Topical Mitomycin as an Adjunct to Choanal Atresia Repair

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Objective: To evaluate the use of topical mitomycin in choanal atresia repair to reduce the development of granulation tissue and cicatrix.

Design and Setting: Retrospective case series in 2 tertiary care centers.

Patients: Twenty patients with either unilateral or bilateral congenital choanal atresia underwent repair using the transnasal endoscopic approach, the transpalatal approach, or both.

Interventions: The surgeons favor the use of the endoscopic transnasal drillout technique for all unilateral cases of choanal atresia and for selected bilateral cases. We describe our experience and treatment paradigm for these 20 patients (15 with unilateral atresia, 5 with bilateral atresia). Topical application of mitomycin was used, and in some cases postoperative stenting, for a period of 1 to 2 weeks. In 8 cases, a second application of mitomycin was used. Follow-up ranged from 3 months to 2 years (mean, 9 months).

Outcome Measure: The patency of the choanae without respiratory distress or nasal drainage, as assessed by endoscopic evaluation, determined a successful repair.

Results: Of the 20 patients, 17 retained patent airways. Three patients experienced improvement from a total atresia to a narrowed, stenotic choana.

Conclusions: The use of mitomycin as an adjunct to the surgical repair of choanal atresia may offer improved patency with a decreased need for stenting, dilatations, and revision surgery. Newer endoscopic techniques with powered instrumentation further enhance the safety and efficacy in the repair of choanal atresia.


Choanal atresia is a disease of the nasal airway where no connection exists between the nasal cavity and the aerodigestive tract. It was first described in 1755 by Roederer. Many surgical approaches have been recorded over the last 250 years to correct this anomaly, including transnasal, transpalatal, transmaxillary, transseptal, and sublabial/transseptal. Studies have also evaluated the benefits of placing intraoperative nasal stents to improve patency rates.

Mitomycin is an aminoglycoside antibiotic made by the fungus Streptomyces caesipitosus. It has long been used intravenously as an antineoplastic agent to inhibit DNA synthesis and break DNA strands and chromosomes. Topical application of the same medication has found additional uses, based on its inhibition of fibroblast growth and migration. Surgeons have successfully used mitomycin to maintain trabecular patency in glaucoma surgery, prevent or reduce laryngotracheal stenosis in laryngeal surgery, provide longer patency to myringotomy holes, sustain tear duct function after dacryocystorhinostomy, and maintain sinus drainage and decrease synchiae after sinus surgery (J. Newman, C. Huang, and V. Anand, oral communication, September 2000). This study looks at the effects of intraoperative application of mitomycin to the neochoanae immediately after surgical opening.

RESULTS

No patient was lost to follow-up. Outcome measurements are based on the 3-month postoperative visit, though assessment of choanae size did not change for anyone after that period. In 8 cases, a second application of mitomycin was delivered. Of the 20 patients, 17 retained fully open choanae. The remaining 3 experienced improvement from total stenosis to narrowed choanae; none of the patients’ choanae were closed.

Interestingly, the 3 patients classified with narrow openings all had small nasal cavities that prohibited our preferred endoscopic drillout procedure. Two
PATIENTS AND METHODS

A retrospective analysis was performed on 20 patients (14 female and 6 male) with congenital choanal atresia seen in 2 major tertiary care institutions: New York Hospital, New York, NY, and University of Lyon, Lyon, France. The Table lists each patient’s sex, type of atresia (ie, unilateral vs bilateral), associated medical conditions, surgical approach, previous procedures done, number of mitomycin applications, and outcomes. Fifteen patients had unilateral atresias, and 6 had choanal atresia as part of a syndrome. All but 4 patients underwent endonasal approaches, 3 patients had combined transnasal/transpalatal approaches, and 1 patient had a transpalatal approach. Twelve of the patients had previously undergone surgery for their atresia.

Each patient underwent axial and coronal sinus series computed tomography scans. All families gave informed consent. Vasoconstriction was attained using topical 0.5% oxymetazoline hydrochloride pledgets. A Davis mouth gag provided adequate exposure of the oral cavity and oropharynx, while a 120° endoscope was used to visualize the nasopharynx. A 4.0- or 2.7-mm, 0° endoscope was used to correlate findings with the radiographic images, after which 1% xylocaine with 1:100,000 epinephrine was injected into the posterior septum, lateral wall, and atretic plate.

The surgeon then passed a 25-gauge spinal needle through the inferomedially atretic plate visualizing the needle via the 120° endoscope. This permitted assessment of the thickness of the atretic plate as well as the superior and lateral surgical boundaries. A sickle knife was then used to elevate a mucosal flap nasally, after which powered instrumentation was used to drill out the atretic plate. The contralateral choana was treated as necessary.

Before completing the procedure, we used backbiting forceps to remove the posteroinferior vomer. After creation of the neochoanae, 0.5 mg of mitomycin was applied in 1 mL of solution to the newly opened nasopharyngeal area via neopledgets for 3 minutes. Assessment was made regarding placement of endotracheal tube stents. Four weeks after the initial operation, or after stent removal, the area was reassessed for granulation tissue formation. Repeated nasal endoscopy was continued periodically in an outpatient setting.

Neochoanae were classified as closed (no opening), open (patent enough to pass a 3.5-mm endotracheal tube), or narrowed (a neochoana too small to pass a 3.5-mm endotracheal tube, but not entirely closed). Figure 1 shows the narrowed and Figure 2, the open postoperative results.

Our study illustrates the benefit of applying mitomycin to the neochoanae during choanal atresia surgery. Adding very little time to the operation and no complications, mitomycin treatment inhibits fibroblast growth and migration and

<table>
<thead>
<tr>
<th>Patient No./Sex</th>
<th>Type of Atresia</th>
<th>Associated Conditions</th>
<th>Repair Approach</th>
<th>No. of Procedures Done Before Mitomycin Application</th>
<th>No. of Procedures Mitomycin Used</th>
<th>Outcome</th>
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<tr>
<td>1/F</td>
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<td>CHARGE</td>
<td>TP/N</td>
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*CHARGE indicates coloboma (of eyes), hearing deficit, choanal atresia, retardation of growth, genital defects (males only), and endocardial cushion defect; S, syndromic; NA, not applicable; VACTERL, vertebral, anal, cardiac, tracheal, esophageal, renal, and limb anomalies; TP, transpalatal; and N, nasal.
allows for healing with decreased scar formation as seen
in the eyes, ears, larynx, and sinus ostia. Our results com-
pare favorably with historical statistics, which illustrate that
patients with bilateral and unilateral atresia typically un-
dergo 5 and 3 surgical corrections, respectively. This study
is limited by the small number of patients, but it serves only
as a preliminary study, which we have decided to report
secondary to the success the intervention has achieved in
limited numbers. We intend to observe our cohort for a
longer time and also to enroll additional patients in the same
study, including more primary repairs. With the rarity of
the disease, sharing our results will allow us to compare
findings with those obtained at other centers. An ideal
study would be to compare mitomycin treatment with pla-
cebo in bilateral atresia.

The use of mitomycin as an adjunct to the repair of
choanal atresia may offer improved patency with a de-
creased need for stenting, dilations, and revision sur-
gery. Newer endoscopic techniques with powered in-
strumentation further enhance the safety and efficacy in
the repair of choanal atresia. Questions remain as to how
a brief application of a topical agent (which the body
quickly metabolizes) can have a long-term effect on healing.
There may be a role for injectable mitomycin, or mi-
tomycin in slow-release form, perhaps on the surface of
choanal stents.

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REFERENCES

1. Park AH, Brockenbrough J, Stankiewicz J. Endoscopic versus traditional ap-
52:45-51.
4. Josephson GD, Vickery CL, Giles WC, Gross CW. Transnasal endoscopic repair
540.
5. Keller JL, Kacker A. Choanal atresia, CHARGE association, and congenital nasal
6. Harris J, Robert E, Kallen B. Epidemiology of choanal atresia with special refer-
7. Jassir D, Buchman CA, Gomez-Marín O. Safety and efficacy of topical mitomycin
8. Daniels JT, Occeleston NL, Crowston JG, Khaw PT. Effects of antimetabolite in-
duced cellular growth arrest on fibroblast-fibroblast interactions. Exp Eye Res.
9. Liao SL, Kao SCS, Tseng JHS, Chen MS, Hou PK. Results of intraoperative mitomy-
11. Ingrams DR, Volk MS, Biesman BS, Panikratov MM, Shapshay SM. Sinus sur-