Transnasal Endoscopic Repair of Congenital Choanal Atresia

Long-term Results

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Objectives: To evaluate the short- and long-term success of the repair of congenital choanal atresia using the transnasal endoscopic approach with and without power instruments.

Design and Setting: Retrospective case series in a tertiary care center.

Patients: Fifteen patients with either unilateral or bilateral congenital choanal atresia were treated using the transnasal endoscopic approach. Postoperative stenting was used in all 15 patients.

Interventions: The senior surgeon (C.W.G.) currently uses the transnasal endoscopic drill-out technique. We describe our experience and long-term follow-up of 15 patients (9 with unilateral atresia, 5 with bilateral atresia, and 1 with unilateral stenosis) who were treated with the use of the transnasal endoscopic technique during a 7-year period. In 8 patients, the transnasal endoscopic technique was performed using conventional biting instruments, and in 7 patients, the transnasal endoscopic technique with power instruments was used.

Main Outcome Measure: The patency of the surgical repair of congenital choanal atresia by the transnasal endoscopic approach.

Results: Of 14 patient procedures, 12 remained patent. One patient required minor debridement of granulation tissue 1 week following stent removal, and 1 patient required surgical transnasal revision 2 months after the primary procedure, with a patent result after the second procedure. Despite patent choanae being achieved, 1 patient died of cardiac anomalies 8 months after the atresia repair.

Conclusions: The transnasal endoscopic route offers excellent visualization of the posterior choana and, hence, the ability to open the defect widely with a high surgical success rate. Newer powered instrumentation further enhances the ability to perform this technique cleanly.


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ONGENITAL choanal atresia (CCA) was first described by Johann Roderer in 1755 in the clinical evaluation of a newborn with total choanal obstruction.1 Otto, however, was credited with first describing it to Roderer in 1830.2 In 1854, Emmert reported the first successful operation for CCA on a 7-year-old boy, which he had performed 3 years earlier using a curved trocar transnasally.2 Four hypotheses of the embryological origin of the disorder exist, but none has been proved. These include (1) the persistence of the nasobuccal membrane of Hochstetter (2) or of the foregut buccopharyngeal membrane, (3) abnormal mesodermal adhesions forming in the nasal choanae, and (4) a misdirection of mesodermal flow due to local factors.3 Choanal atresia has an incidence of 1 in 5000 births.2,4 It occurs more commonly in females than in males (2:1), and unilateral atresia is more common than bilateral.2 It is said that 90% of CCAs are of the bony type and that 10% are of the membranous type,5 but a combination of bony and membranous components seems to be common. The clinical evaluation should include a complete physical examination to look for other congenital anomalies and a complete nasal and nasopharyngeal examination to assess the deformity. This can be performed using flexible fiberoptic endoscopes. An axial computed tomographic scan is the imaging study of choice in assessing CCA.6,7 The location and type of atresia confirmed on computed tomographic scan assist the operating surgeon in establishing a treatment plan.

Many approaches to the repair of CCA have been reported in the literature. These most commonly include the
PATIENTS AND METHODS

A retrospective medical record analysis was performed of patients with CCA seen at the University of Virginia Medical Center, Charlottesville, between June 1989 and June 1996. Fifteen patients with such a diagnosis were treated by the transnasal endoscopic surgical technique. From June 1989 to December 1992, 8 patients were treated endoscopically using traditional sinus instrumentation, and from January 1993 to June 1996, 7 patients were treated with the endoscopic drill-out technique. Patients' age at the time of treatment, sex, the type of stenosis (bony, membranous, or mixed), laterality (bilateral or unilateral), the type of instrument used, and follow-up results are shown in the Table.

With standard nasal endoscopic equipment and nasal power instrumentation available, oxymetazoline hydrochloride spray is applied to the nasal cavity 15 minutes before the patient is transported to the operating department. On arrival, general anesthesia is induced. Additional nasal decongestion is obtained by applying a solution of 1% lidocaine hydrochloride and 0.2% phenylephrine hydrochloride to neurosurgical cotton pledgets that are carefully placed in the nasal cavity. Using a 4.0 mm, 0° telescope, both sides of the nasal cavity are inspected, and the atretic plate is carefully identified. A solution of 2% lidocaine with 1:50 000 epinephrine is administered with a spinal needle under direct visualization to the atretic plate and posterior septum. In a patient with bilateral atresia, the anesthetic is administered to both sides during the inspection. The eyes are taped closed at the lateral canthus and exposed in the operative field. A tonsil sponge is positioned high in the nasopharynx, distending the soft palate caudally. The sponge serves as a landmark during the procedure.

Using a power soft tissue shaver (Linvatec Corporation, Largo, Fla) under endoscopic visualization, the mucosa over the atretic plate is carefully removed. A round cutting burr then replaces the tissue shaver on the powered handpiece. Staying posterior, inferior, and medial in the nasal cavity, the surgeon perforates the atretic bony plate. Visualizing the tonsil sponge previously placed in the nasopharynx ensures correct fenestration. Once this is ascertained, the neoochoana is completed by drilling laterally, enlarging to the lateral edge of the nasopharynx. Backbiting forceps are then used to reduce a portion of the posterior bony septum. This further enlarges the neoochoana.

When the surgical technique is completed, a custom-made soft Silastic stent with a foam cuff (Bivona Corporation, Gary, Ind) is placed in the neoochoanae and secured with a transtemporal nylon suture anteriorly. Antibiotic medications and an isotonic sodium chloride nasal spray are administered postoperatively.

transpalatal and transnasal routes. Transseptal repair is still occasionally used for older patients with unilateral atresia,8 and the transantral route is of historical importance only.9

The transnasal route fell out of favor because of the high rate of failure requiring revision.10 This was attributed to the difficulty in visualizing areas of the choana that required special surgical attention, such as the vomerine septal bridge and bony narrowing of the lateral walls. As patients grow, the depth from the nasal vestibule to the posterior choana becomes longer, and thus, the transnasal approach is further complicated even with the use of an operating microscope. Septal deviation, turbinate hypertrophy, or other anatomical abnormalities can further complicate visualization during the transnasal approach.11 The transpalatal route has, therefore, become the method preferred by many surgeons.1,7,11,12 Its use has been advocated for the repair of unilateral and bilateral atresia, in younger or older patients, and for revisions. It offers excellent exposure and high success rates. The transpalatal approach, however, is not without disadvantages. Increased operative time, increased blood loss, palatal fistula, palatal muscle dysfunction, and maxillofacial growth disturbance are sequelae of this procedure.1,12

The appreciable incidence of surgical failure with CCA repair led to a search for better surgical alternatives. Technical advances in endoscopic visualization and newer sinonasal powered instruments for endonasal surgical procedures have provided the opportunity to use the transnasal endoscopic route. We describe our experience using this route and why it is our preferred surgical approach for the repair of CCA.

RESULTS

Fifteen patients were treated for CCA with the transnasal endoscopic technique. Of these, 7 patients were treated using powered instruments (1993-1996) and 8 patients had the endoscopic procedure with traditional biting equipment (1989-1992). Five patients were male, and 10 were female. The age at the time of treatment ranged from 2 days to 15 years with an average of 3 years. Nine patients had a unilateral atresia, 5 had bilateral atresia, and 1 had a unilateral stenosis.

Computed tomography was performed preoperatively on all patients to confirm the presence of atresia. Furthermore, computed tomographic scanning was used to determine if the atresias were of the bony (8 patients) or membranous (1 patient) type or of mixed bony and membranous elements (6 patients, including 1 with stenosis). All 15 patients were treated endoscopically with either the use of power instruments or conventional biting tools to open the bony aspect of the atresia (Table). After the operation, stents were left in place for 3 to 12 weeks, 3 weeks for unilateral atresia, 6 weeks for bilateral atresia, and 12 weeks for revision cases.

Patent choanae resulted in all patients, with only 1 patient needing revision. Four patients had other concurrent congenital anomalies. One of these patients died of her cardiac abnormalities 8 months after successful atresia repair. One patient who had the endoscopic drill-out...
The prevention of excessive trauma to mucosa diminishes the formation of granulation tissue.10 As has been reported,15-17 the newer soft tissue power shaver causes less tissue injury with more rapid healing. With endoscopic nasal and sinus surgical procedures more popular, instruments that allow better visualization and more surgical precision continue to be developed. Power-suction soft tissue shavers and drills are believed to be less traumatic to nasal tissue and allow better tissue healing.13 In addition, the attached suction apparatus facilitates the removal of blood and debris, providing continued visualization and a safer surgical technique.15

The senior surgeon (C.W.G.) strongly advocates the use of telescopic visualization for endonasal operations. The direct access, higher optics, and excellent visualization offered with the nasal telescopes enables a surgeon to safely correct the difficult anatomical areas that have caused high failure rates in the past, ie, the lateral bony narrowing and the posterior septum. We believe that this was one of the reasons for the high success rate in our series in all age groups, with either laterality of atresia, and with all types of stenosis.

Congenital choanal atresia can be successfully treated by the endoscopic transnasal approach in all age groups. Special attention to the following critical points in the surgical procedure have contributed to our high success rate:

- The prevention of excessive trauma to mucosa diminishes the formation of granulation tissue.10 As has been reported,15-17 the newer soft tissue power shaver causes less tissue injury with more rapid healing.
- An adequate amount of lateral bony wall and posterior septum must be safely removed.3 The 4.0 mm,
0° telescopes provide superior visualization of these trouble areas. In addition, the new nasal power instruments offer both soft tissue shavers and bone-cutting drills with protective sheaths to prevent accidental trauma to nonsurgical areas.

- Stents should be made of soft material to limit the formation of granulation tissue. We use a custom-made, self-inflating, soft-cuffed Silastic stent.

In the hands of experienced endoscopists, the transnasal route with the use of endoscopes offers excellent visualization of the posterior nasal defect in patients with CCA. Traditional endoscopic biting instruments have proved effective in the treatment of these patients, but with new power-suction instruments available for endonasal surgical procedures, the long-term success rate of the repair of CCA is excellent, with decreased tissue trauma and greater ease in removing the bony choanal abnormality. Transnasal endoscopic drill-out repair with power instrumentation is our mode of choice for the correction of CCA.

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