BMC Endocrine Disorders

RESEARCH

Open Access

A comparative study on the short-term and long-term efficacy of endoscopic lipolysis, liposuction, and traditional open excision in gynecomastia treatment

Xiao Diao[1], Meng Wang[2], Di Chen[3], Haojie Jiang[4], Wanwan Wang[4], Linxin Zhang[5] and Hanchao Zhang[4*]

Abstract

Objective This study investigates the comparative short-term and long-term efficacy of endoscopic lipolysis and liposuction versus traditional open excision in the treatment of gynecomastia.

Methods A total of 140 male patients diagnosed with gynecomastia and admitted to our hospital from April 2021 to May 2022 were enrolled in this study. Patients were randomly assigned to two groups based on the surgical treatment method: the control group (traditional open excision, $n=70$) and the observation group (liposuction under endoscope, $n=70$). Comprehensive demographic and clinical data were collected for both groups. Surgical indicators, postoperative complication rates, and pain levels measured using the Visual Analog Scale (VAS) one month post-surgery were observed and compared. Additionally, recurrence rates and patient satisfaction scores were evaluated one year after the procedure.

Results There were no significant differences in demographic and clinical characteristics between the two groups ($P>0.05$). The observation group exhibited shorter incision lengths, reduced operation times, and decreased hospital stays compared to the control group ($P<0.05$), alongside less intraoperative bleeding ($P<0.05$). The incidence of postoperative complications was significantly lower in the observation group ($P<0.05$). At one and three weeks post-surgery, the observation group reported lower VAS scores for pain compared to the control group ($P<0.05$). There were no significant differences in recurrence rates between the groups one year post-surgery ($P>0.05$). However, the observation group achieved higher scores in terms of chest appearance, wound scarring, nipple and areola aesthetics, and overall satisfaction ($P<0.05$).

Conclusion Endoscopic lipolysis and liposuction not only demonstrate advantages such as lower complication rates and expedited recovery in the treatment of gynecomastia but also provide long-term efficacy comparable to traditional surgical methods. This approach significantly enhances patient satisfaction, establishing it as a preferred treatment option due to its safety profile and ability to deliver superior cosmetic outcomes.

Keywords Laparoscopic liposuction and liposuction, Traditional open resection, Gynecomastia, Effect comparison

*Correspondence:
Hanchao Zhang
fmnp54@163.com

Full list of author information is available at the end of the article

Introduction

Gynecomastia, a prevalent endocrine disorder characterized by the involuntary hyperplasia of male breast tissue, significantly impacts both the physical health and psychological well-being of affected individuals. The primary surgical techniques employed in its management are traditional open excision and endoscopic liposuction [1, 2]. Finding an effective treatment that minimizes postoperative discomfort and enhances recovery is crucial.

The ultrasound image of breast dysplasia presents as glandular echoes with mild dilation of ducts below the nipple. Ultrasound diagnosis has the advantages of non invasiveness, non radiation, low cost, and easy operation, and can clearly display the internal structure and lesions of the breast. It is suitable for early screening and monitoring of breast diseases. However, its ability to display small calcifications and spiculated changes is weak, and its display of parasternal lymph node metastasis is limited. MRI has outstanding performance in the diagnosis of male breast development, which can clearly display the subtle structure and blood supply of breast tissue. Its high-resolution images are helpful in accurately determining the degree of breast tissue hyperplasia and have important value in detecting early lesions, providing reliable basis for clinical diagnosis and treatment decisions. MRI and ultrasound have their own advantages in the diagnosis of breast dysplasia. MRI can provide multidimensional imaging, with high resolution for soft tissue, and accurately evaluate the benign, malignant, and extent of lesions; Ultrasound operation is simple, fast, non-invasive, sensitive to nodules, and suitable for general screening and dynamic observation. The combination of the two can improve diagnostic accuracy.

Traditionally, open excision has been considered the gold standard for its ability to thoroughly remove excess breast and adipose tissue, demonstrating high efficacy in treating gynecomastia [3–5]. This method involves making a larger incision to directly excise the tissue, effectively reducing recurrence rates. However, the associated larger incisions can lead to prolonged recovery times and more pronounced scarring, which may adversely affect the patient's appearance and mental health.

Recent advances in medical technology have introduced endoscopic liposuction as a minimally invasive alternative that is gaining attention [3, 6, 7]. This technique employs an endoscope and liposuction equipment introduced through small incisions, allowing for precise identification and dissolution of breast and adipose tissue. As a result, it minimizes surgical trauma and pain, thereby accelerating recovery [8, 9]. The minimally invasive nature of endoscopic surgery leads to smaller scars and shorter recovery periods, significantly enhancing the postoperative experience and overall quality of life for patients [10–12].

While the short-term benefits of endoscopic surgery are well-documented, including reduced operation times, lower complication rates, and expedited recovery, data regarding its long-term efficacy and recurrence rates remain limited. This gap has fueled ongoing debate within the medical community concerning the significant differences in long-term outcomes between these surgical methods. Specifically, understanding the long-term recurrence rates and patient satisfaction associated with endoscopic liposuction compared to traditional open excision is a key area of current research.

Therefore, this study aims to compare the short-term and long-term effectiveness of endoscopic liposuction and traditional open excision in managing gynecomastia. The objective is to provide clinicians with a comprehensive framework to guide treatment decisions.

Materials and methods

Demographic data of patients

This study is a prospective analysis employing a convenience sampling method. From April 2021 to May 2022, a total of 140 male patients diagnosed with gynecomastia were enrolled upon admission to our hospital. The diagnosis of gynecomastia was confirmed through ultrasound imaging. The study received approval from the Ethics Committee of Xuzhou Municipal Hospital Affiliated to Xuzhou Medical University and was conducted in accordance with the principles outlined in the Declaration of Helsinki II.

Diagnostic criteria and grading of male breast development

1. **Physical signs**: Gynecomastia is diagnosed when the diameter of the palpable breast mass exceeds 2.0 cm. A comprehensive physical examination is essential to determine the size and extent of the lesion, whether it is unilateral or bilateral, the presence of secretions, tenderness, and the evaluation of secondary sexual characteristics.
2. **Medical history**: A thorough review of the patient's medical history is critical for diagnosis, including medication history, and any history of liver or kidney diseases, sexual dysfunction, and environmental factors related to work and living conditions.
3. **Auxiliary examinations**: When necessary, additional diagnostic tools such as X-ray, ultrasound, and laboratory tests are employed to elucidate the etiology and assist in determining the appropriate treatment strategy. Routine laboratory evaluations should include assessments of liver and kidney function, as well as sex hormone levels. In cases where malignant transformation is suspected, fine

needle aspiration cytology or core needle biopsy may be performed for histopathological examination.

4. **Classification**: Male breast development is classified into three grades and four degrees based on breast size and the presence of excess skin, following Simon's criteria:

- **Grade I**: Mild glandular hypertrophy without excess skin.
- **Grade IIa**: Moderate enlargement of glandular tissue without skin redundancy.
- **Grade IIb**: Moderate glandular hypertrophy accompanied by excess skin.
- **Grade III**: Severe glandular hypertrophy with significant excess skin.

To ensure the accuracy and uniformity of the subject diagnosis, all enrolled patients underwent both ultrasound and MRI examinations simultaneously。.

Inclusion criteria

Participants included in this study were patients with primary or secondary gynecomastia, aged between 18 and 50 years, who had a confirmed diagnosis through clinical examination and relevant imaging modalities, such as ultrasound or MRI. Eligibility required that patients experienced visible breast development symptoms for at least 6 months, expressed a willingness to undergo surgical intervention, and had a clear medical indication for surgery. All participants were required to be in a general health condition suitable for surgery, with no serious comorbidities or high-risk conditions, and were able to understand the study's objectives and provide informed consent voluntarily.

Exclusion criteria

Patients were excluded if they met any of the following criteria: presence of pre-existing heart, liver, or kidney diseases, or any significant health conditions that could impact the surgical procedure or recovery. Individuals with known coagulation disorders or those currently undergoing anticoagulant therapy were also excluded. Patients with uncontrolled hormonal imbalances, such as hyperthyroidism or adrenal dysfunction, were not eligible. Additionally, those taking medications that might affect breast development or confound study outcomes, such as steroids or other hormones, were excluded. Lastly, individuals with a history of previous breast surgeries were not included in the study.

Surgical plan

Patients were randomly assigned to one of two groups based on the surgical treatment method: the control group (traditional open resection, $n = 70$) and the observation group (endoscopic liposuction, $n = 70$).

Control group Traditional open resection surgery was employed for treatment.

Preoperative procedure The patient was positioned standing, with both arms naturally hanging, and the area of breast hypertrophy was marked. Infiltration anesthesia was administered. Subsequently, the patient was repositioned supine with both upper limbs abducted at 90 degrees.

Intraoperative procedure An arc-shaped incision was marked along the inframammary fold, measuring approximately 5–6 cm in length. The skin and subcutaneous tissue were incised along this marked line. Upon entering the incision, an electric knife was utilized to separate the breast tissue from the surrounding subcutaneous tissue. The gland was carefully elevated to the defined boundary, and the tissue was gradually peeled away from the surface of the pectoralis major muscle. A 1.5–2 cm thick layer of glandular tissue was preserved beneath the nipple to ensure adequate blood supply and to prevent necrosis. Hemostasis was achieved through electrocoagulation, and a drainage tube was placed in the incision cavity. The incision was then sutured, and a pressure bandage was applied with elastic material.

Observation group The treatment involved endoscopic liposuction and lipolysis.

Positioning and incision selection The patient was positioned seated or standing, with the area of hyperplasia marked prior to making three small incisions along the midaxillary line. The middle incision was placed at the flat nipple (10 mm), while the upper and lower incisions measured 5 mm each, positioned 6–8 cm from the central incision. General anesthesia was administered, and the patient was repositioned supine with a positioning pad under the affected shoulder, abducting the affected limb at 90 degrees and securing it with sterile dressing.

Establishment of spatial operation A ventilation technique was employed to inflate the surgical field with CO2 at a pressure of 6–10 mmHg.

Preparation of the swelling anesthesia fat solution A solution comprising 250 ml of physiological saline, 250 ml of sterile water, 20 ml of lidocaine, and 1 mg of adrenaline was injected subcutaneously into the breast area. The injection was performed based on the preoperatively marked area of breast hypertrophy to create swelling. The breast was subsequently manipulated to evenly dis-

tribute the fat solution until the local tissue became firm, the skin turned pale, and an "orange peel" appearance was observed.

Liposuction procedure A trocar with a diameter of approximately 0.5 cm was inserted at the pre-marked entry site, allowing the suction head to be introduced at a negative pressure of 0.2–0.8 kPa. During subcutaneous liposuction, care was taken to avoid positioning the suction head's side hole towards the skin. When suctioning the posterior breast space, the side hole was oriented towards the gland, and when suctioning in the axillary region, it was directed away from the axillary vein to minimize trauma. After completing the liposuction, the surgical field was assessed under laparoscopy. Negative pressure drainage was placed at the insertion point of the liposuction needle, followed by suturing of the incision. An elastic bandage was applied externally for fixation, and the patient was instructed to wear a post-liposuction elastic vest for one month to apply pressure for shaping.

Analysis of surgical indicators

During the surgical procedure, precise measurements of incision length were recorded for each patient. The operation time was documented, spanning from the initiation of the procedure to the completion of suturing, thereby capturing the total duration of the surgery. Additionally, the actual number of hospitalization days, calculated from the time of admission to discharge following the operation, was systematically recorded. This meticulous data collection facilitated a thorough evaluation of the efficiency of the two surgical techniques in question and provided insights into patient recovery rates.

Statistics of short-term postoperative complications

Patients were regularly monitored at intervals of one week, one month, and three months post-operatively to identify any complications through clinical examinations and imaging evaluations. The incidence of complications occurring within the three-month period was recorded. Comprehensive assessments included monitoring the surgical site for signs of inflammation—such as redness, discharge, or elevated temperature—to detect possible wound infections. Additionally, evaluations were conducted for any discoloration or tissue necrosis in the nipple and areola region to ascertain the presence of nipple and areola necrosis. Subcutaneous hematomas were detected via tactile examination, with supplementary ultrasound imaging employed as necessary. Furthermore, the wound healing progress was documented within three weeks post-operation to assess for any delayed healing.

Visual analog scale (vas)

The Visual Analog Scale (VAS) [13] was employed to assess pain levels experienced by patients at one week and three weeks post-surgery. The VAS quantifies pain on a scale ranging from 0 to 10, where 0 indicates "no pain" and 10 signifies the "worst imaginable pain." Prior to surgery, patients received comprehensive instructions regarding the VAS scoring method to ensure they understood how to accurately report their pain levels based on personal sensations. At one week and three weeks post-operation, medical personnel assisted patients in completing the VAS assessment.

Postoperative recurrence rates

All patients participated in regular follow-up assessments at three months, six months, and twelve months post-surgery. During these evaluations, changes in breast tissue volume were initially assessed through clinical examination, with ultrasound or MRI imaging employed as necessary. Recurrence was defined as a greater than 20% increase in breast volume. Additionally, patients were interviewed regarding any breast pain, with pain intensity quantified using the VAS. Any discomfort reported by patients, such as local itching or tingling, was carefully documented. The collected data were subsequently subjected to statistical analysis using the chi-square test or Fisher's exact test to compare recurrence rates and associated symptoms between the two surgical methods. It is important to note that in this study, recurrence diagnosis was established through a combination of clinical examination, ultrasound, and MRI.

Satisfaction survey

This research questionnaire (supplementary file 1) was meticulously designed and validated according to standardized protocols. The objectives of the survey were clearly defined prior to the development of the questionnaire, focusing on key aspects such as healthcare quality, hospital facilities, services provided by doctors and nurses, and waiting times.

Development of the questionnaire

1. **Clear and concise questions**: Each question was crafted to be straightforward and unambiguous, aligning with the survey objectives.
2. **Diverse question types**: The questionnaire incorporated various question formats, including closed-ended questions (yes/no, multiple choice), satisfaction scales (ranging from 1 to 5 or 1 to 10), and open-ended questions that invited detailed responses. This approach aimed to gather comprehensive data.

3. **Topical grouping**: Questions were organized by themes—such as healthcare, environment, and communication—to facilitate understanding and response from patients.
4. **Avoidance of double negatives**: The questionnaire was designed to minimize the use of double negatives, thereby reducing potential confusion for respondents.
5. **Neutral language**: All questions were phrased in neutral terms, avoiding bias and emotionally charged vocabulary.
6. **Single questions**: Care was taken to avoid combining multiple questions into one, ensuring each query received a clear and focused answer.
7. **'Not applicable' option**: For certain questions, a 'Not Applicable' option was included to help prevent misleading responses.
8. **Adequate space for responses**: Sufficient space was provided for open-ended questions to allow patients to articulate their thoughts comprehensively.
9. **Pre-testing the questionnaire**: Before the formal investigation, the questionnaire underwent pre-testing to gather feedback and ensure clarity and relevance.
10. **Anonymity and Privacy**: The survey emphasized respondent anonymity to encourage honest answers while safeguarding privacy.
11. **Balanced questions**: A mix of positive questions (regarding satisfaction) and negative questions (addressing dissatisfaction) was included to ensure balanced feedback.
12. **Controlling length**: The questionnaire was designed to be concise to prevent respondent fatigue, with shorter surveys typically yielding higher response rates.
13. **Logical flow**: The order of questions was structured logically to enhance comfort and ease of response for participants.
14. **Feedback opportunity**: An open-ended question was included at the end of the questionnaire to invite additional comments or suggestions from patients.
15. **Multilingual versions**: For hospitals serving multilingual populations, a translated version of the questionnaire was made available to ensure inclusivity.
16. **Data analysis plan**: Consideration was given to the methods of data analysis and interpretation during the questionnaire design to ensure alignment between questions and data collection techniques.

Follow-up and data collection

During the one-year follow-up post-operation, a specially designed questionnaire [14] was administered, encompassing four dimensions: chest appearance, wound scar assessment, nipple and areola appearance, and overall satisfaction. Each dimension was rated on a scale from 0 to 5, where 0 indicated extreme dissatisfaction and 5 represented extreme satisfaction. Responses were collected through face-to-face or telephone interviews conducted by independent assessors and subsequently entered into statistical software for analysis.

Statistical analysis

Data were analyzed using SPSS 20.0 statistical software (IBM, USA). Measurement data were expressed as "mean ± standard deviation" (± s), with inter-group comparisons conducted using one-way ANOVA or repeated measures ANOVA. Pairwise comparisons between groups were performed using the LSD t-test. Categorical data were reported as percentages (%), and inter-group comparisons were conducted using χ^2 analysis. A p-value of <0.05 was considered statistically significant. The sample size of this project is calculated according to the following formula: N = Z2 × {P × (1-P)}/E2. N: For sample size; Z: As a statistical measure, with a confidence level of 95%, z = 1.96; When the confidence level is 90%, z = 1.64; E: For the error value; P: For probability values; 140 samples is the minimum sample size for quantitative research.

Results

Demographic characteristics of patients

The patients ranged in age from 19 to 50 years, with a mean age of 35.25 ± 4.67 years. Among these patients, 7 had unilateral breast development and 133 had bilateral breast development. In the control group, the mean age was 35.34 ± 5.26 years, the mean BMI was 23.45 ± 1.67 kg/m2, and the mean disease duration was 2.35 ± 0.54 years. According to Simon's grading, there were 6 cases of grade I, 33 cases of grade IIa, and 31 cases of grade IIb. Additionally, 24 cases reported smoking and 31 cases reported drinking. In the observation group, the mean age was 35.18 ± 4.77 years, the mean BMI was 23.29 ± 1.85 kg/m2, and the mean disease duration was 2.47 ± 0.66 years. According to Simon's classification, there were 8 cases of grade I, 37 cases of grade IIa, and 35 cases of grade IIb. Furthermore, 26 cases reported smoking and 33 cases reported drinking. Overall, there were no significant differences in the general characteristics between the two groups ($P>0.05$) (Table 1).

Comparison of surgical indicators

In the observation group, the incision length, operation time, and hospitalization duration were all shorter compared to the control group ($P<0.05$). Additionally, the amount of wound bleeding in the observation group was significantly lower than that in the control group ($P<0.05$) (Table 2).

Table 1 Demographic data of patients

Index	Control group (*n* = 70)	Observation group (*n* = 70)	T value / χ^2value	*P* value
Age (years)	35.34 ± 5.26	35.18 ± 4.77	4.225	0.441
BMI (kg/m^2)	23.45 ± 1.67	23.29 ± 1.85	2.061	0.262
Course of disease (year)	2.35 ± 0.54	2.47 ± 0.66	3.447	0.144
Simon's grading				0.355
Grade I (%)	6 (8.57%)	8 (11.43%)	2.001	0.218
IIa (%)	33 (47.14%)	37 (52.85%)		
IIb (%)	31 (44.29%)	35 (35.72%)		
Smoking (%)	24 (34.28%)	26 (37.14%)	0.785	0.274
Drinking (%)	31 (44.28%)	33 (47.14%)	1.227	0.404

Table 2 Comparison of surgical indexes ($\overline{X}$±s)

Groups	Incision length (cm)	Operation time (min)	Blood loss (ml)	Length of stay (d)
Control group (*n* = 70)	0.51 ± 0.16	72.35 ± 8.44	40.32 ± 4.16	5.44 ± 1.23
Observation group (*n* = 70)	3.05 ± 0.24	52.61 ± 5.37	28.68 ± 2.59	2.35 ± 0.58
T value	11.45	9.274	13.583	14.229
P value	0.001	0.006	0.001	0.001

Analysis of short-term postoperative complications

The incidence of postoperative complications was documented. In the control group, there were 5 cases of wound infection, 4 cases of nipple and areola necrosis, 5 cases of subcutaneous hematoma, and 6 cases of delayed wound healing, resulting in a complication rate of 28.57%. Conversely, in the observation group, there was 1 case of nipple and areola necrosis and 2 cases of subcutaneous hematoma, leading to a complication rate of 2.85%. Notably, the incidence of postoperative complications in the observation group was significantly lower than that in the control group ($P < 0.05$) (Table 3).

Comparison of vas scores one month post-operation

The VAS scores for wound pain in the observation group were evidently lower than those in the control group at both one week and three weeks post-operation ($P < 0.05$) (Fig. 1; Table 4).

Analysis of long-term recurrence

Rates Post-operation Comparing patient recurrence rates one year post-operation, the control group exhibited 4 cases of breast tissue enlargement, 3 cases of breast pain, and 4 cases of other discomfort. Similarly, the observation group had 6 cases of breast tissue enlargement, 4 cases of breast pain, and 3 cases of other discomfort. Notably, there were no significant differences in the recurrence rates between the two groups ($P > 0.05$) (Table 5).

Long-term postoperative satisfaction scores

Comparing patient satisfaction scores one year postoperation, the observation group demonstrated higher scores in chest appearance, wound scar, nipple and areola appearance, and overall satisfaction compared to the control group ($P < 0.05$) (Fig. 2; Table 6).

Discussion

Male mammary dysplasia, commonly referred to as gynecomastia, is characterized by abnormal hyperplasia of male breast tissue. This condition can arise from various factors, including hormonal imbalances, medication side effects, genetic predisposition, or underlying health conditions [14, 15]. Gynecomastia may cause not only physical discomfort—such as breast pain and sensitivity—but also psychological distress and social embarrassment.

Two primary surgical interventions for male breast development are endoscopic liposuction and traditional open excision. Endoscopic liposuction, a relatively novel technique, offers several advantages, including minimal trauma, faster recovery times, and reduced scarring. Laparoscopic liposuction is particularly favored in the treatment of gynecomastia due to its straightforward operation, minimal invasiveness, and low anesthesia requirements. The application of a liposuction solution facilitates quicker detachment of the local skin flap, minimizes skin flap damage, and achieves complete anesthetic infiltration, thereby alleviating patient discomfort [16]. During this procedure, surgeons introduce endoscopes and specialized instruments through small incisions, allowing for the dissolution and removal of excess adipose tissue. The use of smaller incisions results in an aesthetically favorable postoperative appearance with minimal scarring, making this approach particularly appealing to patients concerned about aesthetics [17–19].

In contrast, traditional open excision represents a more conventional surgical approach, generally reserved for severe cases of gynecomastia. This method involves the direct removal of excess breast and adipose tissue

Table 3 Analysis of short-term postoperative complications ($\overline{X}$±s)

Groups	Infection	Necrosis of nipple and areola	Ecchymoma	Delayed wound healing	Total incidence rate
Control group (*n* = 70)	5 (7.14%)	4 (5.71%)	5 (7.14%)	6 (8.57%)	20 (28.57%)
Observation group (*n* = 70)	0.00 (0.00%)	1 (1.42%)	2 (2.85%)	0.00 (0.00%)	2 (2.85%)
χ^2	11.449	10.627	15.105	9.523	15.226
P value	0.001	0.005	0.001	0.006	0.001

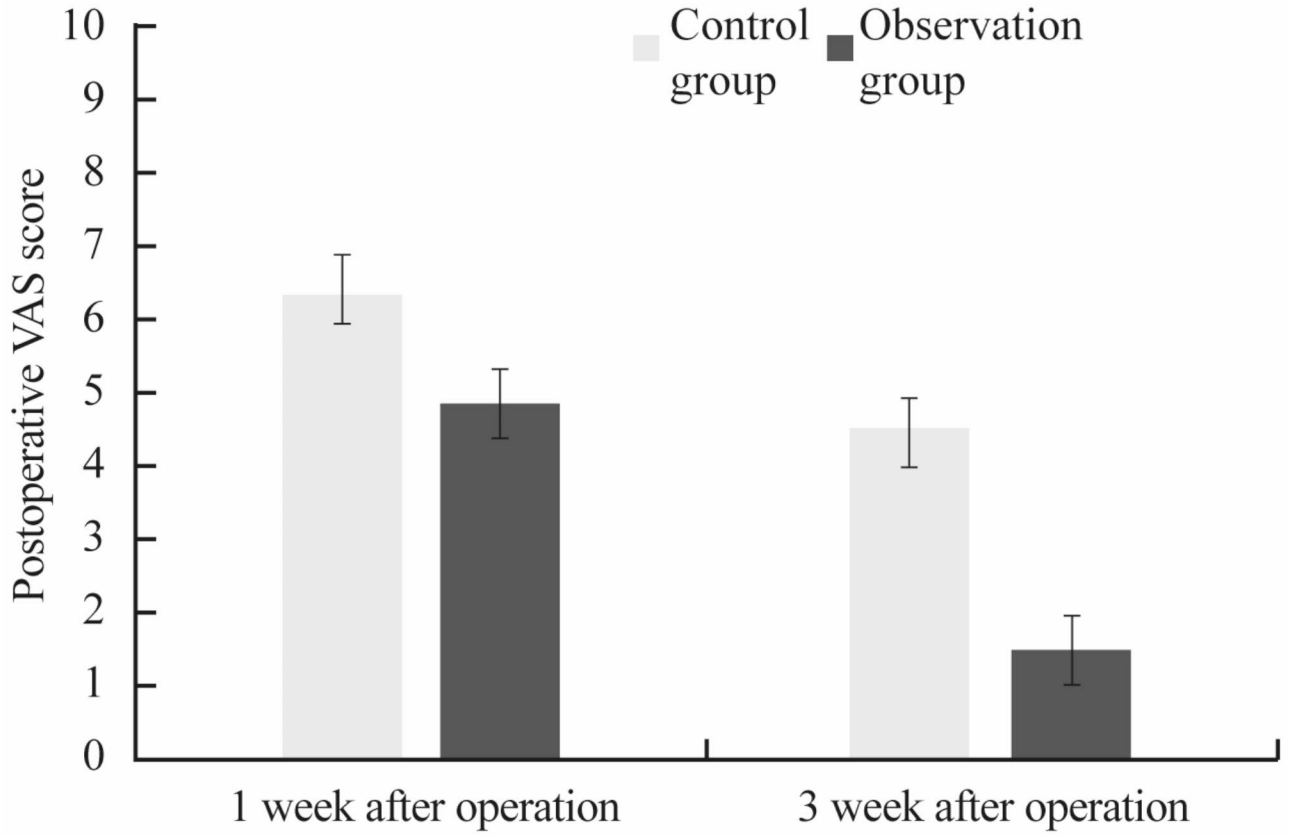

Fig. 1 Comparison of the VAS scores pertaining to postoperative wounds

Table 4 Comparison of the wound VAS scores ($\overline{X}\pm s$)

Groups	VAS scores 1 week post-operation	VAS scores 3 weeks post-operation
Control group ($n=70$)	6.34 ± 1.25	4.51 ± 1.04
Observation group ($n=70$)	4.85 ± 0.86	1.47 ± 0.52
T value	15.207	11.364
P value	0.001	0.002

through larger incisions [20, 21]. While this technique effectively eliminates pathological tissue and is associated with a theoretically low recurrence rate, its drawbacks include increased trauma, prolonged recovery periods, and more noticeable scarring post-operation [22, 23].

Endoscopic liposuction offers distinct advantages in terms of short-term effectiveness. The use of small incisions reduces both operative and hospitalization times while minimizing postoperative discomfort, facilitating a smoother recovery. This technology allows patients to resume their daily activities and work sooner, thereby enhancing their quality of life and alleviating the economic and social burdens associated with prolonged rehabilitation.

Another significant benefit of small incision surgery is the reduction in intraoperative bleeding, which directly contributes to surgical safety and expedites postoperative recovery. By minimizing blood loss, the risks during surgery are decreased, operation times are shortened, and potential complications—such as infection and hematoma formation—are mitigated. Furthermore, reduced bleeding helps maintain a clear surgical field, enhancing precision during procedures, particularly in cases requiring meticulous techniques to avoid damage to vital tissues or structures [16].

This study highlights the importance of endoscopic surgery in ensuring postoperative patient safety and

Table 5 Analysis of the long-term recurrence rates post-operation ($\overline{X}\pm s$)

Groups	Breast tissue enlargement (%)	Breast pain (%)	Other discomfort (%)	Recurrence rate (%)
Control group ($n=70$)	4 (5.71%)	3 (4.28%)	4 (5.71%)	11 (15.71%)
Observation group ($n=70$)	6 (8.57%)	4 (5.71%)	3 (4.28%)	13 (18.57%)
χ^2	1.305	2.119	4.352	3.447
P value	0.214	0.357	0.226	0.415

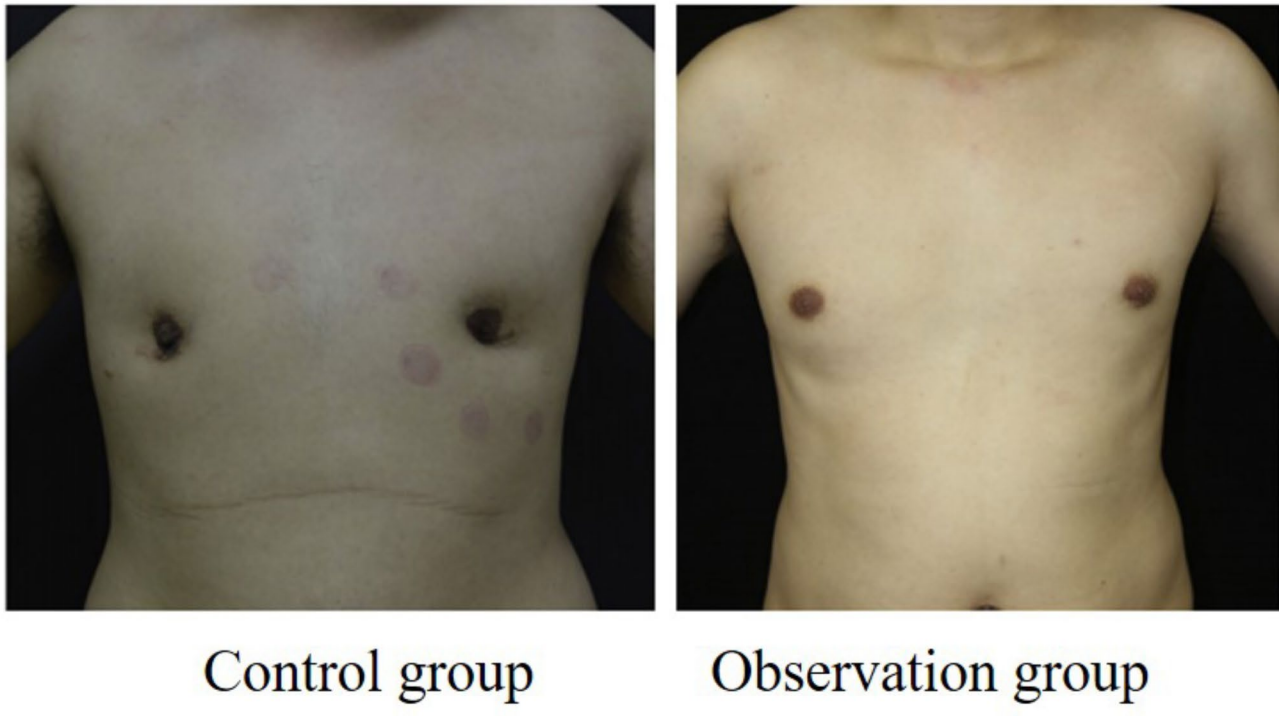

Fig. 2 Comparison of the nipple and areola appearance between the two groups post-operation ($\overline{X}\pm s$)

Table 6 Long-term postoperative satisfaction scores ($\overline{X}\pm s$)

Groups	Chest appearance score	Wound scar score	Nipple areola appearance score	Total satisfaction score
Control group ($n=70$)	3.16 ± 0.30	2.95 ± 0.26	2.57 ± 0.28	3.06 ± 0.26
Observation group ($n=70$)	4.45 ± 0.34	4.11 ± 0.32	4.36 ± 0.35	4.23 ± 0.30
T value	13.089	14.114	12.736	15.223
P value	0.001	0.001	0.002	0.001

improving overall surgical quality. The lower incidence of postoperative complications in the endoscopic group compared to the traditional surgical group underscores this point. The reduced complication rate not only enhances postoperative comfort and recovery quality but also diminishes the need for further medical interventions, thereby lowering overall healthcare costs.

Thus, endoscopic liposuction excels in both the technical refinement of the treatment process and in the economic and social benefits it provides, positioning it as an attractive option for managing male breast development.

Postoperative pain management is critical in evaluating surgical success, as it directly influences recovery speed and overall rehabilitation quality. In this study, patients in the endoscopic group reported lower postoperative Visual Analog Scale (VAS) scores compared to those in the traditional operation group, underscoring the advantages of endoscopic surgery in minimizing postoperative discomfort. The smaller incisions utilized in endoscopic procedures result in less tissue damage, thereby alleviating pain intensity.

The impact of reduced VAS scores on patient recovery is substantial [24]. Pain relief allows patients to initiate postoperative activities—such as walking and physical therapy—more promptly, which are essential for promoting recovery. Furthermore, alleviating pain can decrease patients' reliance on postoperative analgesics, helping to avoid potential side effects associated with long-term use, such as gastrointestinal discomfort and dependency, while also enhancing the overall rehabilitation experience.

Traditionally, open surgery is perceived to achieve more thorough removal of breast tissue and fat, suggesting a theoretically lower recurrence rate. However, the findings of this study indicate no significant difference in recurrence rates between endoscopic liposuction and traditional open resection, providing a new perspective on surgical method selection. Endoscopic surgery has demonstrated excellent short-term and long-term outcomes across various surgical fields due to its precision and minimal trauma. Despite being performed through small incisions, advanced high-definition cameras and delicate instruments in endoscopic surgery enable accurate targeting and removal of diseased tissue under direct visualization.

Moreover, advancements in modern endoscopic equipment and technology have significantly enhanced the accuracy and safety of these procedures, potentially explaining why the recurrence rate of endoscopic surgery is comparable to that of traditional surgery in this study. The minimally invasive nature of endoscopic techniques facilitates faster recovery and reduced pain, encouraging patients to engage more actively in postoperative rehabilitation activities. This positive attitude toward rehabilitation and the reduction in physiological stress may positively influence long-term outcomes, ultimately contributing to a lower recurrence rate.

Patient satisfaction is a pivotal measure of surgical efficacy, particularly in the realms of cosmetic and plastic surgery. In this study, one year post-operation, scores for chest appearance, scar visibility, and the aesthetics of the nipple and areola were significantly higher in the endoscopic group compared to the traditional operation group. This finding underscores not only the technical precision of endoscopic surgery but also its aesthetic benefits during recovery.

The heightened satisfaction levels directly correlate with the minimally invasive nature of endoscopic procedures, characterized by smaller incisions and reduced tissue damage, which typically results in diminished scar formation and a more natural aesthetic outcome. The use of high-definition visualization and precise maneuverability in endoscopic surgery minimizes disruption to healthy tissues, yielding superior aesthetic results. For patients, the enhancement of postoperative appearance is of paramount concern, especially in publicly visible areas such as the chest. Consequently, smaller scars and more natural breast contours significantly bolster patients' self-confidence.

Moreover, from a mental health perspective, satisfaction with postoperative appearance substantially alleviates psychological burdens, enhancing social interactions and overall well-being. Many patients experience feelings of shame or anxiety related to body image concerns prior to surgery, and favorable surgical outcomes effectively mitigate these negative emotions. Thus, endoscopic surgery not only fulfills patients' aspirations for physical beauty but also positively influences their psychological and emotional well-being by delivering superior aesthetic restoration.

The aesthetic and surgical skills of the surgeons involved in this study represent a notable limitation that may impact the findings. To address this, future research will involve higher-level surgeons to enhance the robustness and promotional value of the study. Additionally, limitations are evident in the relatively small number of cases included and the lack of regional representativeness. To mitigate these issues, subsequent studies will be designed as multicenter trials, incorporating a larger participant pool and conducting comprehensive follow-ups over extended periods.

In summary, the findings of this study underscore that endoscopic liposuction provides not only short-term benefits—including a low complication rate, minimal intraoperative bleeding, and expedited recovery—but also demonstrates comparable long-term efficacy, such as recurrence rates, when juxtaposed with traditional open excision methods. Furthermore, patient satisfaction in the endoscopic surgery group significantly surpassed that of the traditional surgery group, reinforcing the notion that endoscopic surgery is a safe and effective treatment option that achieves superior aesthetic outcomes and enhances patient satisfaction.

Abbreviations

VAS Visual Analog Scale

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12902-025-01876-6.

Supplementary Material 1

Acknowledgements

We are thankful to Xuzhou Municipal Hospital Affiliated to Xuzhou Medical University, Beijing Chuiyangliu Hospital, Huizhou Central People's Hospital, and Nanjing Hospital of Chinese Medicine affiliated to Nanjing University of Chinese Medicine for providing the necessary resources and support, allowing us to conduct the research effectively.

Author contributions

XD and MW contributed to the conception and design of the study; DC, HJ J and WW W performed the experiments, collected and analyzed data; XD wrote the manuscript; LX Z and HC Z revised the manuscript. All authors reviewed and approved the final version of the manuscript.

Funding

No funding was received for this study.

Data availability

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The current study was conducted in accordance with the Helsinki Declaration of the World Medical Association and approved by the Ethics Committee of Xuzhou Municipal Hospital Affiliated to Xuzhou Medical University (KY-2023NL-26). Informed consent was obtained from all the study subjects before enrollment.

Consent for publication

Written informed consent was obtained from all patients for the publication of their personal and clinical details, including any identifying images.

Competing interests

The authors declare no competing interests.

Author details

[1]Operating Rooms, Xuzhou Municipal Hospital Affiliated to Xuzhou Medical University, Xuzhou, China

[2]Department of General Surgery, Beijing Chuiyangliu Hospital, Beijing, China
[3]Department of Breast Surgery, Huizhou central People's hospital, Huizhou, China
[4]Department of Thyroid and Breast Surgery, Xuzhou Municipal Hospital Affiliated to Xuzhou Medical University, No. 269 University Road, Tongshan District, Xuzhou 221002, China
[5]Department of Thyroid and Breast Surgery, Nanjing Hospital of Chinese Medicine, Nanjing University of Chinese Medicine, Nanjing, China

Received: 18 June 2024 / Accepted: 11 February 2025
Published online: 21 February 2025

References

1. Innocenti A, Melita D, Dreassi E. Incidence of complications for different approaches in Gynecomastia correction: a systematic review of the literature. Aesthetic Plast Surg. 2022;46(3):1025–41.
2. Beniwal M, Singh K. The Burden of Anabolic Androgenic Steroid-Induced Gynecomastia. Indian J Plast Surgery: Official Publication Association Plast Surg India. 2023;56(4):338–43.
3. Hoyos AE, Perez ME, Domínguez-Millán R. Gynecomastia Treatment through Open Resection and Pectoral High-Definition liposculpture. Plast Reconstr Surg. 2021;147(5):1072–83.
4. Shang F, Zhao Z, Li Z, Liu B. The combination of endoscopic subcutaneous mastectomy and liposuction (Liu and Shang's 2-hole 7-step method) as the treatment of gynecomastia. Surgery. 2023;174(2):159–65.
5. Sreelesh LS, Rajan S. Etiopathological Factors Associated with Gynecomastia patients seeking Surgical correction in the South Indian Population. Indian J Plast Surgery: Official Publication Association Plast Surg India. 2022;55(4):364–7.
6. Karamchandani MM, De La Cruz Ku G, Sokol BL, Chatterjee A, Homsy C. Management of Gynecomastia and Male Benign diseases. Surg Clin North Am. 2022;102(6):989–1005.
7. Lashin R, Youssef RA, Elshahat A, Mohamed EN. Postoperative psychological impact on teenagers after Gynecomastia correction. Plast Reconstr Surg Global open. 2023;11(6):e5094.
8. Yang Y, Mu D, Xu B, Li W, Zhang X, Lin Y, Li H. Endoscopic subcutaneous mastectomy plus liposuction via a single axillary incision for gynecomastia in Asian patients: a report of 45 cases. Surgery. 2021;170(1):39–46.
9. Prasetyono TOH, Andromeda I, Budhipramono AG. Approach to Gynecomastia and Pseudogynecomastia surgical techniques and its outcome: a systematic review. J Plast Reconstr Aesthetic Surgery: JPRAS. 2022;75(5):1704–28.
10. Mekheal E, Kania BE, Kumari P, Kumar V, Maroules M. Gynecomastia and Malignancy: a case of male invasive ductal breast carcinoma treated with Neoadjuvant Chemotherapy. Am J case Rep. 2022;23:e937370.
11. Butler G, Srirangalingam U, Faithfull J, Sangster P, Senniappan S, Mitchell R. Klinefelter syndrome: going beyond the diagnosis. Arch Dis Child. 2023;108(3):166–71.
12. Varlet F, Esposito C, Scalabre A, Lepore B, Vermersch S, Escolino M. Pediatric endoscopic subcutaneous mastectomy (pesma) with liposuction in adolescents with gynecomastia. Surg Endosc. 2023;37(1):766–73.
13. Reed MD, Van Nostran W. Assessing pain intensity with the visual analog scale: a plea for uniformity. J Clin Pharmacol. 2014;54(3):241–4.
14. Maroney JC, Dannheim K, Hollowell ML, Labow BI, Rogers-Vizena CR. Incidental pathologic findings in Young men with Gynecomastia. Plast Reconstr Surg. 2022;149(3):608–13.
15. Jabori SK, Hullfish H, Samaha Y, Becker H, Thaller SR. Unraveling the Enigma: a rare case of recurrent idiopathic Gynecomastia in an adolescent. J Craniofac Surg. 2024;35(1):208–10.
16. Tukenmez M, Emiroglu S, Kozanoglu E, Akalin BE, Mollavelioglu B, Cabioglu N, Muslumanoglu M. Single axillary incision endoscopic surgery and liposuction for gynecomastia. Medicine. 2023;102(7):e33020.
17. Elazizi L, Essafi MA, Hanane A, Aynaou H, Salhi H, El Ouahabi H. A clinical, etiological, and Therapeutic Profile of Gynecomastia. Cureus. 2022;14(8):e27687.
18. Burger A, Sattler A, Grünherz L, Giovanoli P, Lindenblatt N. Scar versus shape: patient-reported outcome after different surgical approaches to Gynecomastia measured by modified BREAST Q®. J Plast Surg Hand Surg. 2023;57(1–6):1–6.
19. Kapoor R, Dharmalingam GC, Sonkar AA, Anand A, Agrawal MK, Gaurav K. Endoscopic subcutaneous mastectomy plus liposuction via a single axillary incision for gynecomastia: views from developing world. Surgery. 2022;171(6):1704–7.
20. Kulka J, Madaras L, Floris G, Lax SF. Papillary lesions of the breast. Virchows Archiv: Int J Pathol. 2022;480(1):65–84.
21. Hanukoglu A, Lev D. Unilateral Gynecomastia in an adolescent with Poland Syndrome. A Clue for diagnosis. Isr Med Association Journal: IMAJ. 2023;25(7):505–6.
22. Bharathidasan K, Curl J, Babu VK, Felton S, Nugent K. An Approach to Gynecomastia in Primary Care clinics. South Med J. 2022;115(8):597–602.
23. Herbert SL, Ergezinger K, Sauer S, Kurz F, Schlaiß T, Wöckel A, Albert US. Prepubertal Idiopathic Unilateral Gynecomastia: Case Report and Literature Review. Breast care (Basel Switzerland). 2022;17(6):573–9.
24. Prasetyono TOH, Budhipramono AG, Andromeda I. Liposuction assisted Gynecomastia surgery with minimal Periareolar incision: a systematic review. Aesthetic Plast Surg. 2022;46(1):123–31.

Publisher's note