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ORIGINAL RESEARCH

Evaluation of the Efficacy and Patient Satisfaction of Endoscope-Assisted High-Speed Rotary Cutter for Nuchal Fat Pad Removal

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Objective: To evaluate the clinical efficacy and patient satisfaction of high-speed rotary cutter combined with endoscopy for the treatment of nuchal fat pads.

Methods: A total of 68 adult patients with hypertrophic nuchal fat pads were included in this study. Under super-wet tumescent anesthesia, incisions were marked around the fat pads. A fork-shaped dissector was first used to sharply dissect the adipose tissue through multiplanar and multiangular separation. Subsequently, an endoscope-assisted high-speed rotary cutter was employed to completely resect and aspirate the isolated fat. Thin liposuction cannulas were then used to refine the contour of the transition zone between the residual fat pads and the normal adipose tissue to achieve a smooth, natural gradient. The incisions were closed using oil-coated sutures, followed by figure-of-8 compression bandaging. Patients were instructed to use a rice pillow postoperatively and were followed up for 3 to 6 months to monitor complications, assess cervical contour improvement, and evaluate patient satisfaction.

Results: The mean operative time was 65 minutes. All patients experienced varying degrees of pain and swelling within 1–2 months after surgery. Among them, 7 cases (10.29%) exhibited bruising or ecchymosis, 3 cases (4.41%) had palpable subcutaneous cords or induration, and 1 case (1.47%) developed a seroma within two weeks. Swelling began to subside from the third postoperative day. Complete resolution of swelling was achieved in 63 patients (92.65%) within one month, and in the remaining 5 patients (7.35%) within one and a half months. One case (1.47%) showed delayed wound healing, which improved after two weeks of active dressing care; the other 67 cases (98.53%) achieved primary healing. One patient (1.47%) presented with a slight "step-off" appearance at the transition zone upon one-month follow-up, while the other 67 cases (98.53%) achieved complete fat removal, resulting in a natural and smooth nuchal contour. Within 3–6 months postoperatively, all patients recovered normal skin sensation, elasticity, and color in the operative area. No serious complications such as skin necrosis, infection, neurovascular injury, or fat embolism occurred. The satisfaction survey showed that 58 patients were satisfied, 8 were somewhat satisfied, and 2 reported fair satisfaction, yielding an overall satisfaction rate of 97.06%.

Conclusion: The combination of a high-speed rotary cutter and endoscopy for nuchal fat pad removal demonstrates a natural appearance, short operative time, low complication rate, and high patient satisfaction. This technique is effective and worthy of clinical promotion.

Keywords: nuchal fat pads, endoscope-assisted surgery, high-speed rotary cutter, fat removal, patient satisfaction, surgical outcomes

Introduction

The nuchal fat pads, commonly referred to as a "buffalo hump", is a localized adipose hyperplasia located in the depressed region between the lower border of the fifth cervical vertebra and the upper border of the second thoracic vertebra along the posterior midline. Its size and consistency vary among individuals.[1] The occurrence of this condition is

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closely associated with prolonged neck flexion, particularly due to the widespread use of electronic devices such as smartphones and tablets, which has significantly increased the time people spend with their heads bent forward, leading to a continual rise in its incidence. In addition to postural factors, genetic predisposition and chronic mechanical stimulation also play important roles in its pathogenesis. Repetitive pressure and microtrauma can trigger abnormal proliferation of subcutaneous adipose tissue accompanied by densification of fibrous connective tissue, ultimately resulting in a firm and visually prominent dorsocervical bulge.

The nuchal fat pads not only compromise the aesthetic appearance of the neck and back, but may also cause psychological distress and physical discomfort, exerting multiple negative impacts on patients' overall well-being. Current commonly used clinical treatments include massage, negative-pressure liposuction,[2] ultrasound-assisted liposuction,[3] and laser lipolysis,[4] among others. However, each of these methods has certain limitations, such as suboptimal efficacy in highly fibrotic fat pads, irregular postoperative contours, prolonged recovery periods, or relatively high risks of complications.

Given the distinct histological characteristics of dorsocervical fat pads and patients' dual expectations for both functional improvement and aesthetic outcomes, there is a clear clinical need to develop a surgical approach that is not only straightforward to perform but also consistently effective and safe. However, current commonly used techniques each present certain limitations in addressing these requirements comprehensively. This necessity underscores the importance of exploring novel strategies to achieve superior results. Therefore, this study was conducted to evaluate the technique of endoscope-assisted rotary cutter resection. It is precisely based on this consideration that we conducted this study, aiming to systematically evaluate the therapeutic efficacy of the endoscope-assisted rotary cutter resection technique and the occurrence of postoperative complications.

Patients and Methods

General Information

From May 2024 to January 2025, medical records of 68 adult patients with nuchal fat pads were retrospectively reviewed, including 53 females and 15 males. All procedures were strictly conducted in accordance with relevant ethical guidelines and regulations, and the study was approved by the Ethics Committee of the Second Affiliated Hospital of University of South China (Approval No.: 2025K021103). In addition, informed consent was obtained from all participants, ensuring ethical compliance and protection of their rights. As a retrospective surgical study analyzing historical patient data, this research falls into the category of an observational study and is exempt from mandatory trial registration according to ICMJE guidelines. Written informed consent for the publication of all identifiable images was obtained from the participants.

Inclusion criteria for patients were as follows: (1) age $\geq$ 18 years; (2) clinical diagnosis of primary nuchal fat pad hypertrophy; (3) a clear desire for neck contour improvement.

Exclusion criteria included: (1) nuchal fat deposition secondary to Cushing's syndrome, HIV infection, or long-term corticosteroid use; (2) presence of active skin infection in the cervical region; (3) severe bleeding tendency or contraindications to anesthesia; (4) pregnancy or lactation.

Anesthesia Method

Tumescent anesthesia was administered using a large-volume, high-tumescence technique (commonly referred to as "super-wet" technique in some literature) in all cases.

i. Preparation of Tumescent Solution: The solution was composed of 250 mL of 0.9% normal saline, 5 mL of 10% sodium bicarbonate, 0.5 mL of 1% epinephrine, and 5 mL of 2% lidocaine injection, yielding a final concentration of epinephrine between 1:500,000 and 1:1,000,000.
ii. Anesthesia Procedure: Using a three-way diversion injector equipped with a 1.5 mm diameter blunt needle, the superset tumescent solution was infiltrated into the marked area of the nuchal fat pads through the incision.[5] The solution was delivered from deep to superficial layers until the local skin became pale and tense, with no significant depression upon pressure and extremely high tissue turgor, and infiltration was continued until the

tissue reached firm turgor and the skin appeared blanched and taut. This endpoint was characterized by minimal tissue depressibility upon pressure and visible fluid egress from the incision site. The anesthesia was extended 1.0–1.5 cm beyond the margin of the fat pads. Surgery commenced after 10–15 minutes, allowing sufficient time for the vasoconstrictive effect of epinephrine to peak.

Surgical Procedure

i. Multiplanar and Multiangular Dissection with Forked Dissector: After anesthesia took effect, an incision was made along the pre-designed line. A forked dissector (Figure 1a) was then introduced between the trapezius muscle fascia and the dermis to sharply and progressively dissect the adipose tissue within the marked region in parallel, vertical, and oblique directions. This technique allowed multiplanar and multiangular release, thoroughly transecting the major fibrous bands within the fat pads.

ii. Complete Resection and Aspiration with Rotary Cutter: A YSG-P-1 medical rotary cutting aspirator[6] (Shanghai Photoelectric Technology Co., Ltd.) with a specialized straight blade head (Figure 1b) was used. The device was set at a speed of 5000 rpm and a negative pressure of 0.03–0.04 MPa. The handpiece was inserted through the incision into the previously dissected planes. Resection was performed progressively from distal to proximal and from deep to superficial layers until minor fibrous strands within the fat pads were adequately disrupted and small fat lobules were completely aspirated. The endpoint was reached when the thickness of the resection area was consistent with the surrounding normal adipose tissue and no significant fibrous traction was felt during rotation.

iii. Refinement of Transition Zone with Thin Liposuction Cannula: A 2.5 mm diameter liposuction cannula connected to a 20 mL syringe was used to perform repeated “tunnel-style” suction in the transition zone between the residual fat pads and the normal adipose tissue. This ensured a smooth and natural contour between the operated area and the surrounding tissue.

iv. Endoscope-Assisted Inspection and Tissue Fixation: The endoscopic imaging system[7] (Figure 1c) was introduced to evaluate the completeness of fat removal and identify any active bleeding. Additional resection or electrocautery was performed as necessary. The operative field was irrigated thoroughly with normal saline to remove residual fragmented tissue. The skin overlying the resection area was perforated at 2–3 cm intervals with 3–6 oil-coated, non-absorbable sutures (eg, silk or polypropylene) placed as quilting sutures to secure the skin flap to the underlying tissue and reduce dead space. A drain was placed, and the wound was closed with interrupted sutures.

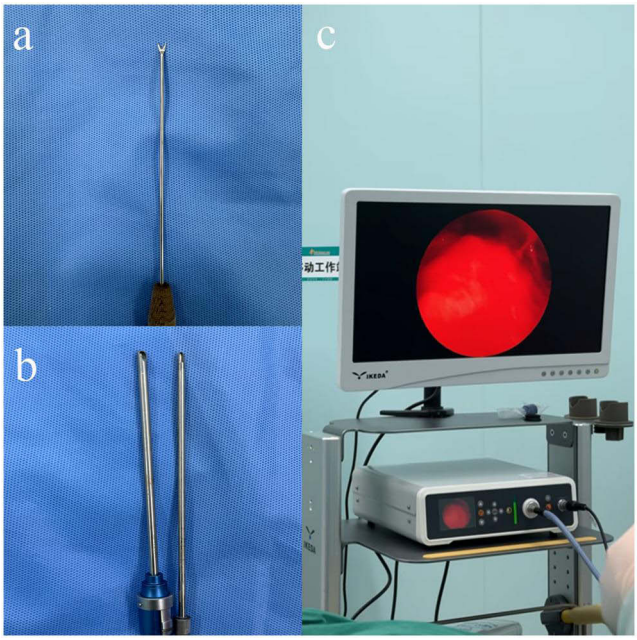

Figure 1 Surgical instruments. (**a**) Forked dissector, (**b**) Rotary cutter, (**c**) Endoscope.

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Postoperative Management

The surgical area was covered with sterile dressings and a compressive figure-of-8 bandage was applied. The wound was redressed 48 to 72 hours after surgery, and the drainage tube was removed. Compression bandaging was continued for an additional 48 hours after drain removal. On postoperative day 5, the wound was redressed again and the oil-based sutures were removed. Patients were instructed to use a rice pillow during the first week after surgery to maintain an appropriate neck position.

Follow-Up and Outcome Evaluation

Patients were followed up for 3 to 6 months to monitor complications, assess cervical appearance, and evaluate patient satisfaction. Satisfaction was graded based on patient self-assessment using the following criteria:

i. Satisfied: The operative area was smooth and flush with the surrounding tissue without irregularities.
ii. Somewhat satisfied: The operative area was generally flat and transitioned smoothly to adjacent areas, without significant uneven.
iii. Fair: The operative area had mild unevenness or a noticeable step-off appearance at the transition zone.
iv. Dissatisfied: The operative area was markedly uneven, or the subjective improvement of the nuchal fat pads was less than 70%.

The patient satisfaction rate was calculated as:

Satisfaction rate = (Number of Satisfied + Number of Somewhat Satisfied)/Total Cases × 100%.

Statistical Analysis

This study is a retrospective case series analysis. All data were analyzed using descriptive statistics. Continuous variables (eg, age, operative time, fat pad dimensions) are presented as mean ± standard deviation or range. Categorical variables (eg, sex, complication rates, patient satisfaction grades) are presented as counts and percentages (n, %). Primary outcome measures (eg, specific complication rates, patient satisfaction proportions) are directly reported in the corresponding results tables. Given the preliminary, single-group nature of this technical report, no hypothesis testing or confidence interval calculations were performed. Data analysis was conducted using Microsoft Excel.

Results

Baseline Characteristics of Patients

A total of 68 adult patients with nuchal fat pads were included in the study, comprising 53 females (77.9%) and 15 males (22.1%). The age range was 28 to 56 years, with a mean age of 37.1 ± 2.9 years. The dimensions of the fat pads were measured preoperatively, with length ranging from 8.0 to 12.0 cm, width from 6.0 to 8.5 cm, and thickness from 0.8 to 1.7 cm (Table 1).

Postoperative Complications

All 68 patients successfully underwent one-time removal of the hypertrophic nuchal fat pads under superset tumescent anesthesia via small incisions in the nuchal region using a high-speed rotary cutter combined with endoscopy. The procedure left 1 small incisions (0.5 cm) in the nuchal region. The operative time ranged from 55 to 75 minutes, with a mean duration of 65 minutes.

The specific outcomes were as follows:

All patients experienced varying degrees of pain and swelling within 1–2 months after surgery. Among them, 7 cases (10.29%) exhibited bruising or ecchymosis, 3 cases (4.41%) reported palpable subcutaneous cord-like induration or nodules, and 1 case (1.47%) developed subcutaneous seroma within two weeks postoperatively.

Follow-up observations indicated that swelling in the operative area began to subside on postoperative day 3. Complete resolution of swelling was achieved in 63 patients (92.65%) at approximately one month, and in the remaining

Table 1 Baseline Characteristics of Patients with Nuchal Fat Pads

Characteristic	Value/Description
Total Number of Patients	68
Sex (n, %)	
Male	15 (22.1%)
Female	53 (77.9%)
Age (years)	
Range	28–56
Mean ± SD	37.1 ± 2.9
Size of Fat Pads (cm)	
Length (Range)	8.0–12.0
Width (Range)	6.0–8.5
Thickness (Range)	0.8–1.7

5 patients (7.35%) around one and a half months. Bruising and ecchymosis in 7 cases, as well as induration in 2 cases, showed significant improvement within about three weeks and resolved completely within 2–3 months. The subcutaneous seroma in one patient resolved after aspiration and compressive bandaging within approximately one week.

Within 3–6 months postoperatively, all patients recovered normal skin sensation, elasticity, and color in the nuchal region. No serious complications such as local skin necrosis, infection, major neurovascular injury, or fat embolism were observed (Table 2).

Table 2 Surgical Outcomes and Postoperative Recovery

Parameter/Category	Findings
Total Patients	68
Surgical Approach	One-time removal via endoscope-assisted high-speed rotary cutter under superset tumescent anesthesia
Incision Characteristics	1 small incision (0.5 cm) in the nuchal region
Operative Time (min)	
Range	55–75
Mean	65
Early Postoperative Symptoms (Within 1–2 months)	
Pain and swelling (all patients)	68 (100%)
Bruising/ecchymosis	7 (10.29%)
Palpable subcutaneous induration/nodules	3 (4.41%)
Subcutaneous seroma (within 2 weeks)	1 (1.47%)
Resolution of Swelling	
Onset of subsidence	Postoperative day 3
Complete resolution at ~1 month	63 (92.65%)
Complete resolution at ~1.5 months	5 (7.35%)
Resolution of Other Complications	
Bruising/Induration (significant improvement at ~3 weeks)	7 cases of bruising + 2 cases of induration
Complete resolution (within 2–3 months)	All above cases
Subcutaneous seroma (resolved after aspiration and bandaging)	~1 week
Long-term Outcomes (3–6 months postoperatively)	
Recovery of normal skin sensation, elasticity, and color	68 (100%)
Serious complications (eg, necrosis, infection, neurovascular injury, fat embolism)	0 (0%)

Note: Data are presented as number (%) or as otherwise specified.

Table 3 Postoperative Efficacy and Patient Satisfaction

Category	n (%)	Description
Wound Healing		
Primary healing	67 (98.53%)	
Delayed healing	1 (1.47%)	Healed well after 2 weeks of active wound care.
Contour Outcome (at 1-month follow-up)		
Smooth and natural contour	67 (98.53%)	Nuchal fat was substantially removed.
Slight "step-off" appearance	1 (1.47%)	Measured 0.76 cm × 0.65 cm × 0.3 cm at the transition zone. No surgical revision required.
Patient Satisfaction		
Satisfied	58 (85.29%)	
Somewhat satisfied	8 (11.77%)	
Fair	2 (2.94%)	
Overall Satisfaction Rate	66 (97.06%)	(Satisfied + Somewhat Satisfied)/Total Cases

Note: Data are presented as number (percentage) of patients unless otherwise specified.

Surgical Efficacy and Patient Satisfaction

One patient (1.47%) experienced delayed wound healing in the early postoperative period; however, the incision healed well after two weeks of active wound care. The remaining 67 patients (98.53%) achieved primary healing. During follow-up, one case (1.47%) exhibited a slight "step-off" appearance at the transition zone between the operated area and the normal adipose tissue one month after surgery, measuring 0.76 cm × 0.65 cm × 0.3 cm. No surgical revision was required. In the other 67 cases (98.53%), the nuchal fat pads was substantially removed, resulting in a natural, smooth, and aesthetically pleasing contour of the nuchal region.

Patient satisfaction survey showed that among the 68 patients, 58 (85.29%) were satisfied, 8 (11.77%) were somewhat satisfied, and 2 (2.94%) reported a fair outcome. The overall satisfaction rate was 97.06% (Table 3).

Typical Case (Figure 2)

A 52-year-old female patient presented with a slowly enlarging mass in the nuchal region without an apparent cause. The mass was accompanied by a mild sense of pressure. There was no relevant family history. Physical examination revealed a mass measuring approximately 11.0 cm × 8.0 cm × 2.8 cm (length × width × thickness). Ultrasonography showed no obvious space-occupying lesion or significant blood flow signal within the mass. There was no tenderness upon compression and the margins were ill-defined. The patient was diagnosed with nuchal fat pad based on ultrasonic findings.

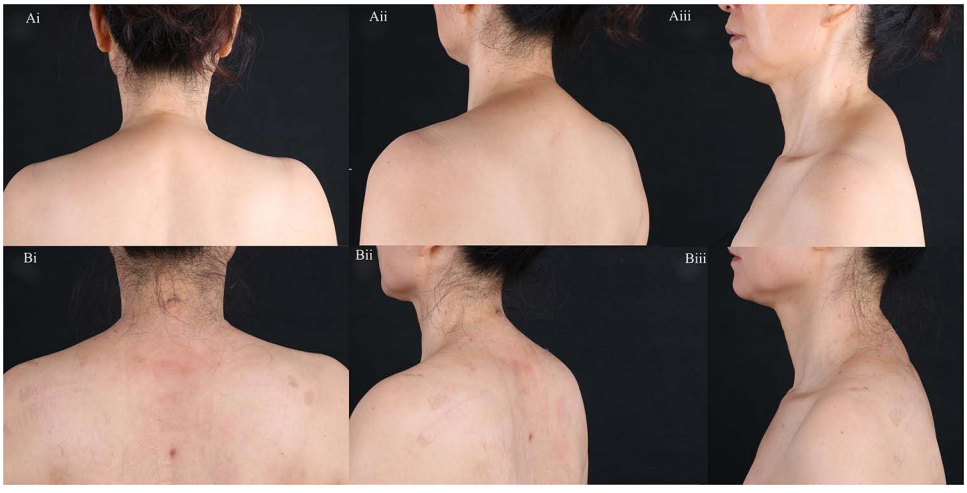

Figure 2 Preoperative and postoperative views of nuchal fat pad in one patient. (**A**i-iii) Preoperative photograph of a 53-year-old female patient showing a prominent nuchal fat pad mass. (**B**i-iii) Immediate postoperative photograph demonstrating a natural nuchal contour and significant improvement. The patient was highly satisfied with the result. Written informed consent for publication was obtained.

The patient was treated with endoscope-assisted high-speed rotary cutter resection, as described in the methods section above. During the 5-month follow-up, no complications such as hematoma, seroma, or infection were observed. The nuchal contour appeared natural with a significant aesthetic improvement, and the patient reported high satisfaction with the outcome.

Discussion

The treatment of nuchal fat pads includes both physical and surgical approaches. Physical therapies often offer symptomatic and cosmetic improvement rather than a definitive cure, as they fail to completely eliminate hyperplastic fibrous and adipose tissues. Surgery interventions consist of traditional open surgery and minimally invasive techniques.[8] While open surgery provides direct visualization, enables complete resection, and facilitates hemostasis, it is associated with significant tissue trauma, considerable blood loss, prolonged recovery, and conspicuous scarring.

Liposuction under tumescent anesthesia has made minimally invasive treatment of nuchal fat pads feasible.[1] However, removal of nuchal fat pads differs markedly from conventional liposuction due to the distinct histologic characteristics of the region: the fat lobules are small and embedded within abundant, densely organized fibrous tissue composed largely of mature collagen fibers, often with focal mucoid and hyaline degeneration. These structural features make it difficult for conventional suction-assisted liposuction to disrupt the dense fibrous connective network, resulting in technically challenging procedures, extended operative times, and frequently incomplete removal.[9]

Ultrasound-assisted liposuction employs cavitation effects to selectively emulsify fat, significantly enhancing the safety and efficacy of fat aspiration while reducing postoperative complications.[3] Nevertheless, this modality still falls short in effectively addressing the dense fibrous bands within nuchal fat pads. Moreover, it carries a relatively high risk of complications—including paresthesia, hyperpigmentation, and seroma—with reported incidence rates ranging from 30% to 50%.[10]

The use of a rotary cutter alone can partially improve the removal of residual fibrous bands. Compared to conventional suction-assisted liposuction, it offers better extraction efficiency and a higher degree of fat removal. However, in areas with thick and densely structured fibrous tracts, the advancement and entry of the rotary cutter head become difficult. Within the tense and rigid structure of the fat pad, tissue is often resistant to being drawn into the aperture of the rotary cutter by negative pressure. This makes the procedure technically demanding and inefficient. Furthermore, the rotary cutter performs suboptimal in transition zones between the fat pad and normal adipose tissue, leading to a high incidence of postoperative "step-off" deformities. This results in an irregular contour of the neck and shoulder region, compromising aesthetic outcomes.[6]

Previous studies have also reported the use of laser-assisted lipolysis for the treatment of nuchal fat pads. However, this technique is associated with prolonged operation time, high equipment costs— limiting its widespread adoption—and an increased risk of complications such as fat liquefaction and wound infection.[11]

After decades of exploratory practice, our department has confirmed that the removal of nuchal fat pads through small incisions using a high-speed rotary cutter combined with suction-assisted resection is superior to other surgical approaches. This technique not only reduces scar contracture resulting from skin scraping injuries but also allows more complete removal of adipose tissue, while significantly decreasing the incidence of complications such as skin necrosis and delayed sensory recovery.

However, blind surgery—ie, procedures performed without visual guidance—still carries risks of suboptimal outcomes, increased bleeding, and hematoma formation. In pursuit of a more stable and effective minimally invasive method for nuchal fat pad removal, our department has developed an endoscope-assisted high-speed rotary cutter technique. The advantages are as follows:

① Minimally invasive incisions promote faster recovery and reduce the risk of infection and hypertrophic scarring.
② Direct visual guidance enables precise monitoring of the resection layer and allows thorough assessment of the clearance extent—particularly in transitional zones—thereby reducing the "step-off" appearance.
③ Enhanced visualization shortens operative time (average time ≈65 minutes), compared to non-endoscopic techniques (average ≈80 minutes).
④ Accurate hemostasis under endoscopic view helps control small arterial bleeding and prevents hematoma formation.

In this study, 7 cases (10.29%) exhibited bruising or ecchymosis in the early postoperative period, which was attributed to intraoperative injury of minor blood vessels causing oozing hemorrhage. Three cases (4.41%) developed a subcutaneous cord-like sensation or induration, likely due to uneven aspiration during the procedure. One case (1.47%) presented with subcutaneous seroma shortly after surgery, presumably resulting from inadequate drainage of the operative site; this resolved completely after aspiration and compressive bandaging. Impaired initial wound healing occurred in one patient (1.47%), possibly caused by friction-induced skin necrosis during suction; the wound healed satisfactorily after two weeks of active dressing care. None of the cases experienced severe complications such as localized skin necrosis or sensory abnormalities. Among the early cases, one (1.47%) showed a slight "step-off" deformity, likely due to insufficient refinement of the transition zone between the treated area and normal tissue, leading to minor residual fat pad. No reoperation was required. The remaining 67 cases (98.53%) achieved a natural and smooth nuchal contour with aesthetically pleasing results and inconspicuous scarring. Both the medical team and the patients expressed satisfaction with the outcomes.

Limitations of the Study

This study has several limitations that should be acknowledged. First, the retrospective, single-center design inherently carries risks of selection and information bias. The relatively small sample size (n=68) and the uneven gender distribution (predominantly female, 77.9%) may limit the generalizability of our findings, although this gender imbalance reflects the typical demographic seeking aesthetic neck contouring procedures. Second, the primary outcome measure of patient satisfaction, while clinically relevant, was assessed using a non-validated, self-reported scale and lacked objective, quantitative metrics (eg, volumetric analysis via MRI or 3D imaging, or blinded photographic assessment by independent panels). Third, the follow-up period of 3–6 months is sufficient to assess early complications and recovery but is too short to evaluate the long-term stability of the contour results and the potential for recurrence. Fourth, the surgical protocol involved specialized equipment (a specific rotary cutter system), which may affect the reproducibility of the technique in other settings. Future research should address these limitations through prospective, multi-center studies with larger cohorts, longer follow-up, standardized objective measurements, and comparative designs against other established techniques. Furthermore, the exploratory nature and sample size of this case series did not allow for robust analysis of potential correlations between patient demographics or fat pad characteristics and clinical outcomes (eg, satisfaction scores, complication rates). Future prospective studies with larger cohorts should employ multivariable regression models to identify significant predictors of outcome.

Conclusion

The endoscopic-assisted high-speed rotary cutter technique demonstrates to be a safe, effective, and minimally invasive approach for the removal of nuchal fat pads. It significantly improves cervical contour aesthetics with a high patient satisfaction rate (97.06%), short operative time, and low incidence of major complications. The integration of endoscopic visualization enhances surgical precision, facilitates complete fat resection—particularly in transition zones—and reduces the risks of bleeding and irregular outcomes. This method is worthy of broader clinical application and may represent a new standard for the surgical management of nuchal fat pads.

Data Sharing Statement

The datasets used and/or analysed during the current study available from the corresponding author Feng Yang (Yangf@fsyy.usc.edu.cn) on reasonable request.

Ethical Statement

This study was reviewed and approved by the Ethics Committee of the Second Affiliated Hospital of University of South China (Approval No.: 2025K021103). The research was conducted in accordance with the principles outlined in the Declaration of Helsinki. All participants were fully informed about the study prior to their enrollment and provided written informed consent. The consent form explicitly permits the use of their anonymized data for scientific purposes and grants authorization for the publication of any potentially identifiable images (eg, facial photographs, medical

images) included in this research. The privacy and security of participants' personal data were protected. All identifiable information has been anonymized and is used solely for the analysis and reporting within this study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declared that they have no conflicts of interest to this work.

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