

American Society of Plastic Surgeons Evidence Based Clinical Practice Guideline: Abdominoplasty & Panniculectomy. Part I: Seroma Prevention

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ABSTRACT

A multi-disciplinary workgroup was convened to develop a clinical practice guideline for abdominoplasty and panniculectomy, with the goal to develop evidence-based recommendations. The workgroup prioritized evidence regarding seroma prevention, multimodal analgesia, VTE prevention, risk factors for postoperative complications, and wound healing adjuncts. Part I of this guideline addresses the prevention of clinically-significant seroma. Adjuncts evaluated included progressive tension sutures, fibrin sealants and other adhesives, sub-Scarpal fat preservation, drains, scalpel dissection, and compression garments. A systematic literature review followed by an appraisal process was used to rate the certainty of relevant research using GRADE methodology. Six clinical practice recommendations are presented with associated recommendation strength, based on the balance of benefits and harms, and certainty, derived from the quality of the evidence. In some cases, insufficient evidence failed to support a recommendation. We identify areas where further methodologically rigorous investigation is warranted.

INTRODUCTION

Abdominoplasty is a mainstay of contemporary plastic surgery practice. According to the American Society of Plastic Surgeons (ASPS) Procedural Statistics, abdominoplasty was the third most commonly performed cosmetic surgical procedure in the United States in 2024¹. Approximately 160,000-170,000 procedures have been performed annually since the pandemic, with an anticipated surge to follow the increased use of glucagon-like peptide-1 receptor agonists (GLP-1s).

Serious postoperative complications after abdominoplasty are fortunately rare², but more minor complications are relatively common. These include cellulitis, minor wound dehiscence, seroma, and need for scar revision. In the absence of surgical adjuncts except drains, seroma occurs in up to 20-30% of cases and may require serial needle aspiration, drain placement, or surgical excision^{3, 4, 5}. Strategies employed to reduce post-abdominoplasty/panniculectomy seroma formation include the use of drains, limited undermining, progressive tension sutures, fibrin glue/sealant and other adhesives, sub-Scarpa fascia preservation, and scalpel dissection. With a desire to reduce the post-operative care burden and thus enhance patient satisfaction, recommendations on mitigation strategies to prevent clinically-significant seromas are warranted.

INTENDED USERS

The guideline is intended to be used by the multidisciplinary team that provides care for patients undergoing abdominal contouring procedures, which include abdominoplasty, lipoabdominoplasty, fleur-de-lys and circumferential procedures, and panniculectomy. The workgroup did not specify who should perform the surgery but assumes that the surgeon planning this procedure will be capable and qualified. Abdominoplasty, CPT 15847, is considered a cosmetic procedure to reshape the torso after pregnancy and/or weight loss. Abdominoplasty involves varying degrees of undermining to allow removal of excess abdominal skin and fat, and repositioning of the remaining abdominal skin flap. Panniculectomy, CPT 15830, is a functional procedure that involves debulking of the abdominal pannus, usually without undermining or umbilical transposition, and is commonly reserved for those patients with chronic intertriginous infection or ulceration within the pannicular fold, or patients with significant co-morbidities for whom a shorter, less invasive procedure is warranted.

This Guideline assumes that surgeons limit undermining to preserve upper abdominal perforators, consistent with established principles of minimizing dead space and preserving flap vascularity. These

technical principles were not evaluated as independent interventions within the systematic review as the workgroup determined limited undermining to be a current standard of practice.

Disclaimer

Evidence-based guidelines are strategies for patient management, developed to assist clinical decision-making. Such guidelines, developed through a comprehensive review of the scientific literature and relevant clinical experience, describe a range of approaches to diagnose, manage, or prevent specific diseases or conditions. Recommendations attempt to define principles of practice to meet the needs of most patients in most circumstances.

However, this guideline should not be construed as a rule, nor inclusive of all proper methods of care reasonably directed at obtaining appropriate results. It may be necessary to approach particular patients' needs differently. Decision-making regarding a patient's care is only made in light of all circumstances presented, available diagnostic and treatment options, and resources.

This guideline is not intended to define or serve as a standard of care. Such a standard is based upon all the facts or circumstances involved, and is subject to change with advances in scientific knowledge and technology and as practice patterns evolve. This guideline reflects the current state of knowledge, and can be considered relevant for a period of 5 years following publication.

METHODS

Guideline questions and priorities were developed by an 18-person multi-disciplinary workgroup. For details on the Workgroup Selection Process, see Supplemental Digital Content-1 ([SDC-1](#)). For the full, detailed systematic review methodology, please see the Systematic Review pages 6-15 in Supplemental Digital Content-2 ([SDC-2](#)).

Clinical Question Development

Workgroup members employed a consensus-based approach for the selection of topics and related clinical questions to be addressed. Clinical questions were submitted via a blinded process to the ASPS project manager, who compiled and dispersed them amongst workgroup members. The clinical questions and topics were then discussed in detail by the workgroup at an in-person introductory meeting in June 2019.

A total of 37 proposed topics and questions were reviewed by the workgroup. Clinical questions were selected based on scope and relevance to patient outcomes. Question prioritization voting was completed via email, and all questions were converted into the PICO format, specifying the population, intervention, comparison, and outcomes of interest. This process resulted in the following clinical questions regarding clinically-significant seroma:

In adult patients undergoing abdominoplasty or panniculectomy...

- 1) Are progressive tension sutures superior to drains for the prevention of clinically-significant seroma?
- 2) Is fibrin sealant superior to drains for the prevention of clinically-significant seroma?
- 3) Are other adhesives (lysine-derived urethane adhesive) superior to drains for the prevention of clinically-significant seroma?
- 4) Is Scarpa's fascia/sub-Scarpal tissue preservation superior to dissection at the level of the rectus fascia for the prevention of clinically-significant seroma?
- 5) Are drains necessary for the prevention of clinically-significant seroma?
- 6) Is dissection with a scalpel superior to the use of electrocautery for the prevention of clinically-significant seroma?

7) Are compression garments effective for the prevention of clinically-significant seroma?

Systematic Review

After finalizing the clinical questions, ASPS quality staff performed a systematic review of the evidence during the period of 2019 to 2026, with an interruption from the Covid-19 pandemic of 2020-2023.

Literature searches were performed to identify relevant studies in major medical databases. Electronic searches of PubMed, Embase, the Latin American and Caribbean Health Sciences Literature (LILACS) database and clinicaltrials.gov were performed using appropriate combinations of subject headers and keywords, as permitted by the search functionalities of each database. The initial search dates were January 1, 2000 through July 24, 2019, with a subsequent update on March 9, 2026. Complete search strategies are available on pages 7-9 in the Systematic Review, [SDC-2](#).

Initial study selection for each clinical question was performed by two reviewers with a multi-level screening process. Level I review involved title and abstract screening to remove irrelevant studies. Level II screening involved full-text review of potentially relevant articles to confirm adherence to the PICO elements of each clinical question. Inclusion and exclusion criteria are available in [SDC-2](#).

Relevant clinical practice guidelines and systematic reviews underwent a separate bibliographic screen as a cross-reference to ensure no relevant literature was excluded during the search process. These articles were screened as described above. Duplicate articles were eliminated. Excluded studies and their reasons for exclusion are documented in the Prisma Diagram in Figure 1.

Included studies underwent quality appraisal and data extraction. Randomized controlled trials were appraised with the Cochrane Risk of Bias (ROB-2) tool. Non-randomized controlled studies were assessed with a modified version of the Risk of Bias in Non-randomized Studies of Interventions

(ROBINS-I) tool. Study characteristics and results were extracted to a database maintained in Microsoft Excel. Additional information on the operationalization of these processes is available in [SDC-2](#), and results of the analyses are available in the Report Appendices, Supplemental Digital Content-3 ([SDC-3](#)).

Data synthesis was undertaken in a narrative fashion without the use of meta-analysis. Trivial, Small, Medium, and Large effect sizes were defined *a priori* by the workgroup for each outcome important to decision making. Quantitative results were translated to qualitative effect sizes and summarized by clinical question in harvest plots. Visual inspection of study quality, effect size, and statistical significance was used to determine the aggregate certainty of evidence for each outcome. The certainty of evidence was determined with a modified GRADE (Grading of Recommendations Assessment, Development and Evaluation) approach considering overall study quality, imprecision, inconsistency, and indirectness⁶.

Clinical Practice Recommendations

Clinical practice recommendations were initially developed during an in-person meeting in the Spring of 2023 and refined during a series of conference calls and online discussions. Recommendations were reassessed during virtual meetings throughout 2026, following the final literature search update. Workgroup members participated in several rounds of revisions until unanimous consensus was achieved for each recommendation. The recommendations in this guideline are accompanied by qualifiers indicating the strength and certainty of each recommendation, determined by the guideline developers on the basis of the overall balance of benefits and harms (strength) and the quality of supporting evidence (certainty).

Table 1. Strength of Recommendations

	Definition	Level of Adherence
Strong recommendation	A particular action is favored because anticipated benefits clearly exceed harms (or vice versa), and quality of evidence is excellent (moderate or strong) or unobtainable.	Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present.
Moderate recommendation	A particular action is favored because anticipated benefits exceed harms (or vice versa), and the quality of evidence is good but not excellent (or is unobtainable).	Clinicians would be prudent to follow a moderate recommendation but should remain alert to new information and sensitive to patient preferences.
Weak recommendation	A particular action is favored because anticipated benefits exceed harms (or vice versa), but the quality of evidence is low or very low.	Clinicians would be prudent to follow a weak recommendation but should remain alert to new information and very sensitive to patient preferences.
Option	An option is provided when the aggregated data shows evidence of both benefit and harm that appear similar in magnitude for any available courses of action	Clinicians should consider the options in their decision making, but patient preference may have a substantial role.

Table 2. Certainty of Evidence from the GRADE Working Group

High Certainty	We are very confident that the true effect lies close to that of the estimate of the effect
Moderate Certainty	We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different
Low Certainty	Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect
Very Low Certainty	We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect

Plan for Updating Guideline

The guideline will be updated when newly published evidence impacts the strength or certainty of existing recommendations. The Quality and Evidence-based Initiatives Committee of ASPS currently reviews clinical practice guidelines on an alternating basis every 2 years to ensure recommendations remain current and relevant. Guidelines that do not meet these criteria may be prioritized for update.

RESULTS

A total of 10,291 references were identified from databases during the literature search and 9,157 were screened after excluding duplicate records. After screening and critical appraisal were performed, 62 studies were selected for systematic review in support of this guideline. A summary of recommendation statements is shown in Table 3.

Figure 1: PRISMA Attrition Diagram

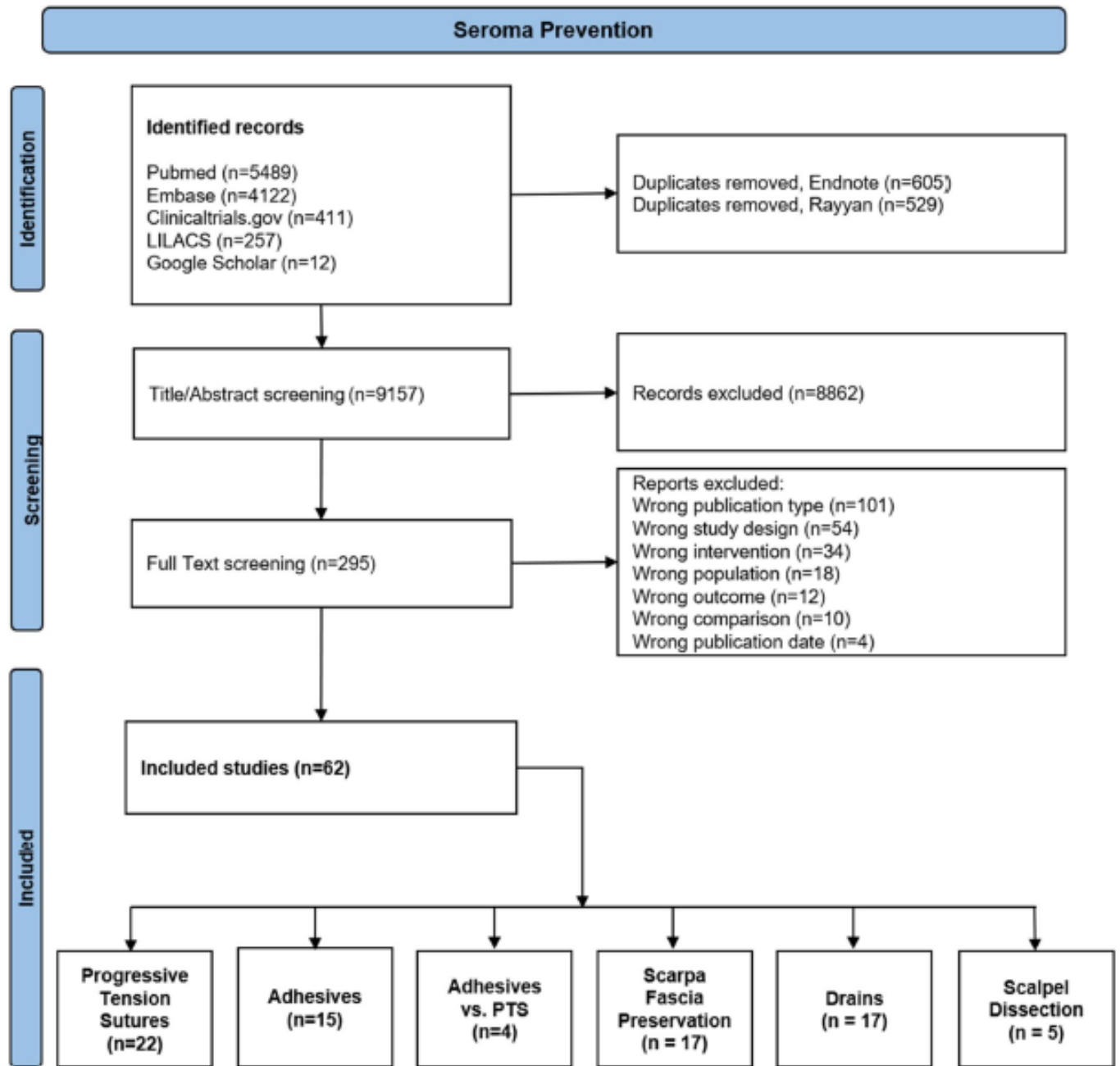


Table 3: Recommendations with level of evidence and strength of recommendation.

Recommendation 1	The workgroup recommends that surgeons use progressive tension sutures as the primary seroma reduction strategy in abdominoplasty and panniculectomy. (Certainty of Evidence: Moderate; Recommendation Strength: Moderate)
Recommendation 2	The workgroup recommends surgeons avoid the use of drains when employing progressive tension sutures in abdominoplasty and panniculectomy, when technique and flap characteristics allow. (Certainty of Evidence: Moderate; Recommendation Strength: Moderate)
Recommendation 3	The workgroup recommends that surgeons preserve some or all of the Scarpa's fascia/sub-Scarpal tissue in abdominoplasty or panniculectomy when anatomically appropriate. (Certainty of Evidence: Moderate; Recommendation Strength: Moderate)
Recommendation 4	The workgroup does not recommend the use of fibrin sealant or lysine-derived urethane adhesive as routine seroma-prevention adjuncts (Certainty of Evidence: Low (fibrin sealant), Moderate (lysine derived urethane adhesive); Recommendation Strength: Moderate)
Recommendation 5	The workgroup does not recommend scalpel dissection as the main seroma-prevention strategy. (Certainty of Evidence: Very low; Recommendation Strength: Weak)
Recommendation 6	The workgroup finds that there is insufficient evidence to support a recommendation for or against the use of compression garments solely for seroma prevention. (Certainty of Evidence: N/A; Recommendation Strength: N/A)

Recommendation 1:

The workgroup recommends that surgeons use progressive tension sutures as the primary seroma reduction strategy in abdominoplasty and panniculectomy.

Table 4: Recommendation 1

Aggregate Certainty of Evidence	Moderate
Strength of Recommendation	Moderate
Benefits	• Reduction in clinically-significant seroma formation and associated management • No need for drain(s) in subcutaneous space
Risks, Harm, Cost	• Increase in operative time • Cost of additional suture material • Temporary dimpling of abdominal skin possible where PTS located • Possible pain related to suture placement into abdominal fascia
Benefit-Harm Assessment	Probably favors the intervention
Equity, Acceptability, Feasibility	Surgeons successfully employing other adjuncts with very low seroma rates may not find the time to place progressive tension sutures acceptable. However, the workgroup believes most surgeons will find the intervention feasible.
Value Judgments	None
Intentional Vagueness	The workgroup did not specify the ideal number of individual progressive tension sutures or “bites” with running sutures.
Role of Patient Preferences	The workgroup believes patient values and preferences will not vary much in this regard
Exclusions	None
Differences of Opinion	None

Rationale

Twenty studies encompassing 4110 patients compared progressive tension sutures to drains in patients who underwent abdominoplasty or panniculectomy^{4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24}. Nine studies looked at patients treated with PTS and drains,^{5, 8, 11, 14, 15, 16, 17, 19, 22}, while eight evaluated drainless PTS^{9, 10, 12, 13, 18, 20, 21, 24} and three analyzed both^{4, 7, 23}. These results were compared to patients in whom drains alone were used. Much of the available evidence was limited by risk of bias, but favored the use

of PTS as a primary strategy for reducing clinically-significant seroma. Our systematic review concluded that PTS probably decreases the risk of seroma formation when compared with drains, with moderate certainty of evidence.

The placement of PTS does add to the operative time. Within the evaluated studies, the effect on operative time was dependent upon the number of sutures placed and the experience of the surgeon. Experienced surgeons generally reported smaller effects on operative time. The systematic review characterized the effect on operative time as small to moderate, requiring approximately 10-20 minutes when surgeons placed 15-25 PTS. PTS resulting in long-term skin dimpling was not demonstrated by the evidence.

The available evidence does not prescribe a specific number of individual PTS, nor the number of fixation points if a running suture is used, in order to obtain the seroma-reduction benefit. Accordingly, the workgroup offers no recommendation for a particular PTS technique or number.

Overall, the workgroup determined the benefit of reducing clinically-significant seroma outweighs the additional operative time and limited harms associated with the use of PTS.

To review the workgroup's complete evaluation of PTS, please see the Systematic Review pages 21-32 in [SDC-2](#).

Recommendation 2:

The workgroup recommends surgeons avoid the use of drains when employing progressive tension sutures in abdominoplasty and panniculectomy, when technique and flap characteristics allow.

Table 5: Recommendation 2

Aggregate Certainty of Evidence	Moderate
Strength of Recommendation	Moderate

Benefits	- Improved patient comfort and faster return to normal activity - Decreased risk of infection due to no drain site - No drain expense - Reduced post-operative care related to drains
Risk, Harm, Cost	- Some patients may experience spontaneous drainage through the incision, requiring education and management. - A small percentage of patients may require additional procedures for seroma management, including the possibility of drain insertion.
Benefit-Harm Assessment	Probably favors the intervention
Equity, Acceptability, Feasibility	Some surgeons may be resistant to the use of drainless procedures, particularly those serving patient populations at high risk of seroma.
Value Judgments	None
Intentional Vagueness	None
Role of Patient Preferences	Many patients prefer surgeries without drains and may actively pursue them.
Exclusions	Drains may still be indicated in patients deemed at higher risk of seroma.
Differences of Opinion	None

Rationale

In eight studies involving 2,431 patients, drainless PTS probably reduced clinically-significant seroma formation when compared to patients treated with drains alone, with moderate certainty of evidence despite some concern for risk of bias^{4, 10, 12, 13, 20, 21, 23, 24}. More importantly, five studies regarding 885 patients directly compared those undergoing abdominoplasty using drainless PTS to those undergoing PTS plus drain placement^{4, 7, 25, 26, 27}. A moderate certainty of evidence demonstrated that the addition of drains to PTS probably had no effect on the risk of clinically-significant seroma. The addition of drains did appear to have a trivial effect on the number of aspirations needed for seroma management, although the certainty for that outcome was low^{7, 27}. Evidence for differences in other risks, such as

hematoma, infection, and wound dehiscence, was very uncertain due to imprecision and low rates of these events.

There is high certainty that omitting drains eliminates the burden of drain management. The systematic review revealed a large effect associated with a reduction in drain-related discomfort, office visits for drain management, and aesthetic compromise due to drain-site scars^{28, 29, 30}. The workgroup concluded that the benefits of drainless PTS outweigh the burdens of routine drain placement.

The workgroup does not recommend drainless surgery in the absence of another effective seroma-reduction strategy, as this would likely result in a moderate-large increase in clinically-significant seroma when compared to patients treated with drains.

To review the Workgroup's complete evaluation of drainless PTS, please see the Systematic Review pages 66-73 in [SDC-2](#).

Recommendation 3:

The workgroup recommends preservation of some or all of Scarpa's fascia/sub-Scarpa tissue in abdominoplasty or panniculectomy when anatomically appropriate

Table 6: Recommendation 3

Aggregate Certainty of Evidence	Moderate
Strength of Recommendation	Moderate
Benefits	• Preservation of lymphatic channels within sub-Scarpal tissue • Faster adhesion of abdominal skin flap to reduce shear forces
Risk, Harm, Cost	• Possible increase in operative time • Post-operative subcutaneous abdominal fat layer slightly thicker
Benefit-Harm Assessment	Probably favors the intervention
Equity, Acceptability, Feasibility	As there is little to no learning curve associated with preservation of some or all of the Scarpa's fascia/sub-Scarpal tissue, the intervention is likely feasible and acceptable to most surgeons.
Value Judgments	None

Intentional Vagueness	The amount of Scarpa's fascia/sub-Scarpal tissue that must be preserved for seroma-reducing benefit is unclear.
Role of Patient Preferences	Patient preferences are unlikely to vary much in this regard.
Exclusions	None
Differences of Opinion	None

Rationale

The evidence also indicates that preservation of Scarpa's fascia/sub-Scarpal tissue is an effective alternative seroma reduction strategy. Thirteen studies encompassing 1,161 patients demonstrated a probable reduction in clinically-significant seroma formation when some or all of the Scarpa's fascia/sub-Scarpal tissue was preserved, in comparison to those patients whose dissection was carried out at the level of the rectus fascia^{5, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42}. The certainty of the evidence was moderate, downgraded due to risk of bias. In addition, fourteen studies including 1,380 patients provided moderate evidence that Scarpa's fascia/sub-Scarpal preservation reduced the time to post-operative drain removal^{5, 31, 32, 33, 34, 35, 37, 38, 39, 40, 41, 42, 43, 44}.

A low certainty of evidence revealed possible additional benefits of Scarpa's fascia/sub-Scarpal preservation in reducing blood loss and the need for transfusion^{31, 44, 33, 40}, the risk of hematoma formation^{31, 32, 33, 34, 35, 39, 41} and the risk of post-operative infection^{31, 32, 44, 34, 35, 39, 41, 42}. With very low confidence, the evidence suggested that the preservation of Scarpa's fascia/sub-Scarpal tissue had little to no adverse effect on aesthetic outcome^{31, 33, 44}.

There is insufficient evidence to establish whether PTS or Scarpa's fascia/sub-Scarpal tissue preservation is the superior seroma-reduction strategy. One small prospective study involving 30 patients compared these techniques, but was underpowered and judged to have a critical risk of bias⁴⁵. Fewer seromas were identified in the Scarpa's fascia cohort, but this was not statistically significant, and of very low certainty.

The workgroup considers Scarpa's fascia/sub-Scarpal tissue preservation to be a reasonable seroma-reduction strategy. However, the evidence does not delineate the amount of tissue that must be preserved, as some studies preserved Scarpa's fascia and all sub-Scarpal tissue and others preserved variable amounts of sub-Scarpal tissue.

To review the Workgroup's complete evaluation regarding preservation of Scarpa's fascia/sub-Scarpal tissue, please see pages 51-58 in [SDC-2](#).

Recommendation 4:

The workgroup does not recommend fibrin sealant or lysine-derived urethane adhesive as routine seroma-prevention adjuncts.

Table 7: Recommendation 4

Aggregate Certainty of Evidence	Low (fibrin sealant), Moderate (lysine-derived urethane adhesive)
Strength of Recommendation	Moderate
Benefits	• May reduce drain output on postoperative day 1 • Probably has no impact on clinically-significant seroma
Risk, Harm, Cost	Cost of material Possible allergic or inflammatory reaction
Benefit-Harm Assessment	Does not favor either the intervention or the comparison
Equity, Acceptability, Feasibility	None
Value Judgments	None
Intentional Vagueness	None
Role of Patient Preferences	None
Exclusions	None
Differences of Opinion	None

Rationale

Neither fibrin sealant nor lysine-derived urethane adhesive demonstrated a clinically-significant seroma reduction effect sufficient to support routine use.

Nine studies including 586 patients indicated little to no effect on seroma reduction when adhesives were used with drains^{3, 46, 47, 48, 49, 53, 54, 56, 57}, and the studies were found to be inconsistent with serious risks of bias. Four studies reported ultrasound diagnosis of subcutaneous fluid collections rather than clinically-significant seroma, and the evidence was inconsistent^{9, 50, 51, 52}. There was very low certainty evidence of a trivial to small reduction in drain output^{53, 54, 55, 56}, or a shorter time to drain removal.^{14, 52, 53, 54, 55, 57} In one study of 130 patients in which lysine-derived urethane adhesive was used without drains, the rate of clinically-significant seroma was probably increased when compared to drains alone³.

Product inserts for these sealants/adhesives do describe uncommon risks of sensitivity reactions, and the potential for viral transmission with fibrin sealants.

Overall, the workgroup determined that neither fibrin sealant nor lysine-derived urethane adhesive should be relied upon as a routine seroma-reduction strategy. This recommendation does not preclude their use for another clinical indication as determined by the surgeon.

See pages 33-45 of the complete Systematic Review in [SDC-2](#).

Recommendation 5:

The workgroup does not recommend scalpel dissection as the main seroma-prevention strategy.

Table 8: Recommendation 5

Aggregate Certainty of Evidence	Very low
Strength of Recommendation	Weak
Benefits	Reduced inflammation inciting seroma fluid production
Risk, Harm, Cost	Increased blood loss Possible hematoma risk increase Increased operative time
Benefit-Harm Assessment	Does not favor either the intervention or the comparison
Equity, Acceptability, Feasibility	None
Value Judgments	None
Intentional Vagueness	None
Role of Patient Preferences	Patients are unlikely to have preferences in this regard.

Exclusions	None
Differences of Opinion	None

Rationale

Five studies including 1,067 patients compared scalpel versus electrocautery dissection in abdominoplasty^{58, 59, 60, 61, 62}. The evidence was inconsistent and limited by risk of bias. Scalpel dissection had little or no effect on the rate of clinically-significant seroma when compared with electrocautery, and certainty was low. Scalpel dissection also appeared to have little or no effect on drain volume. Two studies including 766 patients suggested with low certainty that scalpel dissection resulted in shorter drain duration^{61, 62}. Three studies of 903 patients suggested scalpel dissection increased the risk of hematoma, but also with low certainty^{58, 61, 62}. There was little or no effect noted on infection rates^{58, 61, 62}.

Indirect evidence from non-abdominoplasty surgical populations has suggested a reduction in seroma risk when scalpel dissection is utilized^{63, 64}. However, direct evidence from abdominoplasty and panniculectomy studies does not align with this finding.

Given the absence of evidence of a reduction in clinically-significant seroma within the abdominoplasty and panniculectomy patient population, and the possible increased risk of hematoma, the workgroup concluded surgeons should not rely on scalpel dissection as a seroma-reduction strategy.

See pages 81-85 of the complete Systematic Review in [SDC-2](#).

Recommendation 6:

The workgroup finds that there is insufficient evidence to support a recommendation for or against the use of compression garments solely for seroma prevention.

Table 9: Recommendation 6

Aggregate Evidence Quality	N/A
Strength of Recommendation	N/A

Benefits	• Sense of security to the patient • Garment may hold dressings in place
Risk, Harm, Cost	• Cost of garments • Excess pressure causing skin injury
Benefit-Harm Assessment	N/A
Equity, Acceptability, Feasibility	None
Value Judgments	None
Intentional Vagueness	None
Role of Patient Preferences	Some patients strongly prefer compression
Exclusions	None
Differences of Opinion	None

Rationale

The systematic review found no comparative studies that evaluated the use of compression garments following abdominoplasty or panniculectomy as a seroma-reduction strategy. Several potentially relevant studies were excluded because they failed to include appropriate comparisons or failed to report seroma rates. These studies measured other parameters including intra-abdominal pressure^{65, 66}, ventilatory function⁶⁷, venous stasis⁶⁸, or edema⁶⁹. Compression garments were utilized in some studies that also incorporated other strategies, so that an independent evaluation of the effect of compression was not possible. One study reported subclinical ultrasound-detected fluid collections in patients receiving both PTS and compression, thus the effect on clinically-significant seroma could not be determined⁷⁰. Other studies lacked compression-free control groups for comparison^{71, 72}. As such, the available evidence does not permit a determination as to whether compression reduces clinically-significant seroma.

The workgroup determined that no recommendation for or against post-operative compression as a seroma-reduction strategy could be made.

For further information, see page 86 of the complete Systematic Review in [SDC-2](#) and page 123 in the Appendices in [SDC-3](#).

FUTURE DIRECTIONS

The use of indwelling drains has long been the standard of practice in abdominoplasty surgery, with drains varying in number and location based on surgeon preference. While drains alone do reduce the risk of post-operative seroma formation, this review indicates that progressive tension sutures and preservation of Scarpa's fascia/sub-Scarpal tissue are superior mitigation strategies for the prevention of clinically-significant seroma. This superiority persisted with progressive tension sutures when utilized with or without drains. The Workgroup concluded that the use of indwelling drains could be eliminated, or otherwise relegated to those patients deemed at high risk for the development of seroma.

Several important questions regarding these techniques remain unanswered. Further investigation is needed to determine the optimal number and location of progressive tension sutures, and to define the ideal amount of sub-Scarpal tissue to be preserved for maximal benefit. Friedman et al. mapped lymphatic channels in abdominoplasty tissue specimens. While most of the channels were noted to be superficial, they found 9.4% of the lymphatics were within the Scarpa's fascia and 8% were in the loose areolar tissue overlying the abdominal wall fascia.⁷³ No lymphatics were found within either the superficial or deep fat. Research comparing Scarpa's fascia preservation versus preservation of only the supra-abdominal fascia loose areolar tissue could be undertaken to determine the efficacy of preserving 17.4% of the deeper lymphatics compared to only 8%. In addition, a comparison of progressive tension sutures combined with Scarpa's fascia/sub-Scarpal tissue preservation versus either strategy alone would also be elucidating.

Additional research on patients with a history of massive weight loss will be needed to keep pace with the rise of GLP-1s. Gallagher assessed the risk of post-abdominoplasty seroma formation in patients with a history of massive weight loss (MWL), comparing this risk with that of standard patients, and found there to be a higher incidence of 11% in the MWL arm vs. 2% in the standard arm, although this

difference was not significant ($p=0.055$).⁷⁴ Additional studies on post-abdominoplasty seroma in the MWL population will provide evidence from which to plan mitigation strategies. It remains unclear whether patients who have achieved massive weight loss via bariatric surgery have a differing seroma profile compared to those patients who lose weight via GLP-1 therapy.

Emerging evidence suggests the use of GLP-1 medications may reduce the risk of seroma in panniculectomy patients⁷⁵. This result offers the intriguing possibility of peri-operative GLP-1 use as a seroma mitigation strategy. However, Koenig's findings were not corroborated in two large database studies^{76, 77} and thus this avenue of study requires further high-quality evaluation. Prior studies have demonstrated reduced visceral and subcutaneous edema in GLP-1 patients^{78, 79} and these medications are thought to improve lymphatic flow^{80, 81}, indicating an area ripe for additional research.

The method of surgical dissection represents another potential area of investigation. The use of scalpel dissection has been shown likely to reduce the incidence of seroma in the mastectomy patient population⁶⁴. However, such scalpel dissection remains an unproven mitigation strategy in abdominoplasty and panniculectomy. Further robust study to assess scalpel vs. electrocautery dissection may be warranted.

The role of postoperative compression also remains poorly defined. Future comparative studies should isolate the effect of post-operative compression, employ clinically-significant seroma as an outcome, and standardize compression garment type and duration of use to determine the role of compression in seroma prevention.

Finally, while not investigated within this systematic review, social media from surgeons and laypeople tout the benefits of post-operative lymphatic massage. Robust comparative studies could assess whether such massage has any effect on the reduction of clinically-significant seroma.

CONCLUSIONS

The workgroup recommends surgeons rely on drainless Progressive Tension Suturing and/or Scarpa's fascia/sub-Scarpal tissue preservation as the primary mitigation strategies to reduce post-operative clinically-significant seroma.

The workgroup recommendations are based on a thorough evaluation of the best available evidence.

However, many studies were inconsistent, lacked appropriate control cohorts, demonstrated significant risks of bias, were underpowered, relied on retrospective chart reviews, and/or lacked standardized outcomes. Future studies should aim for robustly-populated prospective, randomized evaluation arms, appropriate controls, and assessment utilizing standardized outcomes.

Patient Reported Outcome studies will be helpful when evaluating the perceived benefit of drainless abdominoplasty, aesthetic outcomes, and the value of post-operative compression and lymphatic massage, which may extend beyond seroma prevention.

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