ORIGINAL RESEARCH

Clinical Application of Tonsillectomy with Preservation of Capsule and Support Tissue

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ABSTRACT

Objective • The clinical effect of tonsillectomy with the preservation of tonsillar capsule and stent tissue and punctuated suture of tonsillar capsule and stent tissue was analyzed retrospectively.

Methods • From January 2013 to January 2022, a total of 960 patients underwent tonsillectomy, consisting of 530 males and 430 females with ages ranging from 4 to 60 years (median age: 11 years). The capsule and scaffold tissues were preserved in all patients during the operation, and the surrounding mucosa, capsule, and scaffold tissues were sutured without tension. Indexes such as operation time, intraoperative blood loss, tonsillar white membrane, incidence of postoperative bleeding, postoperative pain score, and incidence of tonsillar remnant were recorded, and the school attendance of children (≤12 years old) was recorded.

Results • The mucosal covering of tonsillar fossa healed well in all patients, and the sutures were completely removed at 4 weeks after reexamination. All patients were followed up for 1-8 years, and there was no residual hyperplasia or residual inflammation. Children under 12 years old could return to school 4 days after surgery without any postoperative complications.

Conclusion • Tonsillectomy, preserving the tonsillar capsule and scaffold tissue followed by punctate suturing, offered several advantages: it resulted in less intraoperative blood loss and postoperative pain. Patients could resume a normal diet 6 hours after the surgery without an increased risk of complications. Moreover, it significantly reduced the risk of postoperative bleeding. (*Altern Ther Health Med.* 2024;30(12):154-158).

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INTRODUCTION

Tonsillectomy is one of the most common surgeries in the field of otorhinolaryngology[1]. There are many surgical methods for tonsillectomy, such as excision along the tonsillar capsule, squeezing, low-temperature plasma tonsillectomy, electrocautery excision, ultrasonic scalpel excision, and laser excision[2]. The latter four methods are disadvantageous due to their long recovery time and the multiple complications arising from mechanical damage and high-temperature thermal injuries. The traditional tonsillectomy along the capsule has several drawbacks, such as more intraoperative bleeding, high incidence of postoperative bleeding, severe pain, and long recovery time for normal eating[3]. Our department has been performing tonsillectomies with preservation of the capsule and support tissue and point-wise intermittent suturing of the capsule and support tissue in recent years. This approach aims to provide scientific evidence for the optimization and individualization of treatment strategies for tonsillectomy, with its clinical outcomes reported as follows.

MATERIALS AND METHODS

Clinical Data

From January 2013 to January 2022, 960 patients underwent bilateral tonsillectomy in our hospital, including 530 males and 430 females, aged between 4 and 60 years, with a median age of 11 years. The exclusion criteria were: (1) Pregnant or menstruating women; (2) Acute pharyngitis within 2 weeks; (3) Use of anticoagulant drugs such as aspirin within 1 week before surgery; (4) Individuals or family history of coagulation disorders; (5) Unstable severe systemic diseases; (6) Epidemic period of acute infectious diseases.

Figure 1. Exposure of the Junction Between the Upper Pole Mucosa and Tonsillar Lymphoid Tissue: The white line indicates the surgical incision route of the tonsils.

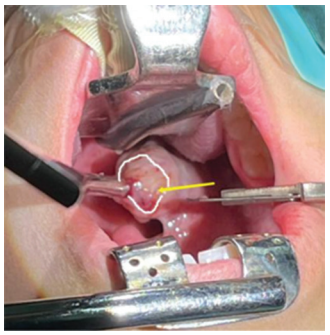


Figure 2. Exposure of the Tonsillar Capsule: White arrows indicate the tonsillar capsule, while black arrows indicate tonsillar lymphoid tissue.

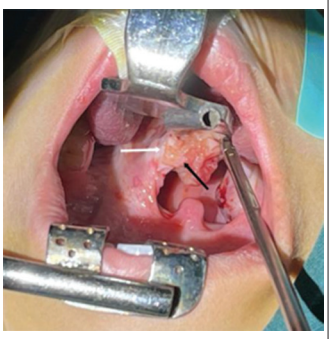


Figure 3. Incision of the Tonsillar Capsule with a Crescent Blade: White arrows indicate the tonsillar capsule.

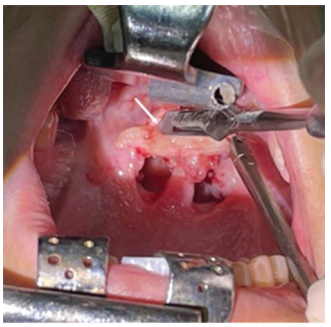


Figure 4. Lymphoid Tissue and Supporting Tissue: Black arrows represent tonsillar supporting tissue, while white arrows indicate tonsillar lymphoid tissue.

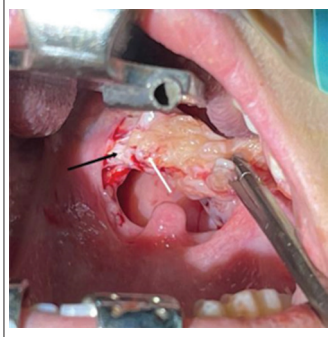


Figure 5. Intraoperative Removal of Tonsillar Lymphoid Tissue in Blocks

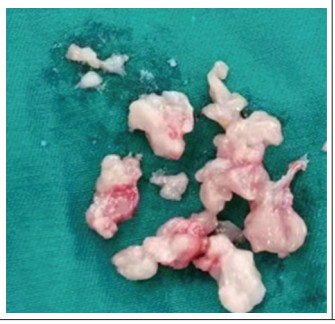


Figure 6. Retained Supporting Tissue and Capsule Within the Tonsillar Fossa: White arrows indicate the supporting tissue pulled by forceps, while black arrows represent the tonsillar capsule.

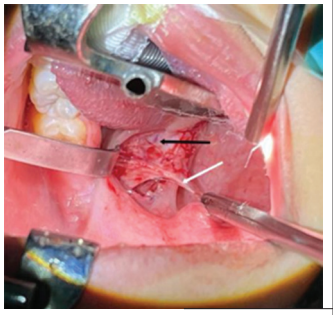


Figure 7. Tonsillar Fossa After Suturing: Black arrows depict the linear mucosal incisions in the tonsillar fossa after suturing.

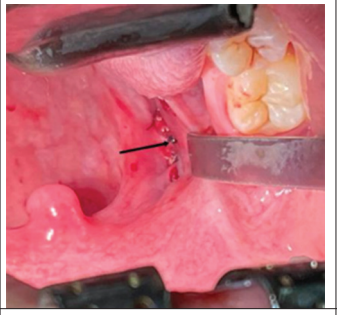
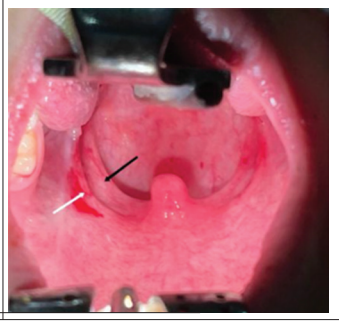


Figure 8. Oropharynx After Suturing: White arrows indicate the palatopharyngeal arch, and black arrows represent the palatal arch.



The dropout criterion was a failure to complete the follow-up. This study complies with the Helsinki Declaration and has been approved by the hospital's ethics committee. Patients and their families were informed about the research plan and signed the informed consent form. The same senior physician performed all surgeries.

Surgical Method

All patients underwent the procedure under general anesthesia with endotracheal intubation. Headlights were used for intraoperative illumination. A mouth gag was inserted to adequately expose the tonsils. Submucosal injections of saline solution containing adrenaline (1/70 000) were administered around the tonsils. The upper pole of the tonsils was grasped with forceps and pulled inward to expose the junction between the upper pole mucosa and tonsillar lymphoid tissue (Figure 1). A scalpel was used to incise the upper pole mucosa, and the incision was extended downward along the crypts surrounding the tonsils (Figure 2). The mucosa surrounding the tonsils was partially separated to expose the tonsillar capsule (Figure 3). The tonsillar capsule was incised near the inner aspect (Figure 3). The tonsillar capsule, along with the supporting tissue, was dissected by pulling it outward (Figure 4). Dissection was continued downward between the tonsillar lymphoid tissue and the supporting tissue. The lymphoid tissue was removed in blocks (Figure 5), making an effort to preserve the supporting tissue that extended between the lymphoid tissue. The lymphoid tissue of the tonsils was removed in small fragments, while the surrounding mucosa, supporting tissue, and capsule were all preserved (Figure 6). A 4-0 absorbable suture was used to pass through the mucosa of the palatopharyngeal arch, 2 mm outside the tonsillar capsule. Inside the tonsillar fossa, the suture was passed every 2-3 mm, securing a small amount of supporting tissue and capsule. Typically, 3-9 sutures were placed forward. After passing through, the suture was tied off 2 mm from the edge of the mucosa of the palatopharyngeal arch. Generally, 4-6 sutures were placed on one side of the tonsillar fossa, securing the mucosa of the palatopharyngeal arch, palatal arch, and some tonsillar surface mucosa to the supporting tissue and capsule within the tonsillar fossa, effectively closing the tonsillar fossa (Figures 7 and 8). During dissection, if any bleeding points were encountered, local compression with cotton balls was

used for hemostasis. When suturing, if bleeding occurred at any point, the suture was applied at that site to achieve hemostasis, obviating the need for the use of electrocautery or bipolar electrocoagulation or ligature for bleeding points.

The intraoperative time of the procedure was recorded, which was the time between the mucosal dissection and the withdrawal of the mouth gag. Intraoperative bleeding was recorded.

Postoperative Management and Follow-up

All patients received postoperative preventive measures for infection and fluid replacement. They were kept fasting for 6 hours after the surgery. After 6 hours, they were allowed to consume regular meals, with a recommendation for all patients to rinse their mouths after eating. Typically, patients were hospitalized for 1 to 4 days, with an average stay of 2.5 days. Children under 12 years of age were usually able to return to school on the 4th day after surgery, with observations for any related complications. At the 2-week postoperative follow-up, an examination of the tonsillar fossa mucosa was performed. At the 4-week follow-up, the status of suture removal was checked, and patients were carefully questioned about wound bleeding and signs of infection. Postoperative pain was assessed using the Visual Analog Scale (VAS), with daily pain scores recorded for each of the four postoperative days. During follow-up appointments or telephone consultations, pain scores were documented, with values ranging from 0 to 10 representing varying degrees of pain intensity, where "0" indicated no pain, "10" represented the most severe pain, 1-4 indicated mild pain, 4-7 indicated moderate pain and scores above 7 indicated severe pain, which could affect eating and sleeping. Patients were followed up at 2 weeks, 4 weeks, 3 months, 6 months, 12 months, 2 years, 5 years, and 8 years after the surgery. During these follow-up visits, patients were primarily asked about the improvement of their symptoms and the occurrence of postoperative bleeding. Additionally, the condition of scars in the tonsillar fossa was examined, and the presence of any residual tonsillar tissue growth was assessed.

RESULTS

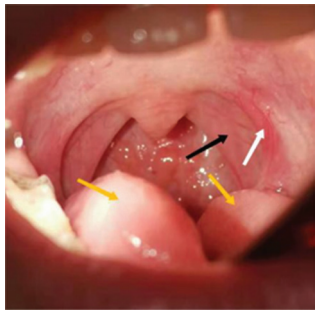
Operation time and intraoperative blood loss

The average surgical duration was 21.5±3.7 minutes, with an average blood loss of 6.53±2.52 mL.

Postoperative wound situation in the operation area

All patients have been followed up to the present day. Starting from the first day after surgery, they exhibited the formation of mucosal membranes in the surgical area, accompanied by mild local redness and swelling of the uvula. The mucosal membrane area was relatively small, appearing only as narrow bands at the mucosal anastomosis site. At the 2-week postoperative follow-up, all patients had complete mucosal membrane detachment. Through the use of tension-free sutures for the surrounding mucosa, membrane, and scaffold tissue, mucosal coverage of the tonsillar fossa healed well, with sutures completely dissolving around 4 weeks post-surgery.

Figure 9. Oropharynx at the 6-Month Postoperative Follow-up: White arrows indicate the palatopharyngeal arch, black arrows represent the palatal arch, and the tonsillar fossa mucosa is completely covered. Yellow arrows indicate tongue compression between cotton swabs in the middle, causing lateral bulging.



Postoperative bleeding, infection and other complications occurred.

All patients have been followed up to the present day without experiencing any postoperative secondary bleeding. Children under 12 years of age returned to school on the 4th day after surgery without any related complications. Within the first 2 weeks after surgery, there were 6 cases where patients had a fever exceeding 38°C. These patients received antimicrobial treatment, and their body temperatures returned to normal within 3 days, with the possibility of upper respiratory tract infection not excluded.

Postoperative pain

Using the Visual Analog Scale for pain assessment (none of the patients used patient-controlled analgesia pumps postoperatively), the degree of postoperative pain gradually decreased over time. On the first day after surgery, it did not affect the patients' eating and sleeping, with an average pain score of 5.7. On the second day, the average pain score was 3.5, indicating a noticeable reduction in pain. On the third day, the average pain score was 2.6, and on the fourth day, it was 1.3. Both patients and their families expressed satisfaction with the level of pain control.

Occurrence of postoperative tonsil remnant

Up to now, all patients have been followed up, and there has been no obvious scarring or hypertrophic growth of tonsillar tissue in the surgical area, as shown in Figure 9.

Statistical analysis

All data in this study were integrated using SPSS 22.0 (IBM, Armonk, NY, USA) for analysis and processing. Descriptive statistics for continuous variables are presented as mean ± standard deviation (Mean± SD).

DISCUSSION

Tonsillectomy is one of the most common procedures in otolaryngology, with common indications being chronic tonsillitis or tonsillar hypertrophy.[4] The tonsils are a pair of oval lymphoid organs composed of lymphoid tissue on the

inside, scaffold tissue extending outward into the lymphoid tissue, and an outer surface covered by dense connective tissue known as the tonsillar capsule. The superior constrictor muscle and fascia of the pharynx wrap around the tonsillar capsule and the lower one-third of the tonsillar lymphoid tissue.[5] Some portions of the superior constrictor muscle and fascia protrude between the lymphoid tissues near the lower one-third of the tonsil tissue.[6] Tonsils have a rich blood supply, with relatively large vessels located in the peripheral gaps of the tonsillar capsule.[7] In contrast, the vascular branches inside the capsule and scaffold tissue are smaller. Techniques such as electrocautery, cold plasma, and ultrasonic scalpel tonsillectomy allow for simultaneous cutting and hemostasis during surgery,[8] which has the advantages of shorter surgical duration and less intraoperative bleeding. However, these methods can cause local tissue damage due to high temperatures, resulting in some collagen degeneration.[9] The delay in the infiltration of inflammatory cells and the formation of fibrous tissue can lead to a longer postoperative recovery period and a higher rate of postoperative secondary bleeding and infection.[10] Additionally, electrocautery, cold plasma, and ultrasonic scalpel tonsillectomies are more expensive than cold dissection, increasing the economic burden on patients. Conventional dissection along the tonsillar capsule damages relatively large vessels, leading to significant bleeding. However, when removing tonsillar capsules and scaffold tissue internally, smaller vessels are damaged, making hemostasis easier after vessel disconnection, resulting in less bleeding. Tension on the lymphoid tissue during separation generates hemostatic function, and the application of small cotton balls for compression significantly reduces intraoperative bleeding. Making an incision along the hidden recesses around the tonsils and preserving the tonsillar surface and surrounding mucosa can achieve tension-free suturing of the surrounding mucosa. After suturing, the mucosal epithelium covers the tonsillar fossa, preventing direct exposure of submucosal tissue. This reduces the risk of infection, minimizes the irritation of food, and alleviates postoperative pain and improper eating, leading to reactive membrane rupture and bleeding.[11]Normal diet after surgery did not result in primary or secondary bleeding. By performing tension-free sutures on the surrounding mucosa, membrane, and scaffold tissue, care was taken not to involve the superior constrictor muscle, palatoglossus muscle, and palatopharyngeus muscle during suturing. After recovery, there was unobstructed muscle activity in the throat during swallowing, and swallowing was relatively painless. In children, the tonsillar fossa is relatively small, and sutures can be applied at 4 points, while in adults, it generally requires 6 points. The upper and lower poles of the tonsils are relatively narrow, so generally, one point requires suturing at about 3 locations, while the middle of the tonsillar fossa has a wider anteroposterior diameter, allowing for suturing at about 9 locations. The palatoglossus muscle, palatopharyngeus muscle, and fascia remained intact during surgery, and after recovery, the anatomical markers of the palatoglossal arch and palatopharyngeal arch were clear. Postoperatively, there were no scar formations in the tonsillar fossa. Up to the present day, no patients have been found to develop chronic inflammation or symptom recurrence due to lymphoid tissue hypertrophy in the tonsillar fossa, and none of the patients required a secondary tonsillectomy. The scaffold tissue and lymphoid tissue of the tonsils grow interlaced without obvious gaps, making the initial operation challenging and requiring a high level of technical skill. However, once proficiency in the separation technique is achieved, there is no significant difference in the time required when compared to tonsillectomy along the tonsillar capsule.

The tonsillectomy technique that preserves the tonsillar capsule scaffold tissue, and utilizes interrupted sutures on the tonsillar capsule and scaffold tissue has demonstrated several significant advantages. By suturing the mucosal surface of the palate, palatoglossal arch, palatopharyngeal arch, and portions of the tonsillar mucosa to the tonsillar fossa, this approach minimizes intraoperative bleeding, reduces postoperative pain, allows for a regular diet post-surgery, and has a minimal impact on a child's learning process. Compared to the traditional complete tonsillectomy, this method allows for the preservation of more normal tissue, reducing the extent of trauma. Consequently, it decreases postoperative inflammatory responses and neural stimulation, thereby mitigating the occurrence of postoperative pain and effectively avoiding postoperative bleeding. This results in a less painful and faster recovery with fewer complications.

Moreover, this technique is cost-effective. Therefore, it is highly recommended for widespread use in clinical practice. However, compared to the traditional complete tonsillectomy, this tonsillectomy procedure is more intricate and complex, demanding a high level of expertise from the performing surgeon. This necessitates that hospitals invest time and resources in providing specialized training for the surgical team.

Certainly, this study also has some limitations. Firstly, this study is retrospective, which might lead to selection bias and cannot establish causality. Secondly, there may be heterogeneity in the patient population in the study, which could affect surgical outcomes and recovery. Therefore, more prospective, randomized controlled studies are needed to verify and supplement the findings of this study.

We encourage further research to delve deeper into different tonsillectomy approaches, including traditional complete tonsillectomy and the tonsil-preserving technique employed in our study. Evaluating and comparing various surgical methods in terms of their impact on patient symptom relief, complication rates, and recovery speed can provide valuable insights for future studies.

ETHICAL COMPLIANCE

This study was approved by the ethics committee of Linyi People's Hospital. Signed written informed consent were obtained from the patients and/or guardians.

CONFLICT OF INTEREST

The authors have no potential conflicts of interest to report relevant to this article.

AUTHOR CONTRIBUTIONS

ZP and HL designed the study, QC and DW collected the data, YY, ZC and QS analyzed the data, ZP and HL prepared the manuscript. All authors read and approved the final manuscript.

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