological well-being
- Social confidence
- Quality of life

Scores were recorded preoperatively and during follow-up visits. The BODY-Q instrument was used and validated and licensed from McMaster University in Italian and Greek versions.

Complications

Complications were prospectively recorded throughout follow-up. Minor complications included contour irregularities, prolonged edema, seroma, fibrosis, hyperpigmentation, hematoma, and superficial infection. Major complications included deep venous thrombosis, pulmonary embolism, fat embolism syndrome, and complications requiring hospitalization or reoperation. Patients experiencing more

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

Table 1. Patient and Procedural Characteristics

Variable	Value
Mean age	37.8 ± 9.6
Female sex	82.4%
BMI	27.1 ± 3.8
Smokers	18.2%
Previous body-contouring surgery	12.6%
Mean aspirate volume	3180 ± 920 mL
Combined procedures	31.4%
Circumferential liposuction	21.8%
Abdominal liposuction	76.5%
PAL (n = 552)	44.2%
UAL (n = 358)	28.7%
Laser-assisted (n = 126)	10.1%
SAL (n = 212)	17.0%

PAL, power-assisted liposuction; SAL, suction-assisted liposuction; UAL, ultrasound-assisted liposuction.

than one complication were counted once in the overall complication rate. Elective revision procedures performed for residual contour asymmetry or patient preference were not classified as major complications unless hospitalization or urgent reoperation was required. No patient required perioperative blood transfusion.

Study Endpoints

The primary endpoints were

- Long-term maintenance of contour improvement
- Overall postoperative complication rate

Secondary endpoints included:

- BODY-Q outcomes
- Weight stability
- Skin retraction maintenance
- Revision surgery
- Predictors of postoperative complications

Statistical Analysis

Continuous variables are presented as mean ± standard deviation, whereas categorical variables are presented as frequencies and percentages. Center effects were accounted for using mixed-effects logistic regression models with the study site included as a random intercept. Changes in BODY-Q scores over time were analyzed using repeated-measures mixed-effects models. Kaplan–Meier analysis was performed to evaluate complication-free survival throughout follow-up. The Kaplan–Meier analysis defined time zero as the date of surgery, and the event was the occurrence of the first postoperative complication. Patients without complications were censored at last follow-up. Multivariable logistic regression analysis was used to identify independent predictors of postoperative complications. Variables entered into the model included age, sex, BMI, smoking status, aspirate volume, and combined procedures. Odds ratios (ORs) are reported with 95% CIs. Statistical significance was defined as $P < .05$. Missing data were handled using multiple imputation by chained equations, with 20 imputed datasets including all baseline covariates and outcomes. Missingness was assumed to be at random. Time was treated as a categorical fixed effect, with patient-level random intercepts. An unstructured covariance matrix was applied. No formal adjustment for residual confounding was possible because of the observational design. Sensitivity analyses were performed using complete-case datasets to evaluate the robustness of findings obtained after multiple imputation.

RESULTS

Patient Population

A total of 1487 patients were assessed for eligibility, of whom 239 were excluded based on predefined criteria. The final study cohort consisted of 1248 patients undergoing liposuction across 8 tertiary referral centers. The mean age was 37.8 ± 9.6 years (range, 18-72 years), and the mean follow-up duration was 52.4 ± 11.6 months. The cohort included 1029 female patients (82.4%) and 219 male patients (17.6%). Baseline demographic and operative characteristics are summarized in Table 1. Follow-up completion rates were 94.2% at 1 year (n = 1175), 88.6% at 3 years (n = 1106), and 81.1% at 5 years (n = 1012). Loss to follow-up was primarily related to relocation, nonresponse to follow-up invitations, or unrelated medical conditions (Figure 1). Inter-rater agreement for photographic contour assessment was excellent (Cohen's κ = .84; 95% CI, 0.80-0.88).

Long-Term Aesthetic Outcomes

Stable contour improvement was observed in 91.2% (95% CI, 89.5-92.7) of patients at 1 year, decreasing to 84.5% (95% CI, 82.2-86.6) at 3 years and 78.6% (95% CI, 76.0-81.0) at 5 years. Despite this gradual decline, the majority of patients maintained clinically significant aesthetic improvement throughout the follow-up period. Representative clinical cases (including both patients undergoing aesthetic liposuction and patients treated for lipedema to reflect the clinical diversity of the study population) illustrating long-term contour improvement after SAL and PAL are shown in Figures 2A-H and 3A-F, and in Supplemental Figures 1A-D and 2A-F, available online at https://doi.org/10.1093/asj/sjag193. Weight stability (<5% variation from postoperative weight) was achieved in 82.8% of patients at 1 year, 76.1% at 3 years, and 71.3% at 5 years, indicating that postoperative weight fluctuations partially influenced long-term outcomes. Patients maintaining weight stability demonstrated significantly higher rates of contour preservation compared with those experiencing weight variation >5% ($P < .05$). Skin retraction was maintained in 88.4% of patients at 1 year and decreased to 72.5% at 5 years. Revision surgery demonstrated a cumulative incidence of 8.7% at 5 years. Long-term outcomes are summarized in Table 2.

Patient-Reported Outcomes (BODY-Q)

Patient-reported outcomes demonstrated significant and sustained improvement across all BODY-Q domains compared with baseline ($P < .001$). BODY-Q questionnaire completion rates remained high throughout follow-up, with response rates of 100% at baseline, 94.2% (1175/1248) at 1 year, 88.6% (1106/1248) at 3 years, and 81.1% (1012/1248) at 5 years (Table 3). These response rates reduce the likelihood of substantial attrition bias in the longitudinal patient-reported

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

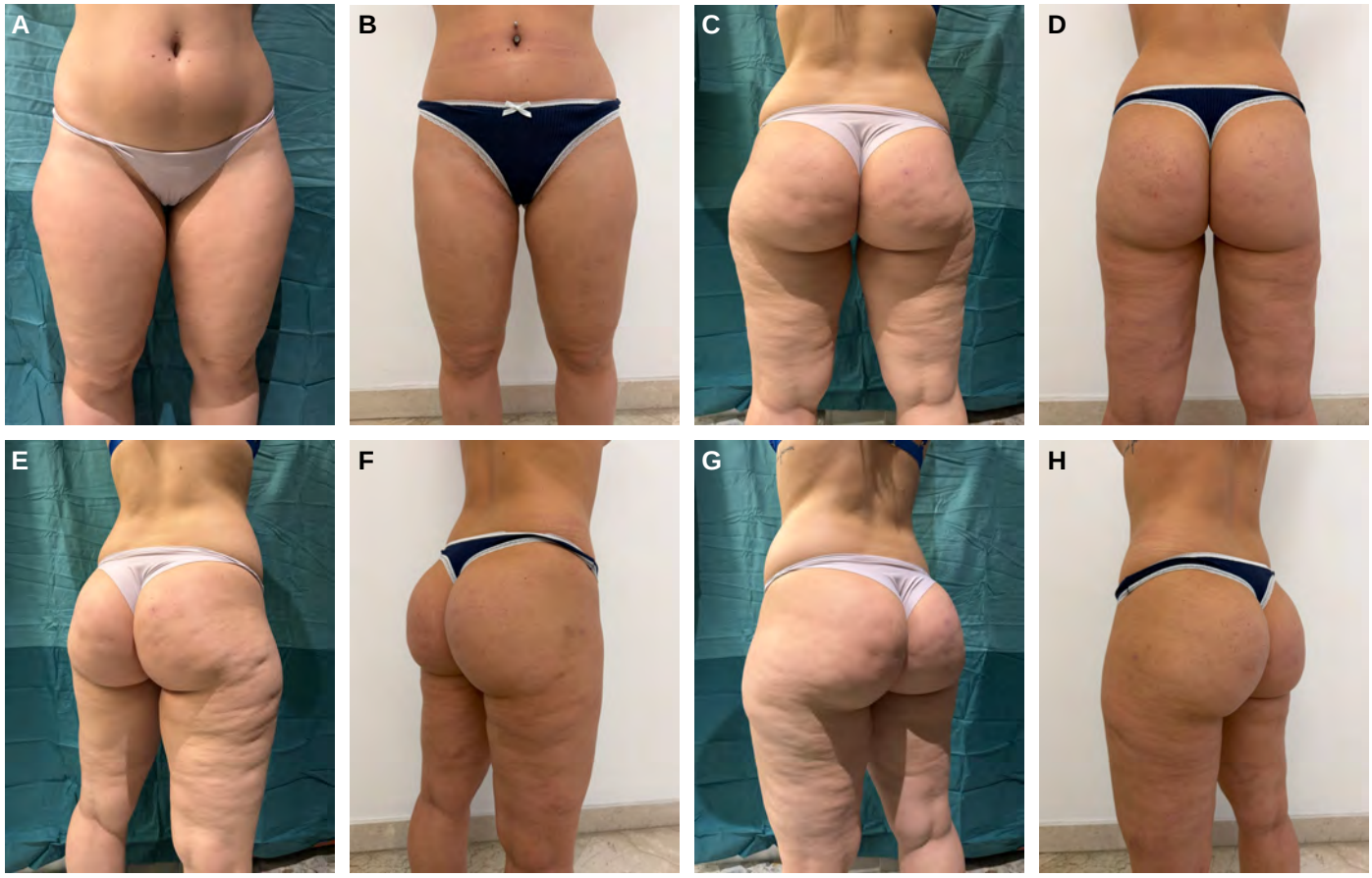


Figure 2. Long-term contour improvement after suction-assisted liposuction (SAL) in a patient with Stage III, Type III lipedema. (A) Preoperative in frontal view, (C) in posterior, (E) posterior-oblique right, and (G) posterior-oblique left views of a 20-year-old female patient affected by Stage III, Type III lipedema, showing bilateral and symmetric pathological adipose tissue accumulation involving the abdomen, flanks, thighs, and medial knees. (B) Postoperative in frontal view, (D) in posterior, (F) posterior-oblique right, and (H) posterior-oblique left view following 2 SAL procedures. Images demonstrate a sustained reduction of pathological adipose tissue deposits, improvement in lower-body contour, and restoration of body proportions at long-term follow-up.

outcome analyses. The greatest improvement was observed at 1 year, with a slight but statistically nonsignificant decline at 5 years, although scores remained substantially higher than baseline values. At 5 years, body satisfaction remained elevated (76.3 ± 9.2 vs 41.6 ± 12.1 at baseline), as did psychological well-being (74.9 ± 8.7 vs 48.1 ± 11.6), social confidence (77.1 ± 8.1 vs 51.2 ± 10.4), and quality of life (75.5 ± 8.5 vs 54.7 ± 9.9). Repeated-measures mixed-effects analysis confirmed a statistically significant improvement over time across all domains ($P < .001$ for all comparisons). Longitudinal BODY-Q score evolution demonstrated a progressive decline between Years 1 and 5 while remaining significantly above baseline levels (Table 3). The BODY-Q was administered using validated Italian and Greek translations, with Rasch-transformed scores converted to a 0 to 100 scale according to standard BODY-Q methodology.

Complications

The overall complication rate was 14.8% (95% CI, 12.9-16.9). Major complications occurred in 1.9% of patients. A total of 184 complication events were included in the multivariable model. Individual complications are not mutually exclusive; therefore, cumulative percentages exceed the overall complication rate. The most frequent complications were contour irregularities (5.8%), prolonged edema (4.9%), seroma formation (2.6%), and fibrosis or palpable nodularity (2.3%). Less frequent complications included hyperpigmentation (1.8%), superficial infection (1.2%), hematoma (1.1%), and skin burns (0.7%). Representative examples of contour irregularities are shown in Supplemental Figure 1B and D. Serious adverse events included deep venous thrombosis (0.3%), pulmonary embolism (0.2%), and fat embolism syndrome (0.1%). No mortality was observed during the study period. No unexpected late safety signals were identified during long-term follow-up. Importantly, some patients experienced more than one complication; therefore, individual complication rates are not mutually exclusive. Complication data are summarized in Table 4. Overall complication rates did not significantly differ among suction-assisted, power-assisted, ultrasound-assisted, and laser-assisted liposuction techniques (χ^2 test, $P = .42$), as detailed in Supplemental Table 2, available online at https://doi.org/10.1093/asj/sjag193.

Multivariate Analysis of Risk Factors

Multivariable logistic regression identified several independent predictors of postoperative complications.

BMI >30 kg/m^2 was associated with a >2-fold increased risk of complications (OR 2.31, 95% CI, 1.64-3.26; $P < .001$). BMI <25 ($n = 411$, 32.9%), BMI between 25 and 29.9 ($n = 611$, 49.0%), BMI ≥30 ($n = 226$, 18.1%). Smoking status also significantly increased complication risk (OR 1.88, 95% CI, 1.27-2.76; $P = .002$).

Large-volume liposuction (>5000 mL aspirate) was the strongest procedural predictor of complications (OR 2.74, 95% CI, 1.91-3.91; $P < .001$), followed by combined procedures performed in a single operative session (OR 1.69, 95% CI, 1.18-2.43; $P = .004$).

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

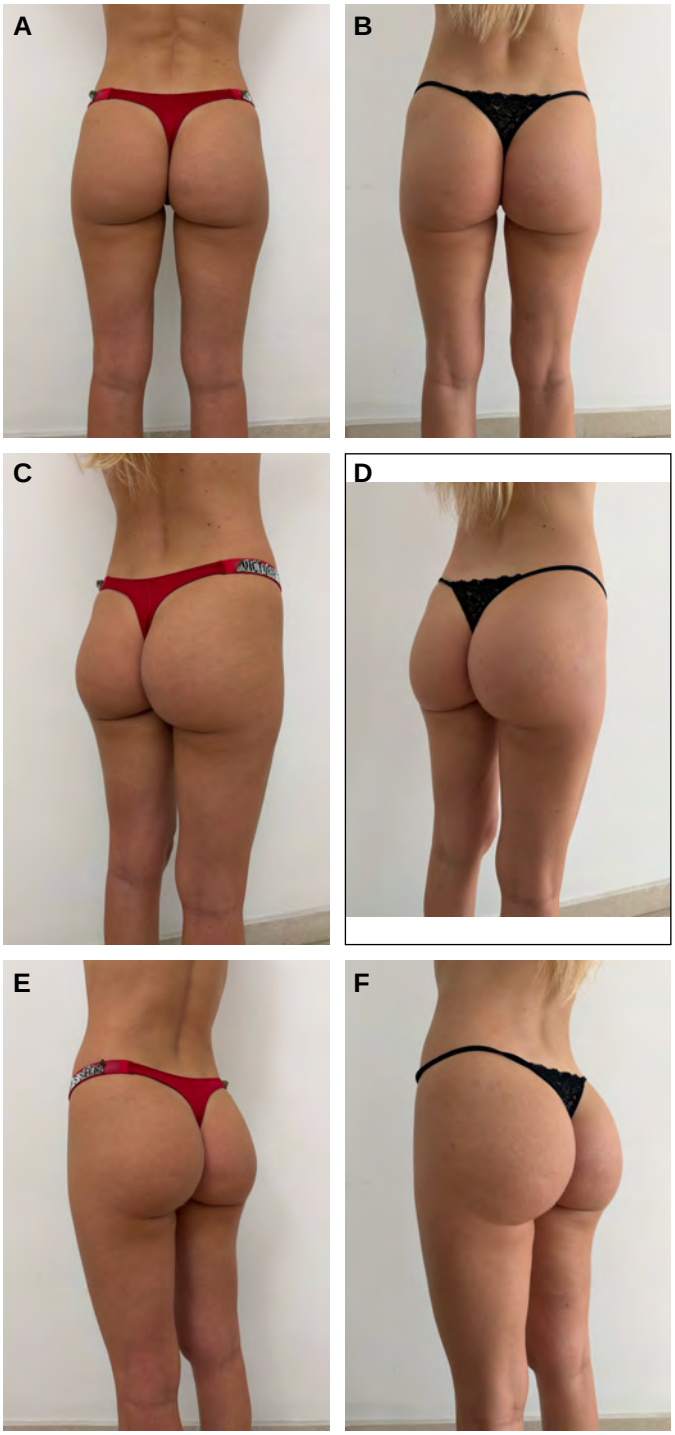


Figure 3. Long-term contour improvement after power-assisted liposuction (PAL) performed for aesthetic purposes. (A) Preoperative in posterior view; (B) postoperative frontal view; (C) preoperative posterior-oblique right lateral view; (D) postoperative posterior-oblique right lateral view; (E) preoperative posterior-oblique left lateral view; (F) postoperative posterior-oblique left lateral view. The patient underwent PAL for aesthetic body contouring. Preoperative figures (A), (C), and (E) showed a 25-year-old female patient affected by localized adiposity of the flanks, trochanteric regions (saddlebags), and medial thighs. Postoperative images (B, D, and F) demonstrate a reduction in localized adipose tissue, improved body contour definition, and maintenance of the aesthetic result.

Age >50 years and male sex were not significantly associated with increased complication risk.

Results of multivariate analysis are presented in Table 5.

Table 2. Long-term Outcomes

Outcome	6 months	1 year	3 years	5 years
Stable contour improvement	94.8	91.2	84.5	78.6
Weight stability	88.9	82.8	76.1	71.3
Skin retraction	92.5	88.4	79.2	72.5
Satisfaction maintained	93.8	90.1	85.3	80.4
Revision surgery	1.2	4.1	6.9	8.7

Kaplan–Meier Complication-Free Survival

Kaplan–Meier analysis demonstrated a progressive but modest decline in complication-free survival over the 5-year follow-up period, with most complications occurring within the first postoperative year. After this period, the curve plateaued, indicating a low incidence of late-onset adverse events. This pattern may partly reflect the under-detection of late minor complications because of decreasing follow-up density over time. All complications, minor and major, were considered events in the Kaplan–Meier analysis. Kaplan–Meier estimated complication-free survival was 91.7% at 6 months, 87.2% at 1 year, 85.8% at 3 years, and 85.2% at 5 years (Supplemental Table 1, available online at https://doi.org/10.1093/asj/sjag193).

DISCUSSION

The present multicenter prospective cohort study provides one of the largest multicenter prospective long-term evaluations of modern liposuction outcomes with up to 5 years of follow-up. The findings demonstrate that liposuction produces durable aesthetic improvement, sustained patient satisfaction, and a relatively low rate of major complications when performed under standardized protocols in appropriately selected patients.

The evolution of liposuction over the past 4 decades has been marked by substantial improvements in both safety and efficacy. Since the introduction of suction-assisted lipectomy and the subsequent development of the tumescent technique, procedural refinements have significantly reduced perioperative morbidity while improving contour predictability.[1-4] More recent technological adjuncts, including power-assisted, ultrasound-assisted, and laser-assisted liposuction, have further enhanced surgical efficiency, particularly in fibrous anatomical regions.[5-8] However, as demonstrated in previous comparative studies, long-term outcomes appear to be influenced more by biological and patient-related factors than by the specific energy modality employed.[9-11]

In the present study, stable contour improvement was maintained in 78.6% of patients at 5 years, confirming that the aesthetic benefits of liposuction are largely durable over time. The gradual decline in contour stability observed during follow-up is likely multifactorial and may be attributed to postoperative weight fluctuations, aging-related soft-tissue changes, and individual variability in skin elasticity and adipose tissue redistribution. These findings are consistent with previous long-term observational studies reporting that weight stability remains one of the strongest predictors of sustained liposuction outcomes.[12-14] Patients maintaining postoperative weight stability demonstrated significantly higher rates of contour preservation throughout follow-up, supporting the central role of long-term

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

Table 3. BODY-Q

BODY-Q domain	Baseline ($n = 1248$)	1 year ($n = 1175$)	3 years ($n = 1106$)	5 years ($n = 1012$)
Body satisfaction	41.6 ± 12.1	82.8 ± 8.9	79.4 ± 9.1	76.3 ± 9.2
Psychological well-being	48.1 ± 11.6	80.4 ± 8.4	77.2 ± 8.6	74.9 ± 8.7
Social confidence	51.2 ± 10.4	83.6 ± 7.8	80.3 ± 8.0	77.1 ± 8.1
Quality of life	54.7 ± 9.9	81.9 ± 8.2	78.6 ± 8.3	75.5 ± 8.5
BODY-Q completion rate (%)	100.0	94.2	88.6	81.1

Follow-up completion rates for BODY-Q assessments were 94.2% at 1 year ($n = 1175$), 88.6% at 3 years ($n = 1106$), and 81.1% at 5 years ($n = 1012$). Values are expressed as mean ± standard deviation. BODY-Q completion rates represent the proportion of eligible participants who completed the questionnaire at each follow-up visit.

Table 4. Complications

Complication	%
Contour irregularities	5.8
Prolonged edema	4.9
Seroma	2.6
Fibrosis	2.3
Hyperpigmentation	1.8
Infection	1.2
Hematoma	1.1
Skin burns	0.7
DVT	0.3
PE	0.2
Fat embolism syndrome	0.1

Values represent the percentage of the total cohort ($n = 1248$).

Table 5. Multivariable Mixed-effects Logistic Regression Model

Variable	OR	95% CI	*P*-value
BMI >30	2.31	1.64-3.26	<.001
Smoking	1.88	1.27-2.76	.002
Aspirate >5000 mL	2.74	1.91-3.91	<.001
Combined procedures	1.69	1.18-2.43	.004
Age >50	1.22	0.81-1.83	.31
Male sex	1.11	0.74-1.67	.59

OR, odds ratio.

weight management in sustaining aesthetic outcomes. These findings support the importance of long-term lifestyle counseling and weight-management strategies following liposuction.

Patient-reported outcomes assessed using the BODY-Q instrument demonstrated significant and sustained improvement across all domains, including body satisfaction, psychological well-being, social confidence, and quality of life. The greatest improvement was observed at 1 year, followed by a mild but nonclinically significant decline at 5 years, whereas scores remained markedly higher than baseline. These results reinforce the importance of incorporating validated patient-reported outcome measures in aesthetic surgery research, as subjective satisfaction often represents the primary determinant of perceived surgical success.[15-17]

The overall complication rate in the present study was 14.8%, with major complications occurring in only 1.9% of patients. The majority of adverse events were minor and included contour irregularities, prolonged edema, and seroma formation. These findings are consistent with previously published large clinical series demonstrating that liposuction, when performed under standardized safety protocols, is associated with a low incidence of serious complications.[18-20] Importantly, no mortality was observed in the present cohort.

Multivariable analysis identified BMI >30 kg/m^2, smoking status, large-volume liposuction (>5000 mL), and combined procedures as independent predictors of postoperative complications. These findings are consistent with established surgical principles and prior literature emphasizing the role of patient selection and operative planning in minimizing risk.[21-23] Large-volume liposuction remains a recognized risk factor for fluid imbalance and metabolic stress, reinforcing the need for careful perioperative monitoring in these cases.

The present findings also highlight the temporal distribution of complications, with the majority occurring within the first postoperative year and a marked plateau thereafter. This pattern suggests that late complications are relatively uncommon and that early postoperative management plays a critical role in overall outcomes. Similar trends have been reported in previous long-term studies of body-contouring procedures.[24,25]

From a clinical perspective, these results support the concept that modern liposuction is not only a safe procedure but also a durable body-contouring intervention when performed under appropriate conditions. The combination of high patient satisfaction and low major complication rates underscores its continued central role in aesthetic surgery practice.[26-30]

Several limitations should be acknowledged. First, although prospective and multicenter, the observational design precludes causal inference and remains susceptible to residual confounding. Second, surgical techniques were not fully standardized across participating centers, potentially introducing procedural heterogeneity. Third, despite an overall 5-year follow-up rate exceeding 80%, attrition bias cannot be completely excluded. Nevertheless, BODY-Q response rates remained above 80% at the 5-year assessment, supporting the robustness and longitudinal validity of the patient-reported outcome analyses. Fourth, postoperative lifestyle modifications and weight fluctuations may have influenced long-term contour outcomes. Finally, patient-reported outcomes, although assessed using

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026

a validated instrument, remain inherently subjective. In addition, although standardized assessments were implemented, photographic evaluation of contour improvement remains partially subjective and may be influenced by residual observer bias. The study was not powered to detect differences among liposuction technologies. Characteristics of patients lost to follow-up were not formally compared with those completing the study.

Future research should focus on refining patient selection criteria, optimizing perioperative protocols, and integrating objective imaging technologies for volumetric and surface contour analysis. The development of standardized registries and artificial intelligence-based outcome prediction models may further improve risk stratification and long-term outcome assessment in liposuction patients.

CONCLUSIONS

Modern liposuction provides durable long-term aesthetic improvement with high patient satisfaction and a low incidence of major complications. Outcomes are strongly influenced by patient-related factors such as BMI, smoking status, and weight stability, as well as procedural factors such as aspirate volume and combined surgical interventions. Careful patient selection and adherence to standardized surgical protocols remain essential for optimizing long-term results and minimizing complications.

Supplemental Material

This article contains supplemental material located online at https://doi.org/10.1093/asj/sjag193.

Acknowledgments

During the preparation of this work, the authors used ChatGPT (OpenAI) for language editing and manuscript organization. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the publication's content.

Disclosures

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

Funding

The authors received no financial support for the research, authorship, and publication of this article.

REFERENCES

1. Illouz YG. Body contouring by lipolysis: a 5-year experience with over 3000 cases. *Plast Reconstr Surg*. 1983;72:591-597. doi: 10.1097/00006534-198311000-00001
2. Fournier PF. *Liposculpture: The Syringe Technique*. Arnette Blackwell; 1991.
3. Klein JA. Tumescent technique for local anesthesia improves safety in large-volume liposuction. *Plast Reconstr Surg*. 1993;92:1085-1098; discussion 1099-100. doi: 10.1097/00006534-199311000-00014
4. Rohrich RJ, Janis JE, Fagien S. The evolution of liposuction: suction-assisted lipectomy and beyond. *Plast Reconstr Surg*. 2003;112:1425-1433. doi: 10.1097/01.PRS.0000067726.09375.9D
5. Matarasso A. Superwet anesthesia redefines large-volume liposuction. *Aesthet Surg J*. 1997;17:358-364. doi: 10.1016/S1090-820X(97)80049-0
6. Haeck PC, Swanson JA, Gutowski KA, et al. Evidence-based patient safety advisory: liposuction. *Plast Reconstr Surg*. 2009;124:28S-44S. doi: 10.1097/PRS.0b013e3181b52fcd
7. Grazer FM, de Jong RH. Fatal outcomes from liposuction: census survey of cosmetic surgeons. *Plast Reconstr Surg*. 2000;105:436-446. doi: 10.1097/00006534-200001000-00072
8. Commons GW, Halperin B, Chang CC. Large-volume liposuction: a review of 631 consecutive cases over 12 years. *Plast Reconstr Surg*. 2001;108:1753-1763. doi: 10.1097/00006534-200111000-00051
9. Hunstad JP, Aitken ME. Liposuction safety in ambulatory surgery centers. *Clin Plast Surg*. 2006;33:1-7. doi: 10.1016/j.cps.2005.08.001
10. Swanson E. Prospective outcome study of 360 patients treated with liposuction. *Plast Reconstr Surg*. 2012;129:965-978. doi: 10.1097/PRS.0b013e318244237f
11. Stevens WG, Gear AJ, Stoker DA, et al. Outpatient liposuction: review of 631 consecutive cases. *Aesthet Surg J*. 2008;28:416-420. doi: 10.1016/j.asj.2008.04.002
12. Graivier MH, Bass LS, Lorenc ZP. Liposuction technologies and techniques: a review. *Aesthet Surg J*. 2017;37:S3-S15. doi: 10.1093/asj/sjx004
13. Rohrich RJ, Beran SJ, Kenkel JM. Liposuction techniques and safety considerations. *Plast Reconstr Surg*. 1999;104:1365-1376. doi: 10.1097/00006534-199910000-00019
14. Cárdenas-Camarena L, Bayter JE, Aguirre-Serrano H, Cuenca-Pardo J. Deaths caused by gluteal lipoinjection: what are we doing wrong? *Plast Reconstr Surg* 2015;136:58-66. doi: 10.1097/PRS.0000000000001364
15. Kenkel JM, Robinson JB Jr, Beran SJ, et al. The tissue effects of ultrasound-assisted lipoplasty. *Plast Reconstr Surg*. 1998;102:213-220. doi: 10.1097/00006534-199807000-00035
16. DiBernardo BE, Reyes J. Evaluation of skin tightening after laser-assisted liposuction. *Aesthet Surg J*. 2009;29:400-407. doi: 10.1016/j.asj.2009.08.006
17. Paul M, Mulholland RS. A new approach for adipose tissue treatment using radiofrequency-assisted liposuction. *Aesthetic Plast Surg*. 2009;33:687-694. doi: 10.1007/s00266-009-9342-z
18. Trott SA, Beran SJ, Rohrich RJ, Kenkel JM, Adams WP, Klein KW. Safety considerations and fluid resuscitation in liposuction: an analysis of 53 consecutive patients. *Plast Reconstr Surg*. 1998;102:2220-2229. doi: 10.1097/00006534-199811000-00063
19. Teimourian B, Adham MN. A national survey of complications associated with suction lipectomy. *Plast Reconstr Surg*. 1989;84:628-631. doi: 10.1097/00006534-198984040-00012
20. Shiffman MA. *Liposuction: Principles and Practice*. Springer; 2006.
21. Illouz YG. Complications of liposuction. *Clin Plast Surg*. 2006;33:129-viii. doi: 10.1016/j.cps.2005.10.001
22. Swanson E. Caprini scores, risk stratification, and rivaroxaban in plastic surgery: time to reconsider our strategy. *Plast Reconstr Surg Glob Open*. 2016;4:e733. doi: 10.1097/GOX.0000000000000660
23. Klassen AF, Cano SJ, Scott A, et al. The BODY-Q: development of a new patient-reported outcome measure for weight loss and body contouring. *Plast Reconstr Surg Glob Open*. 2014;2:e160. doi: 10.1097/GOX.0000000000000116
24. Pusic AL, Klassen AF, Scott AM, et al. Development of a new patient-reported outcome measure for body contouring surgery: the BODY-Q. *Plast Reconstr Surg*. 2013;132:849-859. doi: 10.1097/PRS.0b013e3182a3c5b4
25. Cano SJ, Klassen AF, Scott AM, et al. A closer look at the BODY-Q: psychometric validation. *Plast Reconstr Surg*. 2017;139:81-93. doi: 10.1097/PRS.0000000000002932
26. Mundy LR, Klassen AF, Cano SJ, et al. Patient-reported outcome instruments in plastic surgery: systematic review. *Plast Reconstr Surg*. 2017;139:730-742. doi: 10.1097/PRS.0000000000002938
27. Swanson E. Body contouring outcomes and patient satisfaction. *Plast Reconstr Surg*. 2013;132:1445-1452. doi: 10.1097/PRS.0b013e31829fe3b1
28. Pace MM, Chatterjee A, Merrill DG, Stotland MA, Ridgway EB. Local anesthetics in liposuction: considerations for new practice advisory guidelines to improve patient safety. *Plast Reconstr Surg*. 2013;131:820e-826e. doi: 10.1097/PRS.0b013e3182879f9f
29. Stevens WG, Repta R, Pacella SJ, et al. Safe and consistent outcomes of successfully combining breast surgery and abdominoplasty: an update. *Aesthet Surg J*. 2009;29:129-134. doi: 10.1016/j.asj.2008.12.002
30. Rohrich RJ, Avashia YJ, et al. Modern liposuction techniques. *Plast Reconstr Surg*. 2011;127:1119-1126. doi: 10.1097/PRS.0b013e3181f9f8

Downloaded from academic.oup.com/asj/advance-article/doi/10.1093/asj/sjag193/8790549 by guest on 03 November 2026