

Comparison of the Surgical Outcomes of Minimal Incision and Elliptical Excision in Treating Epidermal Inclusion Cysts: A Single-Center, Randomized Controlled Trial*

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Abstract

Introduction: Epidermal inclusion cysts require surgical intervention to prevent recurrence and symptoms. Elliptical excision is definitive but results in longer scars, while minimal incision techniques offer better cosmetic outcomes despite higher recurrence rates probably due to incomplete excision. To date, there are currently no local studies published.

Methodology: A randomized controlled trial was conducted from October 2023 to May 2024 at a dermatology center in the Philippines. Patients were randomly assigned to minimal incision or elliptical excision techniques. Key metrics included operation time, scar length, post-operative complications, Hollander wound evaluation score (HWES), and histopathological completeness of excision.

Results: Median operation duration was 31.86 minutes, with no significant difference between techniques ($p = 0.5795$). Post-operative scars were longer in the excision group (mean: 2.38 ± 0.66 cm) versus the minimal incision group ($p < 0.001$). Completeness of excision was higher in the excision group (83%) compared to the minimal incision group (27%) ($p = 0.0123$). Follow-up scar length was shorter in the minimal incision group (mean: 0.44 ± 0.21 cm) versus the excision group (mean: 2.1 ± 0.63 cm) ($p < 0.001$). HWES scores showed no significant difference in wound healing and aesthetic satisfaction.

Conclusion: Minimal incision technique results in shorter scars but lower completeness of excision compared to elliptical excision. Both techniques have similar long-term outcomes in wound healing and aesthetic satisfaction, with no recurrences or complications beyond two weeks. The choice should balance scar length and completeness of cyst removal, considering patient-specific factors.

INTRODUCTION

Epidermal inclusion cyst typically present as slow-growing, benign, mobile, subcutaneous or dermal nodules with a central punctum. It can either be congenital or acquired, and usually arises from plugged pilosebaceous units. In 2022, 80 cases of Epidermal inclusion cyst was seen at EAMC Department of Dermatology, 46 of which were newly diagnosed cases. Without surgical

treatment, epidermal inclusion cyst seldom resolves spontaneously. Treatment is usually not necessary unless desired by a patient for cosmetic purposes or before it results in an increase in symptom severity (such as infection and/or pain).

Complete elliptical surgical excision or destruction of the cyst with its wall intact is the definitive treatment, and is required to prevent

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recurrence of the lesion. (1) An alternative surgical procedure is minimal incision technique with the extraction of the intact cyst through the defect created on the lesion. In comparison to the standard surgical excision technique, minimal provides better cosmetic outcomes; however, recurrence rates from 1-8% have been observed in the minimal incision technique (2).

To date, the literature is poor regarding the comparison of surgical outcomes of minimal incision technique and elliptical excision techniques, especially in our local setting. Hence, the primary investigator aspires to fill the gaps in this knowledge in a prospective, randomized study among Filipino patients with Epidermal Inclusion Cyst.

OPERATIONAL DEFINITION

Sex- Gender assigned at birth (Male or Female)

Site- Truncal (lesions involving the chest, abdomen, and back)

Non-truncal (lesions involving the extremities and head)

EIC Duration- Duration in years from the time the lesion was first noted by the patient until consult with the primary investigator

EIC Diameter- Largest measured diameter of the lesion in millimeter

Operation Duration- Time, in minutes, from start of incision/excision to closing of the wound

Scar Length- Longest length of post-operative scar measured in millimeter

Completeness of excision based on histopathology- is defined as the absence of sebaceous glandular tissue or remnants of the cyst wall in the examined tissue sample. A complete excision would show no evidence of residual sebaceous glandular tissue, cystic structures, or inflammation associated with the cyst.

Table 1. Hollander Wound Evaluation Score

Incision Attribute	Score if Absent	Score if Present
Step-off borders	0	1
Contour Irregularities	0	1
Margin Separation	0	1
Edge Inversion	0	1
Excessive Distortion	0	1
Overall Appearance	0 (satisfactory)	1 (unsatisfactory)
Total Hollander Score	0 (best)	(worse)

REVIEW OF RELATED LITERATURE

Treatment of stable, uninfected epidermoid cysts is optional; however, intermittent drainage of malodorous keratinous debris, secondary bacterial infection, and cosmetic concerns may urge patients to seek removal of the lesion (3). There are different techniques done in removing epidermoid cysts which include elliptical excision, minimal incision technique, milia excision technique, and punch technique. In all approaches, it is best to completely remove the lining or wall in all cyst to decrease the risk of recurrence. Ideally, epidermal inclusion cysts are surgically removed when noninfected, noninflamed, and non-ruptured.

Elliptical excision is considered the gold standard of treatment, especially for ruptured, inflamed, or previously infected cysts that may be scarred and attached to surrounding tissue (4). This technique involves the excision of the entire cyst and surrounding tissue as a whole, and has almost no recurrence compared to other less invasive techniques. However, this technique is more time-consuming and often results in longer linear wounds and scar, which can be approximately the same size of the cyst, raising cosmetic concerns among patients (3).

The minimal incision technique is an alternative approach in removing uncomplicated epidermoid cysts. A small incision, approximately 1/3 the diameter of the cyst, is made with a no. 11 surgical blade; the contents of the cyst are then expressed by exerting a lateral pressure on the

cyst, and the cyst wall is removed through the incision (5).

The minimal incision technique causes smaller scar and better cosmetic results than the standard excision and is the preferred procedure for cysts in cosmetically sensitive areas. However, it has the risk of leaving residual cyst wall which may result in recurrence of the cyst. Recurrence rates of approximately <1 to 8 percent have been reported with the minimal incision technique (2, 6, 7). In a prospective, randomized study done by Alijanpour et al in 2018 (8), minimal incision technique lead to smaller mean length of wounds, and shorter operative time producing a superior cosmetic result. In the same study, the recurrence rate after a 24-month follow-up in elliptical excision (3.3%) was not significantly different from that of the minimal incision group (2.8%).

SIGNIFICANCE OF THE STUDY

At present, there has only been a few studies directly comparing surgical outcomes of minimal incision technique and the traditional elliptical excision technique in a prospective, randomized method. Moreover, to the best of the investigator's knowledge, there has not been any similar study in our local setting. Hence, the purpose of this study is to compare the cosmetic outcomes, average operation time, and postoperative complications, completeness of excision based histopathology results of minimal incision technique versus the traditional elliptical excision technique in the removal of epidermal inclusion cyst.

Comparing elliptical excision versus minimal incision surgery in the surgical removal of epidermal inclusion can have various clinical impacts on different stakeholders, including patients, clinicians, institutions, and future research.

1. Patients:

- Clinical outcomes: The study can provide insights into the efficacy and safety of both techniques, allowing

patients to make informed decisions about their treatment options.

- Cosmetic results: Patients may benefit from understanding the potential differences in scarring and wound healing between the two approaches.
- Recovery and post-operative care: The study findings can help patients understand the expected recovery time, pain levels, and post-operative care requirements for each technique, aiding in their decision-making process.

2. Clinicians:

- Treatment selection: The study can assist clinicians in selecting the most appropriate surgical technique based on factors such as the size, location, and characteristics of the sebaceous cyst, as well as the patient's preferences and clinical considerations.
- Surgical outcomes: Clinicians can use the study findings to evaluate the effectiveness of their current approach and consider modifications to optimize patient outcomes.
- Standardization: The study may contribute to establishing standardized protocols or guidelines for the management of sebaceous cysts, ensuring consistent and evidence-based care.

3. Institutions:

- Resource allocation: Understanding the clinical impact of each technique can help institutions allocate resources, such as surgical equipment and training, to support the chosen approach.
- Cost-effectiveness: Comparative studies can provide insights into the cost-effectiveness of different surgical techniques, helping institutions make

informed decisions regarding reimbursement and resource allocation.

4. Future research:

- Advancing knowledge: The study can contribute to the existing body of knowledge regarding the surgical management of epidermal inclusion cysts, potentially prompting further research in related areas.
- Methodological improvements: Findings from the study may highlight limitations or areas for improvement in the current techniques, stimulating research aimed at refining surgical procedures or developing new approaches.
- Comparative effectiveness research: The study can inspire additional comparative studies to explore different surgical techniques or compare them to non-surgical approaches in removing epidermal inclusion cysts.

RESEARCH QUESTION

Is minimal incision technique superior to elliptical excision technique in the surgical management of epidermal inclusion cyst?

OBJECTIVES

General

The goal of the study is to compare the minimal incision technique versus the elliptical excision technique in the surgical management of epidermal inclusion seen at the Department of Dermatology from October 2023 to May 2024.

Specific

The specific objectives are:

1. To compare minimal incision versus elliptical excision of epidermal inclusion cyst on the basis of operation time, scar length, post-operative complications, and Hollander wound evaluation score (HWES).

2. To compare minimal incision versus elliptical excision of epidermal inclusion cyst in terms of completeness of excision based on histopathology.

METHODOLOGY

Study Design

This study employed a single-center, randomized controlled trial design.

Study Setting

The study was conducted at the Out-Patient Department of the East Avenue Medical Center Department of Dermatology, a tertiary government hospital located in Quezon City, Metro Manila, from October 2023 to May 2024.

Study Population

Subjects were recruited from the patients seen at the Out-Patient Department of the East Avenue Medical Center Department of Dermatology.

Inclusion Criteria

- Male or female aged over 18 years.
- Diagnosed with epidermal inclusion cysts less than 3 cm in size.
- Received a clinical diagnosis of an epidermal inclusion cyst at the East Avenue Medical Center Department of Dermatology's Out-Patient Department or through Teledermatology.

Exclusion Criteria

- Refused to consent to participate in the study.
- Had epidermal inclusion cysts greater than 3 cm in maximum diameter.
- Exhibited signs of active infection or had suspicion of malignancy.
- Had recurrent epidermal inclusion cysts.
- Had clinically diagnosed epidermal inclusion cysts with a final histopathologic diagnosis inconsistent with epidermal inclusion cysts.
- Were likely to be lost to follow-up.

- Had an allergy to Lidocaine.
- Did not consent to any of the procedures in the study.
- Had underlying systemic illness or conditions such as uncontrolled diabetes, bleeding disorders, or compromised immune function.
- Were pregnant.

Withdrawal Criteria

Subjects could withdraw from the trial at any time without any implications for their medical care. Reasons for withdrawal included:

- Participant request: Participants had the right to withdraw from the study at any time for any reason, including discomfort, adverse effects, or personal reasons.
- Adverse events: Participants experiencing significant adverse events or complications related to the sebaceous cyst removal procedure during the study could be withdrawn from further participation.
- Medical reasons: Participants who developed a medical condition or experienced a change in health status that affected their eligibility for the study or posed a risk to their well-being could be withdrawn.
- Loss to follow-up: Participants who became unreachable or failed to attend scheduled follow-up visits without providing a valid reason could be withdrawn from the study.

Sampling Design

Patients with epidermal inclusion cysts seen at the Out-Patient Department of the East Avenue Medical Dermatology Department were recruited for the study.

Subjects were randomly assigned into two groups using block randomization through a Microsoft Excel number generator: treatment A (minimal incision group) and treatment B (elliptical excision group). Randomization was carried out by a co-author who did not perform the surgical procedures.

For all patients who agreed to participate, photography of the affected site (with standardized angle, lighting, and position) and measurements of the lesion length were documented from baseline to follow-up. Photography was conducted by the primary investigator in a consistent room and background setting for all participants. A ruler was included in the frame to provide a size reference for the lesion. The distance and angle between the camera and the lesion were kept consistent to enable accurate comparison of photographs over time. Standard patient poses were used for consistent framing.

To protect the anonymity of participants, each participant was assigned a unique identification code upon enrollment. These codes were used in the summary of results instead of names or other possible identifiers.

Sample Size

A sample of 23 subjects was recruited, accounting for an anticipated dropout rate of 20%, with a target actual sample size of 16 subjects satisfying the inclusion criteria. The study aimed to include at least eight subjects in each group subjected to minimal incision and elliptical excision techniques for removing epidermal inclusion cysts. The sample size calculation was based on the comparison of wound lengths between two similar techniques as described by Chen et al. (2006). The comparison factor, wound length, was selected for its feasibility in power analysis compared to other factors in related studies. A two-sided, two-sample t-test between the technique groups with a significance level of 0.05 and power of 0.8 indicated that approximately 7-8 subjects per group would be sufficient to detect differences between the groups.

Study Outcomes

The primary outcomes of the study were the average procedure time, average scar length, and completeness of excision based on histopathology. Secondary outcomes included

complications and Hollander wound evaluation score (HWES).

Data Collection Tool and Method

Participants were recruited from the Out-Patient Department of the East Avenue Medical Center Department of Dermatology, following approval from the Institutional Ethics and Review Board of the East Avenue Medical Center.

The co-author carried out the recruitment of participants. Informed consent was obtained from those who qualified for the study after the study protocol, benefits, and risks were explained before treatment commenced. Participants were informed of the two possible treatments to which they could be assigned.

Surgical Procedure

All surgical procedures were performed by the primary author. The minimal operative surgery was based on the method described by Nakamura (9) and Rao et al (5).

1. The skin was prepped, and the area around the cyst was anesthetized with 1% lidocaine with epinephrine.
2. Using a #11 blade, an incision approximately 1/3 the size of the cyst was made on the central part of the cyst.
3. The contents of the cyst were expressed through the incision by applying compression.
4. After complete expression, the cyst wall was removed using a hemostat via the incision opening. In cases where the cyst wall could not be completely exuded, careful dissection using a hemostat and/or scissors was performed to aid in complete evacuation.
5. The wound was examined to ensure the entire cyst wall was removed.
6. Direct pressure was applied to the post-operative wound using sterile gauze, and interrupted and deep buried stitches were used to close the wound.

7. A topical antibiotic ointment and appropriate dressing were applied, and all patients were instructed to self-dress the wound until all signs of discharge disappeared.
8. The entire extracted cyst wall and contents were sent for histopathologic examination.

The conventional elliptical excision was based on the method described by Suliman (10). Preoperative preparation and anesthesia were identical to those described for the minimal incision technique. An elliptical excision was made based on the size of the cyst and the skin tension lines, with the major axis designed to be as small as possible for optimal cosmetic results.

1. An ellipse was drawn over the cyst with the punctum in the middle.
2. Using a no. 15 blade, a full-thickness skin incision was made along the drawn ellipse.
3. The skin was undermined to separate it from the cyst wall, and the angles of the ellipse were released first to facilitate dissection and removal of the cyst.
4. Finally, the whole cyst was dissected out, and the wound was closed with interrupted and deep buried stitches.
5. A topical antibiotic ointment and appropriate dressing were applied, and patients were instructed to self-dress the wound.
6. The extracted cyst wall and contents were sent for histopathologic examination.

Data including the date of operation, age and sex of the patient, location (truncal vs non-truncal), size of the cyst (maximum diameter in millimeters), length of the wound (maximum length in millimeters), procedure time (in minutes, from first incision to wound closure), and histopathology results were recorded.

Patients were followed up with a 2-week post-operative visit to measure the scar length (in millimeters), Hollander wound evaluation score (HWES), and identify complications. Follow-up

consults were conducted at 1 and 3 months post-operation to record complications and HWES scores. The co-author who did not perform the surgical procedures conducted the evaluations during follow-up consults.

Statistical Analysis

Univariate analysis

To summarize the general and clinical characteristics of the participants, descriptive statistics were employed. Nominal variables were evaluated using frequency and proportion, non-normally distributed interval/ratio variables were assessed using median and range, and normally distributed interval/ratio variables were evaluated using mean and standard deviation.

Shapiro-Wilk

The Shapiro-Wilk test was used to assess the distribution of numeric variables. Those not deviating from normality will be further assessed using parametric tests while those deviating from normality will be assessed using non-parametric tests.

Bivariate analysis

To determine the differences in mean, median, and frequency between two groups, independent T-test, Mann-Whitney U test, and Fisher's Exact/Chi-square test were utilized, respectively. These were performed to compare the distributions between the minimal incision and excision groups. Tests were performed with a two-sided hypothesis.

Missing variables were not replaced or estimated, and the null hypothesis was rejected at a 0.05 α -level of significance. Data analysis was conducted using R 4.3.1.

Limitations of the Study

The sample size of this study was limited to the number of epidermal inclusion cyst cases seen at the Outpatient Department of East Avenue Medical Center that met the inclusion criteria.

ETHICAL CONSIDERATION

The study protocol was submitted to the Technical Review Board and Institutional Ethics and Review Board of the East Avenue Medical Center for review and approval. The study adhered to the guidelines outlined in the NEGRHP 2022 and complied with the legal requirements of the DATA PRIVACY ACT 2012. Data gathered, including age, gender, location, and dermatologic diagnosis of the participants, were kept confidential. The identity, privacy, and confidentiality of all participants were protected. The identity of the participants remained anonymous throughout the study. All reference materials and sources used in the study were properly cited. The study was an individual-initiated research project required for residency training under the Department of Dermatology. The primary investigators were not associated with any sponsors or organizations and did not receive any monetary or other benefits for conducting this research. There were no conflicts of interest to declare.

RESULTS

Table 1. Demographic and procedure profile of participants by procedure techniques.

	Total (n=10)	Minimal Incision (n=11)	Excision (n=12)	p-value
	Frequency (%)			
	Mean $\pm$ SD; Median (IQR)			
Age, years	Mean: 48.74 $\pm$ 14.53, Median: 52 (19-71)	Mean: 41.64 $\pm$ 17.52, Median: 41 (19-71)	Mean: 55.25 $\pm$ 6.8, Median: 55 (43-66)	.0315 ^m
Sex				.6843 ^t
Male	11 (47.83)	6 (54.55)	5 (41.67)	
Female	12 (52.17)	5 (45.45)	7 (58.33)	
Site				.6957 ^m
Face	2 (8.7)	2 (18.18)	0	
Right cheek	1 (4.35)	1 (9.09)	0	
Neck	1 (4.35)	0	1 (8.33)	
Right neck	1 (4.35)	1 (9.09)	0	
Right axilla	1 (4.35)	0	1 (8.33)	
Back	7 (30.43)	4 (36.36)	3 (25)	
Upper back	3 (13.04)	1 (9.09)	2 (16.67)	
Right upper back	1 (4.35)	0	1 (8.33)	
Left back	1 (4.35)	0	1 (8.33)	
Right back	1 (4.35)	0	1 (8.33)	
Lower back	4 (17.39)	2 (18.18)	2 (16.67)	
EIC Diameter, cm	Mean: 1.25 $\pm$ 0.69, Median: 1 (0.3-2.9)	Mean: 1.44 $\pm$ 0.73, Median: 1.5 (0.3-2.8)	Mean: 1.07 $\pm$ 0.62, Median: 0.9 (0.5-2.9)	.1936 ^m
Operation duration, minutes	Mean: 31.86 $\pm$ 15.5, Median: 28.83 (8.68-79)	Mean: 32 $\pm$ 19.61, Median: 27.95 (8.68-79)	Mean: 31.73 $\pm$ 11.45, Median: 30.06 (17.75-62.97)	.5795 ^m
Scar length, cm	Mean: 1.59 $\pm$ 1.01, Median: 1.6 (0.1-4.1)	Mean: 0.72 $\pm$ 0.39, Median: 0.7 (0.1-1.5)	Mean: 2.38 $\pm$ 0.66, Median: 2.2 (1.6-4.1)	<.001 ^t

Statistical test used: t – Student's t-test, m – Mann-Whitney U test, f – Fisher's exact test, cs – Chi-square test with simulated p-value

In this randomized controlled trial, we compared the surgical outcomes of minimal incision and elliptical excision techniques in treating epidermal inclusion cysts (EIC) at a single center. Table 1 summarizes the demographic and procedural profiles of patients, illustrating key differences and similarities between the two techniques. Patients had a mean age of 48.74 years; those undergoing minimal incision were significantly younger (41.64 years) than those undergoing excision (55.25 years) ($p=0.0315$). The sex distribution was equal, with no significant differences between techniques ($p=0.6843$). The most common site was the back (30%), followed by the lower back (17%). Sites around the head were all

treated with minimal incision, while those on the back were predominantly treated with excision, though this was not statistically significant ($p=0.6957$). The median EIC diameter was 1.25 cm, with no significant size difference between techniques ($p=0.1936$). The median operation duration was 31.86 minutes, with no significant difference between procedures ($p=0.5795$). The mean scar length was significantly shorter in the minimal incision group (0.72 cm) compared to the excision group (2.38 cm) ($p<0.001$). This finding suggests that while both procedures take a similar amount of time, minimal incision results in less scarring.

Table 2. Outcomes of EIC removal, by technique.

	Total (n=23)	Minimal Incision (n=11)	Excision (n=12)	p-value
		Frequency (%); Mean $\pm$ SD		
Completeness of excision				.0123 ^f
Yes	13 (56.52)	3 (27.27)	10 (83.33)	
No	10 (43.48)	8 (72.73)	2 (16.67)	
Two – week follow up				
Scar length at 2 weeks, cm	Mean: 1.3 $\pm$ 0.97, Median: 1.2 (0.1-3.3)	Mean: 0.44 $\pm$ 0.21, Median: 0.5 (0.1-0.7)	Mean: 2.1 $\pm$ 0.63, Median: 2.05 (1.2-3.3)	<.001 ^m
HWES at 2 weeks	Mean: 0.96 $\pm$ 0.64, Median: 1 (0-2)	Mean: 0.91 $\pm$ 0.54, Median: 1 (0-2)	Mean: 1 $\pm$ 0.74, Median: 1 (0-2)	.7777 ^m
Complications at 2 weeks				
Dehiscence	2 (8.7)	2 (18.18)	0	.2174 ^f
Drainage	2 (8.7)	2 (18.18)	0	.2174 ^f
Tenderness	2 (8.7)	2 (18.18)	0	.2174 ^f
One – month follow up				
HWES at 1 month	Mean: 0.35 $\pm$ 0.49, Median: 0 (0-1)	Mean: 0.36 $\pm$ 0.5, Median: 0 (0-1)	Mean: 0.33 $\pm$ 0.49, Median: 0 (0-1)	.9110 ^m
Complications at 1 month	0	0	0	
Recurrence at 1 month	0	0	0	
Three – month follow up				
HWES at 3 months	Mean: 0.3 $\pm$ 0.47, Median: 0 (0-1)	Mean: 0.36 $\pm$ 0.5, Median: 0 (0-1)	Mean: 0.25 $\pm$ 0.45, Median: 0 (0-1)	.5892 ^m
Complications at 3 months	0	0	0	
Recurrence at 3 months	0	0	0	

Statistical test used: m – Mann-Whitney U test, f – Fisher's exact test

Table 2 summarizes and compares the outcomes between procedures. Complete excision by histopathology was found in 56% of patients, with a significantly higher completeness in the excision group (83%) compared to the minimal incision group (27%) ($p=0.0123$). The median scar length after 2 weeks was significantly shorter in the minimal incision group (0.44 cm) compared to the excision group (2.1 cm) ($p<0.01$). The median HWES at 2 weeks was 1, with no significant difference between procedures ($p=0.7777$). Complications such as dehiscence, drainage, and tenderness

were reported in 2 patients, all from the minimal incision group, but this difference was not significant ($p=0.2174$). After 1 month, the median HWES was 0, with no complications or recurrences reported (Appendix). This trend continued at the 3-month follow-up, with a median HWES of 0 and no further complications or recurrences reported.

DISCUSSION

Epidermal inclusion cysts (EICs) are common benign lesions of the skin, often requiring surgical intervention when symptomatic,

aesthetically concerning, or potentially prone to complications such as infection. There are several surgical techniques for EIC removal including elliptical excision and the minimal incision technique. The elliptical excision, which is considered the gold standard of treatment, involves a larger elliptical-shaped incision to ensure complete removal of the cyst and its capsule, thereby minimizing the risk of recurrence. However, this method often results in a longer scar, which can be cosmetically displeasing to patients. In contrast, the minimal incision technique, which uses a smaller incision to extract the cyst, offers the benefit of shorter scars but may compromise the completeness of cyst removal.

Despite the use of several techniques, there is limited evidence directly comparing their surgical outcomes, particularly in terms of scar length, completeness of excision, and postoperative complications. This study seeks to address this gap by conducting a randomized controlled trial to compare the outcomes of the two techniques. The study examines key factors such as scar length, operation time, completeness of excision, complication rates, and long-term wound healing and cosmetic satisfaction.

Patient Demographics

Patients undergoing the excision technique were significantly older than those receiving the minimal incision technique (mean ages of 55.25 ± 6.8 years vs. 41.64 ± 17.52 years, respectively; $p = 0.0315$). This age difference is important because younger patients typically have better skin elasticity and healing capacity, which could influence the outcomes like scar formation and healing time [12]. However, this age disparity introduces a confounding factor, making it difficult to attribute differences in outcomes solely to the surgical technique without considering the impact of age.

Operation Time

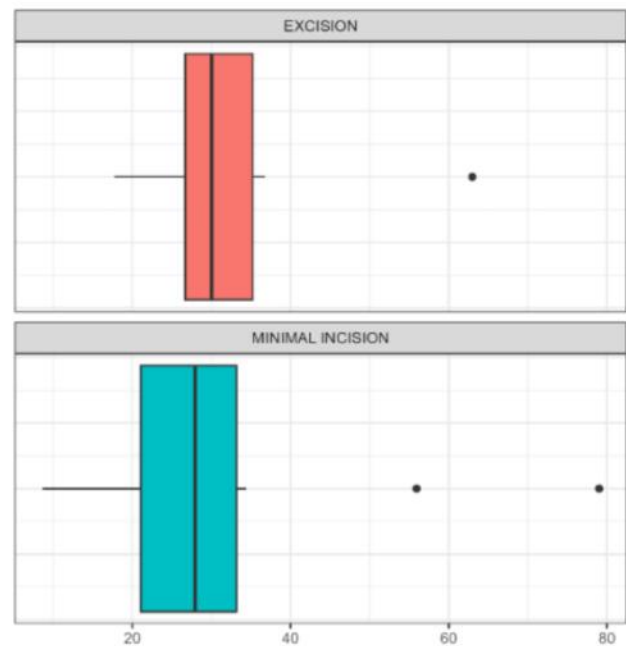


Figure 1. Total operation duration, in minutes.

Figure 1 shows the total duration in minutes of both elliptical excision and minimal incision techniques. The median operation duration of 31.86 minutes, with no significant difference between minimal incision and elliptical excision procedures ($p=0.5795$), can be explained by the fact that while minimal incision aims to reduce the size of the surgical opening, taking out larger cysts through smaller openings can be more challenging and time-consuming [2].

A smaller incision restricts the access of the surgeon to the cyst, making it more difficult to see and manipulate the tissue. This can increase the difficulty of properly grasping and removing the entire cyst without leaving behind remnants that could lead to recurrence.

This added difficulty may offset the time savings expected from a smaller incision, leading to a comparable overall operation duration between the two techniques.

Scar Length

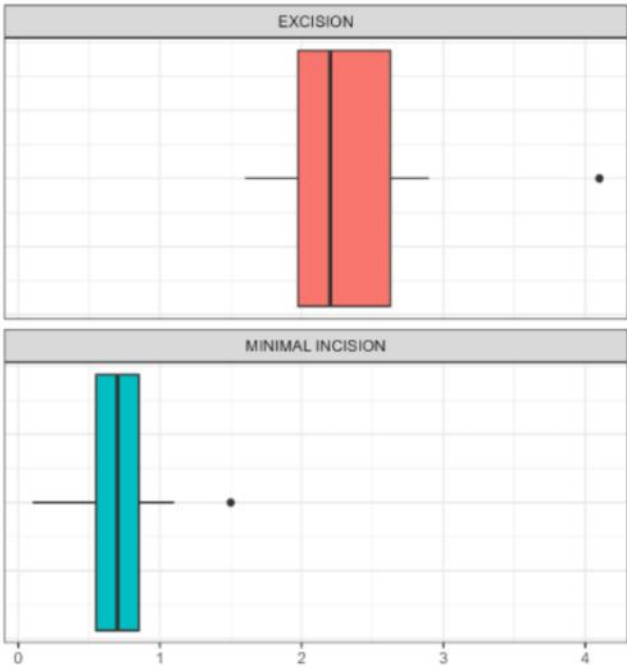


Figure 2a. Scar length after operation,in centimeters.

The excision technique resulted in significantly longer scars (mean: 2.38 ± 0.66 cm) compared to the minimal incision technique (mean: 0.72 ± 0.39 cm), with a significant p-value of <0.001 (Figure 2a). This finding is consistent with the nature of the techniques, where excision requires a larger incision to fully remove the cyst, whereas minimal incision involves a smaller incision.

In a study done by Alijanpour et al comparing the surgical outcomes of minimal excision and elliptical excision techniques in treating epidermal inclusion cysts, the average wound length in the minimal excision group was 2.4 ± 0.50 cm, with no wound exceeding 3 cm, regardless of the cyst's original size. Meanwhile in the elliptical excision group, the wounds were still larger, especially for cysts over 1 cm, due to the need to maintain a long axis two to three times the length of the short axis [8].



Figure 2b. Scar length after 2 weeks, in centimeters.

At the two-week follow-up (Figure 2b), the scar lengths remained significantly shorter in the minimal incision group (mean: 0.44 ± 0.21 cm) compared to the excision group (mean: 2.1 ± 0.63 cm), reinforcing the initial observations. The healing process after a larger excision involves more extensive tissue repair, which can prolong

scar maturation and result in longer visible scars even weeks after the procedure. The minimal incision technique, by virtue of its smaller wound size, undergoes a quicker healing process with less extensive scar tissue formation, leading to shorter and less noticeable scars over time.

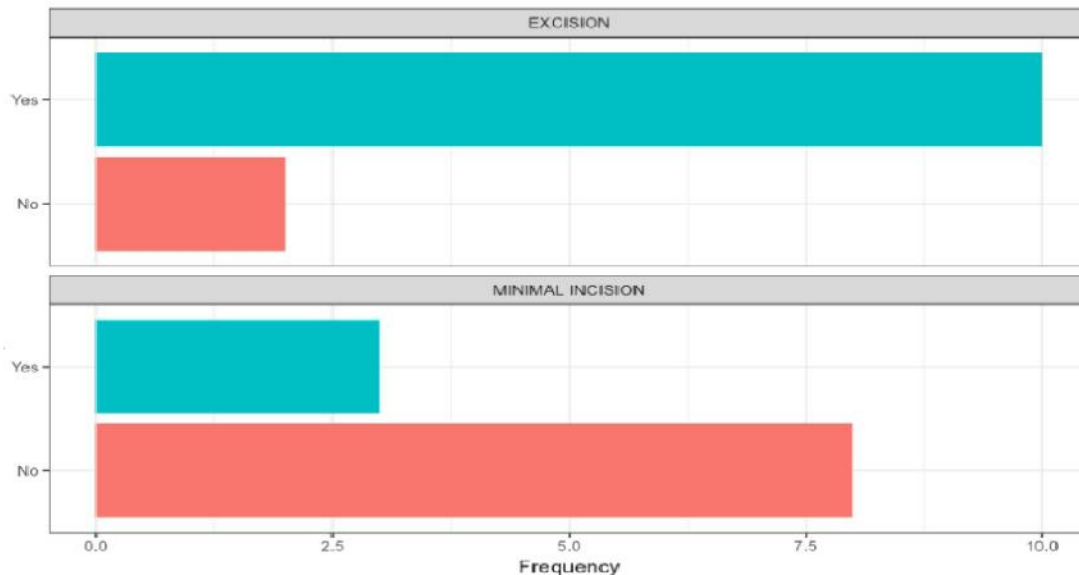


Figure 3. Completeness of excision.

Figure 3 shows that the excision technique had a significantly higher rate of complete excision (83%) compared to the minimal incision technique (27%) with a p-value of 0.0123. This suggests that while the excision method may lead to longer scars, it is more effective at fully removing the cyst, reducing the risk of recurrence.

The elliptical excision technique involves a larger and more comprehensive removal of both the cyst and the surrounding tissue, which includes the cyst capsule. This thorough approach minimizes the likelihood of leaving behind residual cystic material, which is a common cause of recurrence in less extensive procedures. The larger incision and excision margins allow for better visualization and access to the entire cyst, facilitating a more complete removal.

The minimal incision technique, on the other hand, is designed to minimize scarring, but this may come at the cost of less extensive tissue dissection. The smaller incision restricts the ability to fully explore the cyst cavity and ensure that all remnants of the cyst and its capsule are removed. This limitation can lead to incomplete excision, with portions of the cyst remaining, which subsequently increases the risk of recurrence.

Complications

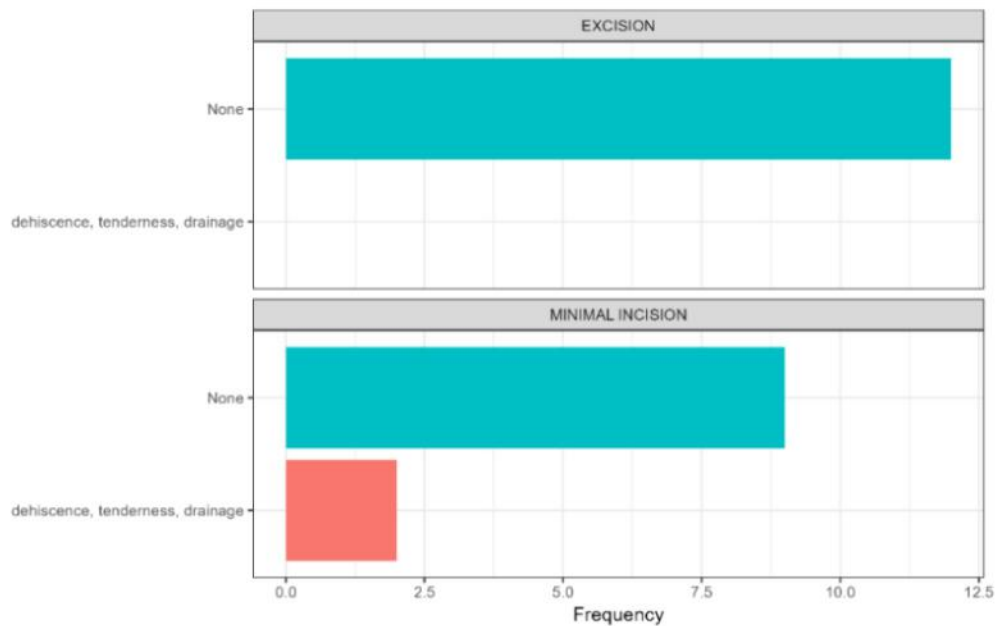


Figure 4. Complications at 2 weeks

At the two-week follow-up, complications such as dehiscence, drainage, and tenderness were reported in the minimal incision group but not in the excision group. Although these complications were not statistically significant ($p = 0.2174$), their clinical significance should not be overlooked, especially considering the higher rate of incomplete excision in the minimal incision group.

For the long-term outcomes, no complications were reported at the one-month and three-month follow-ups in either group, indicating that both techniques are effective in the long term with respect to wound healing and the absence of recurrences.

The minimal incision technique has a higher rate of incomplete excision, which can leave behind remnants of the cyst or its capsule. These remnants can lead to ongoing inflammation, resulting in complications such as drainage and tenderness as the body attempts to expel the remaining cystic material. This incomplete excision increases the risk of postoperative complications,

including wound dehiscence, as the unresolved inflammation can impair wound healing.

The lack of complications at one and three months suggests both techniques are effective for long-term wound healing. This can be attributed to the natural healing process, including collagen deposition and tissue remodeling, which resolves initial issues like inflammation and tenderness. Even if early complications occur, they are usually temporary and resolve as the wound heals. By one month, any cystic material causing early problems would have been absorbed or expelled, and scar tissue formation helps stabilize the area, leading to similar long-term outcomes for both techniques.

Wound Healing and Aesthetic Satisfaction

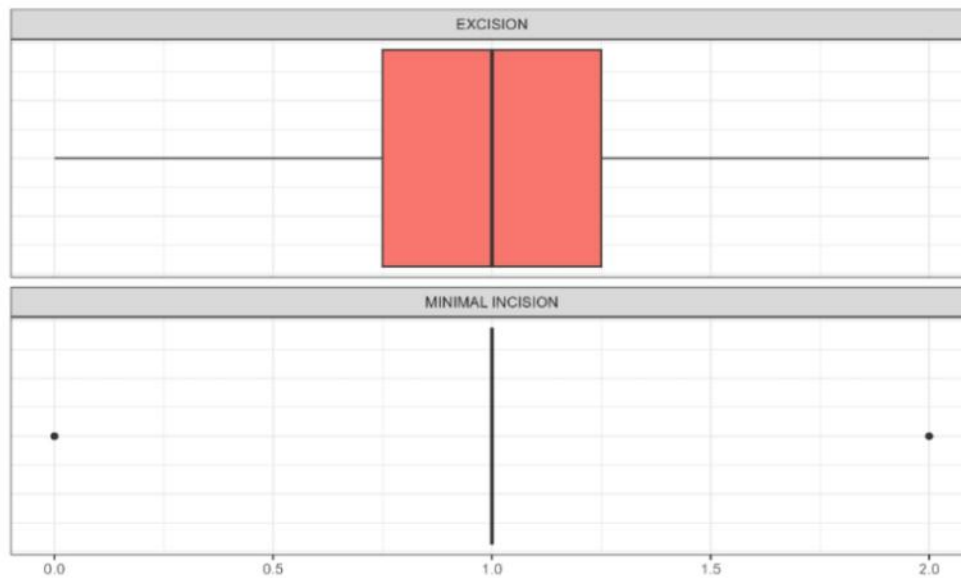


Figure 5. Holland Wound Evaluation Score (HWES) at 2 weeks.

Despite the differences in scar lengths, the HWES remained similar between the two groups at two weeks, one month, and three months. This suggests that from a patient satisfaction and healing perspective, both techniques are comparable in the long run.

While elliptical excision often results in longer scars, patient satisfaction is influenced by various factors such as scar color, texture, visibility, and overall integration into the surrounding tissue rather than just length. Some studies indicate that patients tend to adapt to the presence of scars over time, with initial concerns about scar length diminishing as the scars heal and mature. This psychological adaptation may explain why satisfaction scores, such as the Hollander Wound Evaluation Score (HWES), converge over time despite differences in initial scar lengths [13].

LIMITATIONS

The smaller sample size for minimal incision patients in the analysis of older patients limits the generalizability of these findings.

The significant age difference between the two groups could influence the outcomes, particularly regarding healing and scar formation, which should be considered when interpreting the results.

While the study reported outcomes at two weeks, one month, and three months, these follow-up periods may not be sufficient to capture late complications or recurrences, particularly in cases of incomplete excision. Longer follow-up would be necessary to fully understand the long-term efficacy and safety of both techniques.

CONCLUSION AND RECOMMENDATIONS

Both the minimal incision and excision techniques are viable options for EIC removal, with specific advantages and disadvantages. The excision technique offers a higher likelihood of complete cyst removal at the cost of longer scars, whereas the minimal incision technique provides better cosmetic outcomes in terms of scar length but with a higher risk of incomplete excision and potential complications. Clinicians should weigh these factors, along with patient preferences and specific clinical scenarios, when deciding on the appropriate surgical technique.

Future studies should aim to include a larger sample size to increase the statistical power of the findings. A larger cohort would allow for more reliable subgroup analyses and more definitive conclusions about the efficacy and safety of the two techniques.

To control for the potential confounding effect of age, future studies should either match patients by age or stratify the randomization process to ensure comparable age distributions between groups. This approach would help isolate the effect of the surgical technique on outcomes.

To better understand the long-term outcomes, including late complications and recurrence rates, future studies should include longer follow-up periods, ideally extending to one year or more. This would provide a more comprehensive assessment of the durability and safety of both surgical techniques.

Future research should expand the assessment of patient-reported outcomes beyond HWES scores. Including measures of pain, functional outcomes, and psychological impact would provide a more holistic understanding of how these surgical techniques affect quality of life of the patients.

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APPENDIX

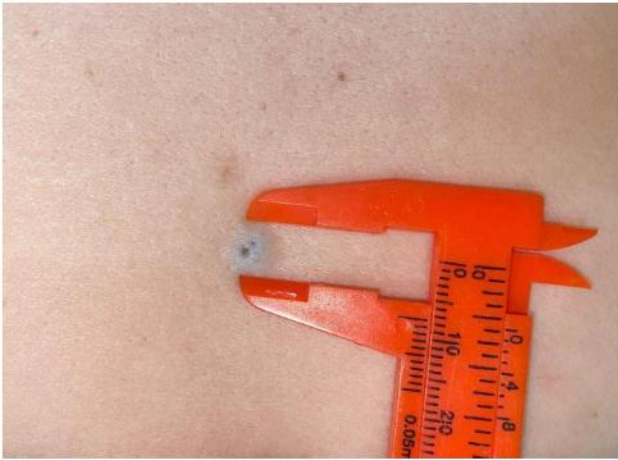


Figure 1a. EIC before excision technique. **1b.** EIC 1 month post-excision technique.



Figure 2a. EIC before minimal incision technique. **2b.** EIC after minimal incision technique.