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Minimal One-Quarter Incision and Four-Step (MOQIF) Excision Method for Subcutaneous Lipoma

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Abstract

Background: Lipomas are common benign subcutaneous neoplasms treated surgically for cosmetic or symptomatic reasons. The minimal one-third incision and four-step (MOTIF) technique provides reliable excision with minimal scarring, but smaller proportional incisions remain unstudied. This study evaluates the minimal one-quarter incision and four-step (MOQIF) technique. **Methods:** Retrospective review of 82 patients undergoing MOQIF excision of histologically confirmed subcutaneous lipomas by a single surgeon from July 2024–December 2025 was done. Lipomas were stratified by maximum diameter: small-intermediate (<5 cm) and large (≥5 cm). MOQIF used a one-quarter incision of the lipoma's long axis with four steps: hydro dissection preserving superficial subcutaneous tissue, superficial dissection, staged deep dissection with selective cautery of fibrovascular septa, and intact mass delivery. Outcomes included excision length, postoperative complications, Vancouver Scar Scale (VSS) scores, recurrence, and subjective treatment satisfaction of patients. **Results:** Mean lipoma size was 6.8±2.0 cm (75.6% ≥5 cm). All lipomas were completely excised through 1.69±0.49 cm incisions (ratio 0.25). Complications were low: seroma 10.98% (16.7% vs 9.4%, p=0.404), hematoma 7.3% (11.1% vs 6.3%, p=0.608), with no infections, nerve injuries, or recurrences at a mean 8.9 months follow-up. VSS scores were equivalent between groups (0.83 vs 1.06; p=0.438) and overall patient satisfaction were high (3.54 ± 0.53 (2-4)). **Conclusions:** MOQIF achieves complete lipoma excision through one-quarter incisions with safety and cosmetic outcomes across lipoma sizes matching the previous MOTIF method.

Keywords: lipoma; minimal incision; MOTIF; MOQIF; subcutaneous neoplasm; Vancouver Scar Scale

1. Introduction

Lipomas represent the most common benign adipocytic neoplasm that frequently arise from the subcutaneous plane [1]. Although they may occur in deeper planes, only a small proportion extend into subfascial, intermuscular, or intramuscular compartments [2,3]. Regardless of depth, lipomas are typically benign and often remain asymptomatic for years [4]. Indications for excision include aesthetic distaste and symptoms related to mass effect on adjacent neurovascular structures, such as pain, paresthesia, discomfort, reduced muscle function, or impingement [2,5].

Surgical excision remains the gold standard of care due to its low recurrence rate and ability to provide a definitive histological diagnosis [6]. However, conventional open techniques may result in visible scarring that can be cosmetically unacceptable, especially in exposed areas of the body [7]. The central challenge in lipoma surgery is therefore to balance complete tumor removal with optimal cosmetic outcomes. While patients desire minimal scarring, reduced incision lengths can potentially increase the risk of complications and paradoxically produce hypertrophic scars [6]. Minimally

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invasive approaches present additional technical challenges, as smaller incisions inherently provide limited surgical visualization [8]. This reduced visualization is especially problematic given that lipomas are surrounded by a fibrous capsule and fibrovascular septa, which can predispose tumor fragmentation, residual tissue, and bleeding if not clearly visualized during dissection [9,10].

To address these competing priorities, multiple minimally invasive techniques have been described, including injection lipolysis, liposuction, and minimal scar extraction (MSE) [7,9,11]. Endoscopic approaches have also been explored, particularly for facial and forehead lipomas, and have demonstrated favorable cosmetic outcomes with hidden incisions [12]. Among these techniques, the minimal one-third incision and four-step (MOTIF) method proposed by Park [6] promises an algorithmic approach that achieves complete excision while minimizing scarring and complication rates. MOTIF utilizes an incision spanning one-third of the lipoma's long-axis and excision is systematically done in four steps. The four sequential steps consist of tumescent infiltration, superficial circumferential dissection, deep circumferential dissection leaving a narrow stalk, and intact mass delivery.

Building upon this foundation, this study proposes a novel modification, the minimal one-quarter incision and four step (MOQIF) technique, specifically designed for subcutaneous lipomas. MOQIF reduces the total incision length to one-quarter of the long axis while preserving the MOTIF four-step dissection sequence. As such, this new technique aims to further minimize incision length and visible scarring without compromising safety, complete excision, or overall clinical outcomes.

2. Materials and Methods

This retrospective chart review included patients who underwent surgical excision of histologically confirmed lipomas using the minimal one-quarter incision and four step (MOQIF) technique at a single institution. From July 2024 to December 2025, a total of 82 patients underwent MOQIF. All procedures were performed under monitored anesthesia care (MAC) and performed by a single surgeon (S.C. Eun). Patients with recurrent lipomas, suspected malignant soft-tissue tumors, or incomplete clinical records were excluded. Lipomas were stratified by maximum diameters into two size groups: small-intermediate (<5cm) and large (≥5cm). Data collected included patient demographics, tumor size and location, anesthesia type, intraoperative details, and postoperative complications (i.e. seroma, hematoma, nerve injury, and recurrence), scar quality, and follow-up duration.

2.1. MOQIF Technique

2.1.1. Step I

The boundary of the lipoma was delineated by careful palpation, following the principles of the original MOTIF method. Two orthogonal axes (x and y) were drawn through the center of the mass to identify the long axis. The maximal diameter was divided into eight equal segments, and central skin incision corresponding to one-quarter of the diameter was planned between the one-eighth points on either side of the center (Figure 1). If required, the incision line was adjusted to align with relaxed skin tension lines to minimize scar formation.

Local anesthesia with 1% lidocaine and epinephrine (1:100,000) was administered generously depending on tumor size and patient factors to achieve hydro dissection around both superficial and deep surfaces of the lipoma. At least five minutes were allowed for optimal vasoconstriction to minimize bleeding, allowing easier dissection of the mass. Additional diluted solution with normal saline could be injected beneath the mass for larger lipomas to facilitate dissection and reduce systemic anesthetic and vasoconstrictor load.

A skin incision was made along the pre-marked one-fourth length using a No. 15 scalpel blade, and dissection was carried through the subcutaneous tissue until the superficial surface of the lipoma was exposed.

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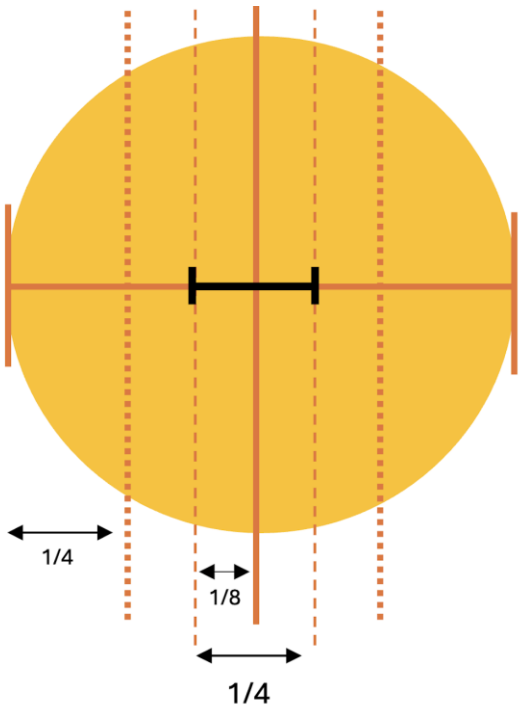

Figure 1. Orthogonal axis planning for the minimal one-fourth incision technique. The lipoma's maximal diameter is divided using central longitudinal and transverse axes (solid red lines), with additional quarter (thick dotted red lines) and one-eighth (thin dotted red lines) reference lines guiding proportional incision placement (solid black line).

2.1.2. Step II

Using forceps (e.g. Adson or Adson-Brown forceps) in the nondominant hand, blunt dissection of the superficial surface of the lipoma was performed in a circumferential manner using Metzenbaum scissors or mosquito forceps. Electrocautery was avoided at this stage to minimize thermal injury and reduce the risk of seroma formation. All fibrous adhesions between the fibrous capsule and the lipoma were released to allow maximal mobilization of the mass within the pocket. Conceptually, this step can be visualized as separating the "yolk" (lipoma) from the "white" (fibrous capsule) without disrupting the integrity of the yolk.

2.1.3. Step III

Deep dissection was initiated at the inferior aspect of the short axis of the lipoma and continued as far as exposure allowed. Gentle rotation of the dominant wrist was used to obtain a more ergonomic and controlled approach to the deep surface. Dissection was then performed from the opposite end of the short axis to complete mobilization from below. Circumferential deep dissection continued along the axial margins until all fibrous adhesions between the capsule and the lipoma were freed, allowing the mass to "sink" into the cavity and facilitating subsequent extraction. During this step, fibrovascular septa were selectively divided using bipolar cautery to maintain hemostasis while limiting collateral thermal damage. Figure 2 illustrates the distinction between Step II and Step III, highlighting the superficial and deep planes of circumferential dissection.

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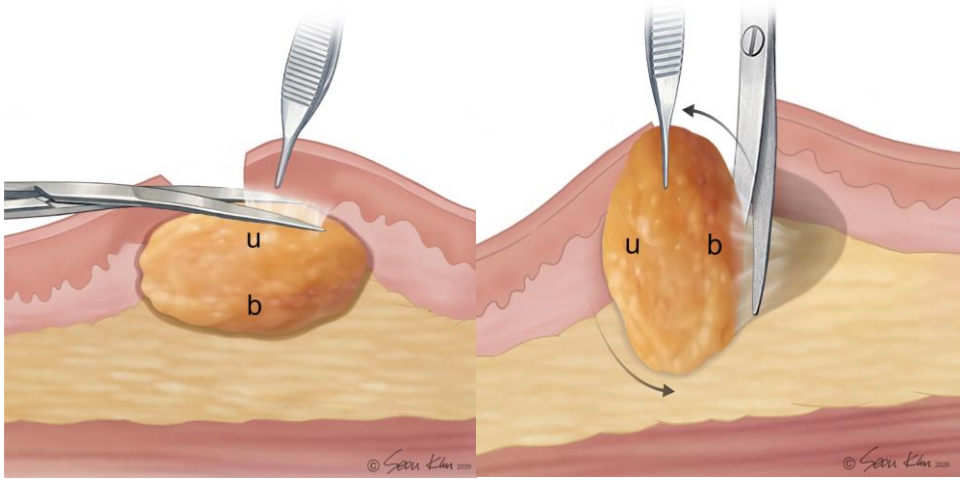

Figure 2. (a) Step II: Circumferential superficial dissection of the lipoma. Adson–Brown forceps are used to gently elevate the epidermal and dermal layers, while Metzenbaum scissors are employed for blunt dissection of the superficial fibrous adhesions (u). **(b)** Step III: Circumferential deep dissection of the lipoma. The mass is carefully mobilized using Adson–Brown forceps and Metzenbaum scissors to release deeper fibrous adhesions (b) prior to extraction.

2.1.4. Step IV

After adequate superficial and deep mobilization, the lipoma was gently expressed and delivered through the central one-fourth incision. As the mass was delivered, bipolar cautery was used as needed to divide any remaining deep fibrovascular septa and achieve complete release. The resulting cavity was irrigated and meticulous hemostasis was confirmed. A silastic drain was placed for lipomas larger than 3 cm or for lesions located on the trunk and extremities, where dead space was more substantial. Wounds were closed in layered fashion, and external dressings were applied to minimize shear forces and support optimal wound healing.

2.2. Postoperative Complications and Vancouver Scar Scale Analysis

Postoperative complications were recorded, including seroma, hematoma, infection, nerve injury, and clinical recurrence during follow-up. Scar quality was assessed at a minimum of six months postoperatively using the Vancouver Scar Scale (VSS), in line with the methodology of the original MOTIF study, by a single evaluator to reduce interobserver variability. Incision length relative to tumor size, total follow-up time (in months), and overall patient satisfaction were also documented to evaluate whether the minimal one-quarter incision approach conferred additional cosmetic or functional benefits compared with previously reported one-third incisions.

2.3. Overall Treatment Outcome

Treatment outcomes were assessed based on subjective patient-reported satisfaction, encompassing postoperative recovery, functional outcome, and aesthetic appearance. Outcomes were graded using a four-point ordinal scale: poor, satisfactory, good, excellent. For descriptive analysis, these categories were assigned numerical scores from 1 (poor) to 4 (excellent).

2.4. Statistical Analysis

All statistical analyses were performed using standard statistical software (e.g. RStudio and Microsoft Excel). Continuous variables such as patient age, lipoma size, incision length, follow-up duration, and Vancouver Scar Scale (VSS) scores were summarized as means with standard deviations and ranges. Categorical variables, including sex, lipoma location, size group, post-operative complications (seroma, hematoma, infection, nerve injury, recurrence), and treatment outcome will be presented as frequencies and percentages.

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To compare outcomes among the two lipoma size groups (<5cm and ≥5cm), independent two sample t-tests (Welch's) was used for continuous variables after checking for normality, and chi-square or Fisher's exact tests was applied to categorical variables.

For binary outcomes, complication rates were reported with 95% confidence intervals calculated using the Wilson score method. For continuous outcomes, mean differences and 95% confidence interval were obtained from Welch's two-sample t-test. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Patient Demographic and Lesion Characteristics

A total of 82 patients underwent subcutaneous lipoma excision using the MOQIF method. The mean patient age was 55.2 ± 12.4 years. The cohort included both male and female patients, with majority of lipomas located at the trunk (n = 48; 58.5%) and extremities (n = 32; 39.0%), followed by the face (n = 2; 2.4%).

The mean lipoma size was 6.8 cm, and when further stratified 22.0% were in the small-intermediate group (<5 cm) and 78.0% were in the large group (≥5 cm). The mean incision length was 1.69 ± 0.49cm, corresponding to an average incision-to-tumor size ratio of 0.25. All lipomas were successfully excised without the need for incision extension (Table 1). Figure 3 and 4 illustrates a step-by-step of two cases of lipoma excision utilizing the MOQIF method.

Table 1. Patient Demographic and Treatment Outcome.

Patient Demographics Variables	Values
No. of Patients	82
Mean Age ± SD (range), years	55.2 ± 12.4 (33-86)
Sex	
Male	52 (63.4%)
Female	30 (36.5%)
Location	
Trunk	48 (58.5%)
Extremities	32 (39.0%)
Face	2 (2.4%)
Mean Size ± SD (range), cm	6.8 ± 2.0 (2.2-9.9)
Mean Incision Size ± SD (range), cm	1.69 ± 0.49 (0.55-2.45)
Size	
< 5cm	18 (22.0%)
≥ 5cm	64 (78.0%)
Mean Follow-up ± SD (range), months	8.9 ± 3.9 (3-18)
Overall Treatment Outcome	3.54 ± 0.53 (2-4)

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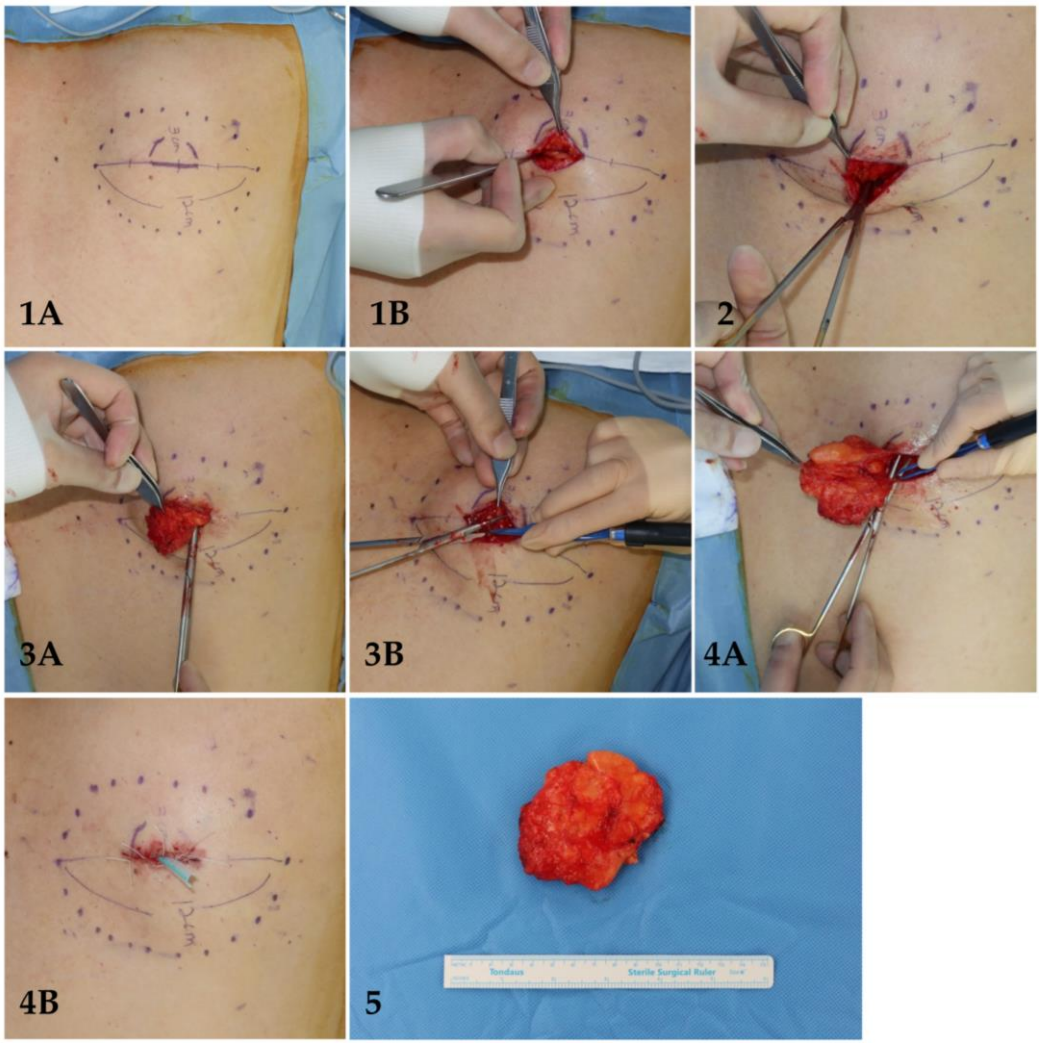

Figure 3. Case 1: Subcutaneous lipoma located at the right posterior shoulder. **(1A)** Step I: Lipoma boundary made after deep palpation of borders; **(1B)** Step I: Incision to reveal superficial surface of lipoma; **(2)** Step 2: Circumferential superficial dissection of lipoma; **(3A)** Step 3: Circumferential deep dissection of lipoma; **(3B)** Step 3: Electrocautery to release fibrovascular septa of lipoma; **(4A)** Step IV: Delivery of lipoma and separation of deep fibrovascular septa using electrocautery; **(4B)** Step IV: Silastic drain insertion; **(5)** Excised lipoma.

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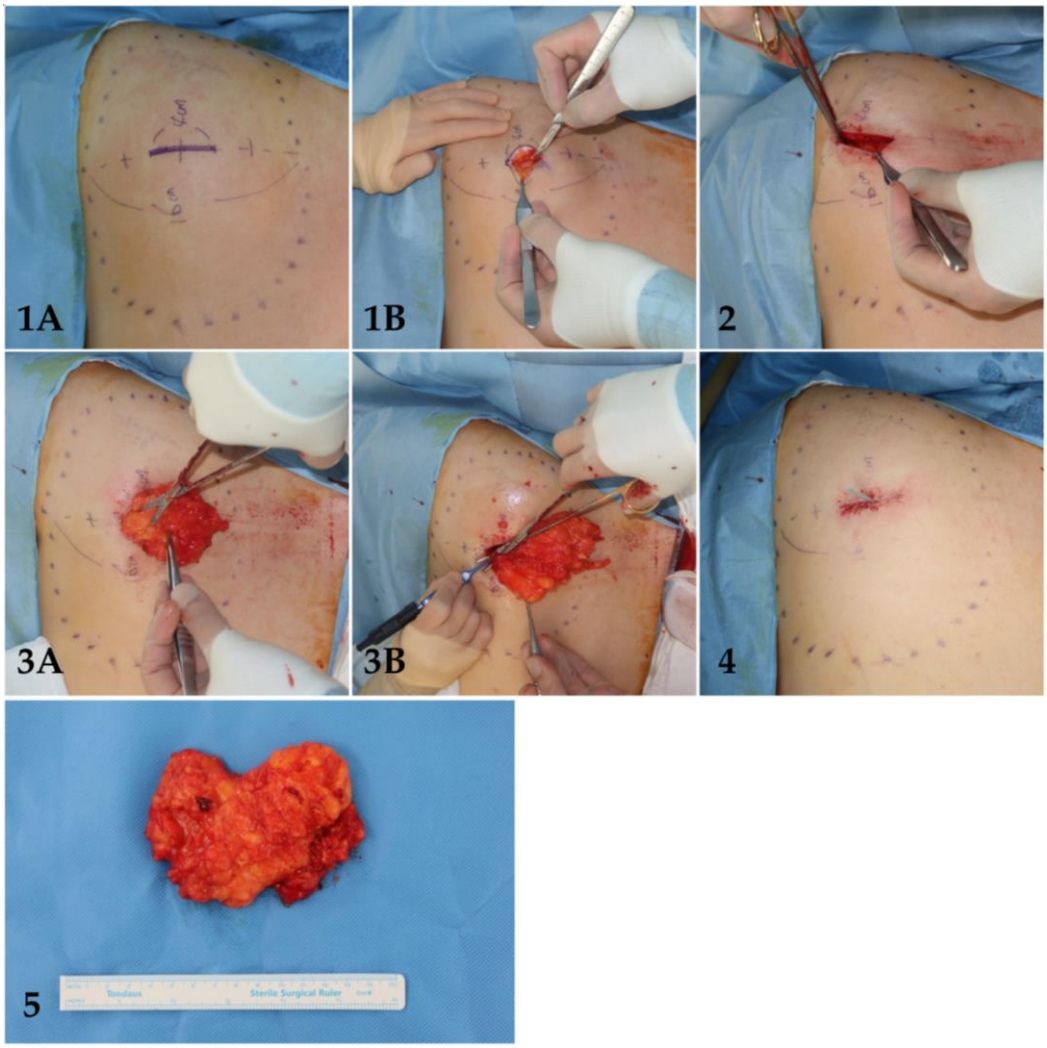

Figure 4. Case 2: Subcutaneous lipoma located at the left posterior shoulder. **(1A)** Step I: Lipoma boundary made after deep palpation of borders; **(1B)** Step I: Incision to reveal superficial surface of lipoma; **(2)** Step 2: Circumferential superficial dissection of lipoma; **(3A)** Step 3: Circumferential deep dissection of lipoma; **(3B)** Step 3: Electrocautery to release fibrovascular septa of lipoma; **(4)** Step IV: Silastic drain insertion; **(5)** Excised lipoma.

3.2. Post-Operative Complications and Vancouver Scar Scale Analysis

Overall complication rates were low, with only 9 seromas (10.98%) and 6 hematomas (7.3%) formation in the cohort. There were no cases of infections, nerve injuries, or recurrences during the follow-up period. Furthermore, all complications were managed conservatively without any long-term sequelae.

When stratified by size group, seroma formation occurred in 16.7% of patients in the small–intermediate group (95% CI = 5.8–39.2%) and 9.4% in the large group (95% CI = 4.4–19.0%), with no statistically significant difference between groups (p = 0.404). Hematoma formation occurred in 11.1% of the small-intermediate group (95% CI = 3.1–33.0%) and 6.3% in the large group (95% CI = 2.5–15.0%), with no statistically significant difference (p = 0.608) (Table 2).

Table 2. Postoperative Complications using Fischer's Exact Test.

Complication	< 5cm (n = 18)	≥ 5cm (n = 64)	Total (n = 82)	*p*-Value
Seroma	3 (16.7%)	6 (9.4%)	9 (10.98%)	0.404
Hematoma	2 (11.1%)	4 (6.3%)	6 (7.3%)	0.608

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Nerve Injury	0	0	0	-
Recurrence	0	0	0	-

3.3. Scar Assessment, Follow-Up, and Overall Treatment Outcome

Scar assessment, using VSS scores, were favorable in both size groups, indicating favorable scar quality and outcomes. The mean VSS was 0.83 ± 1.10 in the small-intermediate group and 1.06 ± 1.07 in the large group. The mean difference (small-intermediate – large) was -0.23 (95% CI = -0.83–0.37; p = 0.438), indicating no statistically significant difference (Figure 5).

The mean follow-up duration for the cohort was 8.9 months, with no lipoma recurrences. Subjective treatment satisfaction was high across the cohort. Global treatment outcome based on recovery, functional outcome, and aesthetic appearance was 3.54 ± 0.53 (2-4), corresponding to outcomes rated as good to excellent. No patients reported poor outcomes, and majority of patients rated their overall treatment outcome as excellent.

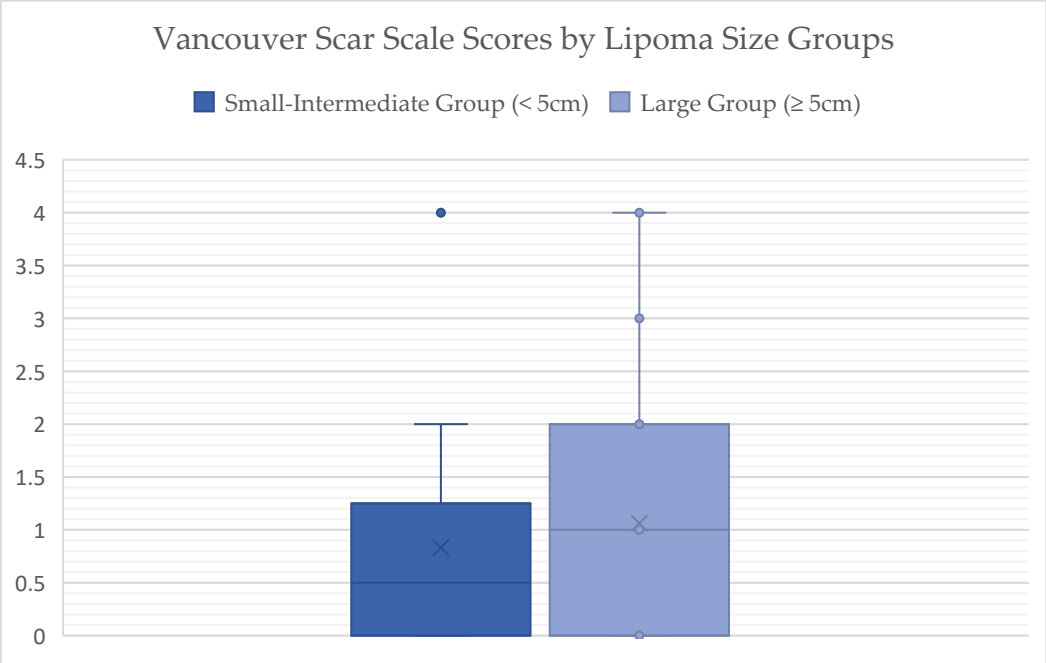

Figure 5. Comparison using Box-and-whisker plot of Vancouver Scar Scale Scores between Two Size Groups. (Welch's Two Sample Independent t-tests, p = 0.438; 95% CI = -0.83–0.37).

4. Discussion

The surgical management of subcutaneous lipomas has evolved significantly with the development of minimal incision techniques that prioritize both complete tumor removal and optimal cosmetic outcomes. The minimal one-third incision and four-step method (MOTIF), as described by Park [6], established a benchmark for minimal incision lipoma surgery, demonstrating 100% complete excision rates across all lipoma sizes with consistent low complication rates and scar quality regardless of tumor dimensions. However, despite the success of the original MOTIF technique, a critical gap exists in the literature regarding even more conservative incision approaches.

Other minimally invasive strategies, such as liposuction and lipolysis injection, offer minimal scar formation due to the utilization of tiny access ports, but they provide virtually no direct visualization of the tumor. This increases the risk of lipoma fragmentation, incomplete excision, and potential recurrence, especially when malignancy cannot be excluded preoperatively [13]. Endoscopic approaches similarly achieve minimal scarring and have demonstrated very low recurrence rates, but they are associated with longer operative times, higher procedural costs, and a need for specialized equipment and training, limiting their availability to highly trained subspecialty

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surgeons [12]. Against this background, a simple open technique that preserves direct visualization while further reducing incision length, such as the MOQIF modification of MOTIF, may offer a more broadly applicable balance between safety, efficiency, and cosmetic benefit.

Notably, Sakamoto [14] demonstrated successful complete resection of large lipomas (5-12 cm) using fixed 1-inch incisions, representing proportional incisions (approximately 21% of tumor diameter), confirming that proportional incisions well below the traditional one-third can achieve complete excision. Similarly, Kang [15] analyzed 122 lipomas and found that anatomical location, rather than tumor size and depth, was the primary determinant of minimal achievable incision length during extraction, supporting the feasibility of further incision reduction for trunk and extremity lesions. These findings provide a strong rational for the present MOQIF technique, which standardizes a one-quarter incision specifically for subcutaneous lipomas in these common sites.

In this cohort of 82 patients (mean tumor size of 6.8cm), the MOQIF technique achieved 100% complete excision using mean incisions of 1.69cm (incision-to-tumor ratio of 0.25cm), with 75.6% of cases involving large lipomas (≥5cm). Complication rates remained low and size-independent, where seroma occurred in 10.98% of patients (16.7% vs 9.4% in <5 cm and ≥5 cm groups, respectively; $p = 0.404$) and hematoma in 7.3% (11.1% vs 6.3%; $p = 0.608$), with no infections, nerve injuries, or recurrences during a mean follow-up of 8.9 months, and all events managed conservatively without sequelae. Vancouver Scar Scale scores were excellent in both size groups (0.83 vs 1.06; mean difference −0.23, 95% CI = -0.83–0.37; $p = 0.438$), indicating that reducing the incision to one-quarter of the tumor's long axis did not compromise scar quality. Taken together, these data suggest that further proportional incision reduction from one-third (MOTIF) to one-quarter (MOQIF) can be achieved without increasing morbidity or impairing cosmetic outcomes.

The predominance of lesions on the trunk (58.5%) and extremities (39.0%) in this series reflects the well-described distribution of subcutaneous lipomas, which arise most frequently in these regions and only rarely on the face. This pattern is consistent with previous epidemiologic and clinical series and supports the primary application of MOQIF to trunk and extremity lesions, where skin redundancy facilitates delivery of relatively large tumors through short incisions. For facial lipomas, where aesthetic demands and anatomic constraints are greater, endoscopic or other hidden-incision approaches may remain preferable in selected cases, provided the necessary expertise and resources are available.

Several technical considerations are critical to the success of the MOQIF method. During Step I, meticulous palpation and marking using orthogonal axes standardizes the one-quarter incision design and help ensure the centralization of the incision and alignment along relaxed skin tension lines to minimize scar formation. Similar to the original MOTIF paper, generous tumescent infiltration and adequate waiting time allow effective hydro dissection, reduce bleeding, and facilitate atraumatic dissection. Furthermore, during dissection through the subcutaneous tissue preservation of the superficial subcutaneous layer must be deliberately done to prevent postoperative skin indentation or contour depression. This is a recognized complication of aggressive tissue undermining in minimal incision surgery [14].

In Step II, mobilization of the mass with forceps grasping the fibrous capsule, rather than retractors or direct manipulation of the fatty lobules, improves visualization of the circumferential pocket and reduces fragmentation of the lipoma.

In Step III, staged deep dissection from both ends of the short axis allows the surgeon to work within a constrained field more ergonomically and promotes symmetric mobilization of the mass. Selective use of bipolar cautery to divide fibrovascular septa maintains hemostasis while limiting thermal injury to surrounding tissues, which is particularly important given the association between excessive cautery and seroma formation [16]. Finally, in Step IV, progressive expression of the fully mobilized lipoma through the small central incision, with division of any remaining deep fibrovascular septa using electrocautery, permits intact mass delivery and confirmation of complete excision.

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This study has several limitations. Its retrospective, single-center design and absence of a direct MOTIF control group restrict definitive comparative conclusions regarding superiority of one-quarter versus one-third incisions. The follow-up period, while sufficient to capture early complications and clinically evident recurrences, may be inadequate to detect very late recurrences of slow-growing lesions. Additionally, all procedures were performed by a surgeon experienced in minimal-incision lipoma excision, which may limit generalizability to less experienced operators. Nonetheless, the present findings provide preliminary evidence that a standardized one-quarter incision, four-step approach can safely extend minimal-incision principles while preserving direct visualization, and they support further prospective and comparative studies to refine indications and validate long-term outcomes for the MOQIF technique.

5. Conclusions

In conclusion, the MOQIF technique represents a safe, reproducible, and cosmetically favorable refinement of minimally invasive lipoma excision. By reliably achieving complete tumor removal through a one-quarter incision without increasing complication rates, this method offers a valuable alternative for surgeons seeking to further minimize surgical footprint while preserving excellent clinical outcomes.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Seoul National University (B-2602-1027-111) on February 2, 2026.

Informed Consent Statement: Informed consent was waived due to the retrospective nature of the study and the analysis used anonymous clinical data.

Data Availability Statement: The data collected and analyzed can be requested from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

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