Repair of Acquired Posterior Choanal Stenosis and Atresia by Temperature-Controlled Radio Frequency With the Aid of an Endoscope

Qin ying Wang, MD; Liang Chai, MD; Shen qing Wang, MM; Shui hong Zhou, MD; Yu yu Lu, MM

Objectives: To examine the clinical effects of temperature-controlled radio frequency (TCRF) repair of acquired choanal stenosis and atresia with the aid of an endoscope and to discuss the value of acquired choanal stenosis and atresia typing in clinical therapy.

Design: Retrospective study.

Setting: Academic otolaryngologic referral center.

Patients: Thirty-two patients, aged 32 to 65 years, with acquired choanal stenosis and atresia (from trauma in 9 cases and from radiotherapy after nasopharyngeal carcinoma in 23 cases); 13 cases were bilateral, and 19 were unilateral.

Interventions: Transnasal TCRF repair with the aid of an endoscope. Acquired choanal stenosis and atresia can be divided into 3 types: type 1, diagnosed within 3 months of the causative trauma or radiotherapy; type 2, diagnosed between 3 and 6 months after the trauma or radiotherapy; and type 3, diagnosed more than 6 months after the trauma or radiotherapy. All patients with types 1 and 2 disease received nasal stents made from Silastic that were fixed with transseptal sutures. However, patients with type 3 disease received no stenting.

Main Outcome Measures: The thickness of the stenosis and atresia revealed by computed tomographic scan and the surgical results were also analyzed. There was no significant correlation between them ($P > .05$).

Results: Twenty-nine patients remained free of symptoms for 12 to 42 months after surgery. Three patients required revision surgery, including 2 cases of type 1 disease (3 sides) and 1 case of type 2 (1 side). Two of the patients who underwent revision recovered completely, with no restenosis at 12 months after the second surgery. However, 1 patient with type 1 bilateral atresia experienced another restenosis and required another revision, through a transpalatal approach. There were no postoperative complications. There was no significant correlation between thickness of the stenosis revealed by computed tomographic scan and the surgical results.

Conclusions: We describe a TCRF technique with the aid of an endoscope for choanal repair. In our experience, it has been a highly successful, safe, and effective procedure, with minimal blood loss, swift recovery, and short time of hospitalization. It is important in postoperative care to remove any granulation or polyps at the site of the neochoana. Types 2 and 3 are the best types of disease to treat with this procedure.


THERE ARE CONGENITAL AND acquired choanal atresias (CAs). Most acquired CAs are fibrous membranous atresias. Many approaches have been used in the repair of CA, including transnasal, transpalatal, and transseptal approaches. The transpalatal approach offers excellent exposure and high success rates. However, increased operative time, bleeding, palatal fistula, palatal muscle dysfunction, and maxillofacial disturbances are possible sequelae of this procedure.1

Technical advances and experience in endoscopic nasal surgery have provided the opportunity to use a transnasal endoscopic approach. The transnasal endoscopic approach has been successfully used over the past decade in the treatment of CA.2-12 The technique permits a direct approach to the atretic area, with the advantages of an angled view, good illumination, and magnification of the CA.

We describe an endoscopic surgical technique and the clinical types of acquired choanal stenosis and atresia that may decrease the rate of restenosis in surgery for acquired choanal stenosis and atresia. We also discuss the value of acquired choanal stenosis and atresia typing for clinical therapy.
Thirty-two patients with acquired choanal stenosis and atresia were treated with transnasal temperature-controlled radio frequency (TCRF) procedures with the aid of an endoscope between January 2000 and December 2006. There were 21 men and 11 women, aged 32 to 65 years (mean age, 49.5 years), with the conditions arising from trauma in 9 cases and radiotherapy after nasopharyngeal carcinoma in 23 cases. Thirteen cases were bilateral, and 19 were unilateral. All patients were diagnosed by endoscopic examination (Figure 1) and computed tomographic (CT) scan (Figure 2). The stenosis and atresia were located in the posterior part of the nasal cavity and the edge of the choana. The thickness of the stenosis and atresia ranged from 0.2 to 3.0 cm.

Choanal stenosis and atresia occurred 2 to 24 months (mean, 9.3 months) after trauma or radiotherapy. Based on the time of injury of the posterior choana as inferred from the inflammation encountered during surgery, acquired choanal stenosis and atresia can be divided into 3 types: type 1, diagnosed within 3 months of the causative trauma or radiotherapy; type 2, diagnosed between 3 and 6 months after the trauma or radiotherapy; and type 3, diagnosed more than 6 months after the trauma or radiotherapy. Four of our cases were type 1 disease (6 sides), 19 were type 2 (26 sides), and 9 were type 3 (13 sides).

SURGICAL TECHNIQUE

We conducted the transnasal TCRF procedure with the aid of endoscopy using a System 2000 Atlas Coblator II (ArthroCare Corporation, Austin, Texas); an endoscopic and video system (Stryker Corporation, Kalamazoo, Michigan), which included a 4-mm 0° and 30° telescope; Blakesley forceps; and a power soft-tissue shaver (Linvatec Corporation, Largo, Florida). General anesthesia was used. Additional nasal decongestion was achieved by applying a solution of 1% lidocaine hydrochloride and 0.25% phenylephrine hydrochloride to neurosurgical cotton pledgets that were carefully placed in the nasal cavity. A solution of 1% lidocaine hydrochloride with 1:100 000 epinephrine was administered with a spinal needle to the stenosis, atretic plate, and posterior septum under direct visualization. In patients with bilateral stenosis and atresia, the anesthetic was administered to both sides during the inspection.

Under endoscopic visualization, a radiofrequency knife was used to trim the scarred mucosa in the posterior choana. Additional scar tissue on the posterior septum and posterior end of the inferior or middle turbinate was excised with the power soft-tissue shaver and Blakesley forceps. Partial resection of the posterior edge of the vomer was performed with backward-biting forceps, which were then also used to reduce a portion of the posterior bony septum, further enlarging the neo-choana. Care was taken not to damage normal adjacent nasal mucosa. The nasopharynx was carefully examined to rule out tumor recurrence, and surgical specimens were sent for histologic examination.

When the surgical procedure was complete, a custom-made soft Silastic (Dow Corning, Midland, Michigan) stent with a foam cuff (Bivona Corporation, Gary, Indiana) was placed in the neochoana and secured with a transseptal 2-0 silk suture. In 4 patients with type 1 disease and 19 patients with type 2, stenting was performed using these Silastic stents. In the 9 patients with type 3 disease, no stent was inserted. Antibiotic and local glucocorticoid (0.05% mometasone furoate aqueous nasal spray; Schering Plough Labo NV, Brussels, Belgium) were administered postoperatively.

POSTOPERATIVE CARE

Oral amoxicillin with clavulanic acid was prescribed for 2 weeks to prevent infection. Endoscopic follow-up was performed weekly, and blood clots and crusts were removed or suctioned. After removal of the nasal packs, all patients were trained and advised to perform nasal douches with normal saline (isotonic sodium chloride) solution at least 3 times a day. Mometasone furoate, 0.05%, aqueous nasal spray was also administered twice per day. The patients were seen weekly for the first 2 postoperative weeks to change the nasal packing. They were then observed every 2 weeks for 1 month, monthly for 2 months, and then once per 3 months. In the 4 type 1 cases, the stent was removed within 2 to 4 weeks (mean, 3 weeks). In the 19 type 2 cases, the stent was removed within 2 to 4 weeks (mean, 3 weeks).
Choanal atresia can be either congenital or acquired, although most cases are congenital. Acquired choanal stenosis and atresia are often complications of chemical cauterization, nasopharyngeal carcinoma and radiotherapy, surgical trauma, and infectious disease. Most are related to radiotherapy; in the present study, 23 of 32 cases (72%) were the result of radiotherapy.

Many surgical approaches have been suggested for the treatment of choanal stenosis and atresia, including transnasal, transpalatal, transantral, sublabial-transnasal, and transseptal approaches. The transpalatal approach offers excellent exposure and high success rates. However, increased operative time, bleeding, palatal fistula, palatal muscle dysfunction, and maxillofacial disturbances are possible sequelae of this procedure. The transnasal approach has narrow exposure and limited possibility to develop mucosal flaps. It also has the risk of possible injury to the eustachian tube and skull base. Advantages of a TCRF approach with the aid of a rigid endoscope in the repair of choanal stenosis and atresia are clear vision of the operative field and accurate removal of the stenosis and atresia plate without damaging neighboring structures, thus significantly reducing the rate of restenosis. The TCRF approach is a safe procedure with minimal blood loss, swift recovery, and a short time of hospitalization. It is also convenient, in postoperative care, to remove any granulation or polyps at the site of the neochoana at follow-up visits.

Congenital and acquired choanal stenoses and atresias differ in structure and in the areas blocked; in addition, the structures in acquired choanal stenosis and atresia can change with development. These differences have clinical value, so we divided acquired choanal stenosis and atresia into 3 types. Type 1 had patent inflammation, abundant secretions, and scar tissue in the nasopharynx and bled freely. The tissue of the nasopharynx and choanae were significantly edematous after surgery. As a result, the restenosis rate in type 1 cases was higher than in types 2 and 3. Two patients with type 1 disease experienced restenosis within 2 months of surgery. The recurrence rate in type 1 cases was 50% (2/4). This was clearly the worst type for the operation. Type 2 is a better type to operate on. Type 2 cases showed a lower restenosis rate; there was 1 case of restenosis within 2 months of surgery (recurrence rate, 1 of 19 [5%]). Type 3 cases had almost no inflammation in the nasal cavity and dryer mucosa; there was no case of type 3 restenosis in this study. Thus, type 3 is the optimal type to undergo operation, but the procedure should be performed in patients with type 2 or type 3 disease.

The use of stents in the management of patients with CA is a subject of some controversy. Several authors advocate postoperative stenting. Stents are generally left in place for 6 to 8 weeks because this is considered to be the time necessary for the reepithelialization of the neochoana. Many materials have been used for stenting, and softer materials apparently give better results in terms of preventing restenosis. We believe that stents are useful to stabilize the nasal airway in the postoperative period and to prevent the development of stenosis by maintaining a lumen. However, stents can also serve as a nidus for infection, and there is a question whether such a foreign body may contribute to choanal stenosis, as an endotracheal tube may cause subglottic stenosis. We have empirically used readily available Silastic stents for 2 to 4 weeks in type 1 cases and for 1 to 2 weeks in type 2 cases (stenting was not
carried out in our patients with type 3 disease). We usually maintain a regimen of oral antibiotics for our patients for the duration of stenting to lessen the risk of purulent rhinorrhea. Mometasone furoate, 0.05%, aqueous nasal spray was also used to lessen mucosal edema in the nasopharynx. Our study demonstrated that it is possible to find treatments that allow a reduction or even avoidance of the period of postoperative stenting.

We followed the technique of mucosal preservation indicated by Andrieu et al in their description of the transseptal approach for the repair of CA. The TCRF system and power soft-tissue shavers are believed to be less traumatic to nasal tissue than traditional endoscopic surgical techniques, allowing better tissue healing. Thus, TCRF and power soft-tissue shavers were used in our study. Some patients whose disease was caused by trauma showed significant proliferation of fibrosis in choanal stenoses and atresias. The TCRF system is easier and safer to use than power soft-tissue shavers in cases of fibrosis. We think that the TCRF technique helped to reduce the postoperative recurrence rate and the period of postoperative stenting. Furthermore, the shortened period of stenting and the use of soft stents diminished the likelihood of granulation tissue formation and the risk of postoperative infection.

On removal of the stent, endoscopic examination of the neochoana was carried out to ensure patency. If necessary, reactionary polyps at or near the neochoana were removed. The cases of restenosis in this study related primarily to granulation tissue or polyps at the site of the neochoana that were not removed owing to the lack of endoscopic examination.

Preoperative assessment by means of a CT scan and rigid endoscopic examination is very important for the success of surgical treatment. Axial CT scanning and rigid endoscopy can confirm the clinical diagnosis. In fact, CT scans can accurately characterize the nature and thickness of the atresia, the narrowing of the posterior nasal cavity, and the thickening of the vomer. In our series, all patients received a preoperative CT scan and rigid endoscopic examination to assess the thickness and nature of the atretic plate, the deformity of the posterolateral aspect of the nasal cavity, and the presence and nature of anatomic deformities at the level of the vomer and post-

Table 1. Transnasal Endoscopic Repair of Choanal Atresia and Choanal Stenosis in 32 Patients

<table>
<thead>
<tr>
<th>Disease Type</th>
<th>Patient</th>
<th>Laterality</th>
<th>Follow-up, mo</th>
<th>Stent Duration, wk</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Bilateral</td>
<td>40.0</td>
<td>3.5</td>
<td>Repair</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>Unilateral</td>
<td>23.0</td>
<td>1.0</td>
<td>Repair</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>Unilateral</td>
<td>18.0</td>
<td>1.5</td>
<td>Repair</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>Unilateral</td>
<td>21.0</td>
<td>2.0</td>
<td>Repair</td>
</tr>
</tbody>
</table>

Table 2. The Thickness of the Stenosis and/or Atresia and Surgical Results

<table>
<thead>
<tr>
<th>Thickness, cm</th>
<th>Patients, No.</th>
<th>Repairs</th>
<th>Revisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0-1.0</td>
<td>12</td>
<td>11</td>
<td>1 (Type 1)</td>
</tr>
<tr>
<td>1.1-2.0</td>
<td>11</td>
<td>10</td>
<td>1 (Type 2)</td>
</tr>
<tr>
<td>&gt;2.0</td>
<td>9</td>
<td>8</td>
<td>1 (Type 1)</td>
</tr>
</tbody>
</table>

*Unless otherwise indicated, data are reported as number of patients. For the comparison of type 1 with type 2 revisions, \( \chi^2 = 0.048 \) (\( P > .05 \)).
terior nasal cavity to choose the most suitable surgical approach. However, our study findings suggest no significant correlation between thickness of the stenosis revealed by CT scan and the surgical results.

In conclusion, a transnasal TCRF approach with the aid of an endoscope is a useful procedure for the repair of acquired choanal stenosis and atresia. This technique permits an angled vision, excellent visualization, and magnification of the atretic plate; compared with traditional techniques, this technique allowed a shorter hospital stay and less blood loss. To reduce the chance of restenosis and shorten or even avoid the period of postoperative stenting, thorough mucosal preservation of the neochoana is of paramount importance. Postoperative care is also important for removing any granulation or polyps at the site of the neochoana. Type 2 and 3 are the best types to consider for the operation.

Submitted for Publication: November 23, 2007; final revision received April 14, 2008; accepted May 12, 2008.

Correspondence: Qin ying Wang, MD, Department of Otolaryngology, The First Affiliated Hospital, College of Medicine, Zhejiang University, 310003, Hangzhou, Zhejiang, China (huxl324@yahoo.com.cn).

Author Contributions: Drs S. Wang and Lu had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Acquisition of data: Q. Wang, Chai, S. Wang, and Lu. Analysis and interpretation of data: Q. Wang, S. Wang, and Zhou. Drafting of the manuscript: Q. Wang, Chai, S. Wang, Zhou, and Lu. Critical revision of the manuscript for important intellectual content: Q. Wang and S. Wang. Statistical analysis: Q. Wang, Chai, and Zhou. Administrative, technical, and material support: Q. Wang. Study supervision: S. Wang and Lu.

Financial Disclosure: None reported.

REFERENCES


