International Journal of Pediatric Otorhinolaryngology (2006) **70**, 1369—1373

ELSEVIER

International Journal of Pediatric Otorhinolaryngology

www.elsevier.com/locate/ijporl

Treatment strategy for iatrogenic nasal vestibular stenosis in young children☆

Lee P. Smith, Soham Roy*

University of Miami — Miller School of Medicine, Department of Otolaryngology Head and Neck Surgery, United States

Received 13 January 2006; accepted 30 January 2006

KEYWORDS
Nasal vestibule;
Stenosis;
Iatrogenic

Summary Iatrogenic nasal vestibular stenosis is an uncommon complication of supportive care in neonates. There is minimal literature describing this entity; previous treatment strategies focus on correction with local flaps or skin grafts. We describe symptomatic iatrogenic vestibular stenosis treated successfully with endoscopic lysis of synechiae and nasal stenting. Three children with nasal stenosis were identified from 2003 to 2004 at a large academic tertiary care medical center. All patients were born premature (25—34 weeks). Two developed vestibular stenosis after extended use of nasal CPAP; one developed unilateral nasal stenosis 4 years after use of a nasal feeding tube. Age at time of surgical repair was from 4 months to 5 years. Two patients (4 and 5 months) presented with nasal airway obstruction, and difficulty breathing during feeding. One patient (5 years) presented with right-sided nasal obstruction and nasal whistling. Endoscopic lysis of nasal synechiae and release of vestibular scarring was performed in all three cases without complication. Nasal stenting with a modified endotracheal tube was used for 4—6 weeks. Topical Mitomycin C was utilized in two patients. All patients had complete resolution of airway symptoms after stent removal and all three remain asymptomatic 1 year after repair with no recurrence of vestibular stenosis. Nasal vestibular stenosis is a rare complication following supportive care in premature infants, causing airway and feeding difficulties in the obligate nasal breather. This can be successfully corrected with endoscopic repair, nasal stenting and application of Mitomycin C.

1. Introduction

Iatrogenic nasal vestibular stenosis is an uncommon complication of supportive care in neonates [1,2]. Poor placement or insufficient immobilization of the cannula can result in injury to the nasal lining and, over time, eventual scarring with contracture of the vestibule [3—5].

☆ Presented as an oral presentation at the SENTAC meeting, December 2, 2005, Baltimore, MD, USA.

* Corresponding author. Present address: Pediatric Otolaryngology, University of Miami — Miller School of Medicine, Bascom Palmer Eye Institute, Pediatric Ear, Nose and Throat, 900 N.W. 17th Street #529, Miami, FL 33136, United States.
Tel.: +1 305 326 6332; fax: +1 305 326 6525.
E-mail address: sroy2@med.miami.edu (S. Roy).

0165-5876/$ — see front matter
doi:10.1016/j.ijporl.2006.01.015

Prior surgical treatment modalities have focused on lysis of adhesions with skin grafting, mucosal grafting or local tissue transposition to cover the resultant tissue defect [2,6—12]. While these treatments are relatively easy to perform in other anatomic sites, the nasal vestibule is an extremely small space, available tissue for rotation is sparse, and other intranasal incisions can lead to further scarring [13]. Irrespective of the surgical technique, most authors advocate prolonged stenting to prevent restenosis. In this article we discuss our recent experience with iatrogenic nasal vestibular stenosis and present a simplified treatment algorithm involving endoscopic-assisted lysis of adhesions with postoperative stenting.

2. Case reports

All three patients presented to the Pediatric Otolaryngology service of a large Academic Tertiary Care Center between 2003 and 2004. All three children were born premature (25—34 weeks). Two developed vestibular stenosis after extended use of nasal prongs for nasal continuous positive airway pressure (CPAP) (patients #1 and #3); one developed unilateral nasal stenosis 4 years after use of a nasogastric feeding tube (patient #2). All operations were performed by or under the direct supervision of the senior author (SR).

2.1. Patient #1

A 4 month-old ex-26 week premature infant presented with a chief complaint of nasal airway obstruction and bilateral nasal vestibular retraction, with resulting airway difficulties during feeding and failure to thrive. Physical examination revealed adhesions within the nasal vestibule bilaterally obscuring 80% of the nasal airway and causing a significant cosmetic deformity (Fig. 1A). The patient was diagnosed with iatrogenic nasal vestibular stenosis and brought to the operating room for surgical correction. After lysis of the vestibular adhesions, the nasal ala returned to the normal anatomic position correcting the cosmetic deformity. An endoscopic exam of her nasal airway revealed additional synechia between the nasal septum and along the full length of the left inferior turbinate. The patient also had synechia between his septum and the anterior aspect of his inferior and middle turbinates on the right side. The intranasal synechia were lysed with endoscopic assistance (Fig. 1B). A pledget soaked in Mitomycin C (0.4 mg/ml) (MMC) was applied to the raw mucosal surfaces bilaterally for a period of 2 min. Following this a customized 3.0 endotracheal tube (ETT) (Mallinckrodt Inc., Hazelwood, MO) was placed in each nostril with a spacer placed along the columella and secured in place with a 4.0 prolene suture placed through the nasal septum. The patient returned to the operating room 4 weeks later for an examination under anesthesia and stent removal. Intranasal examination revealed no residual stenosis. The patient remained asymptomatic, with an excellent cosmetic outcome and without recurrence of synechia at his 6-month post-operative clinic visit.

2.2. Patient #2

A 5 year-old ex-34 week premature infant presented with her mother with a chief complaint of whistling

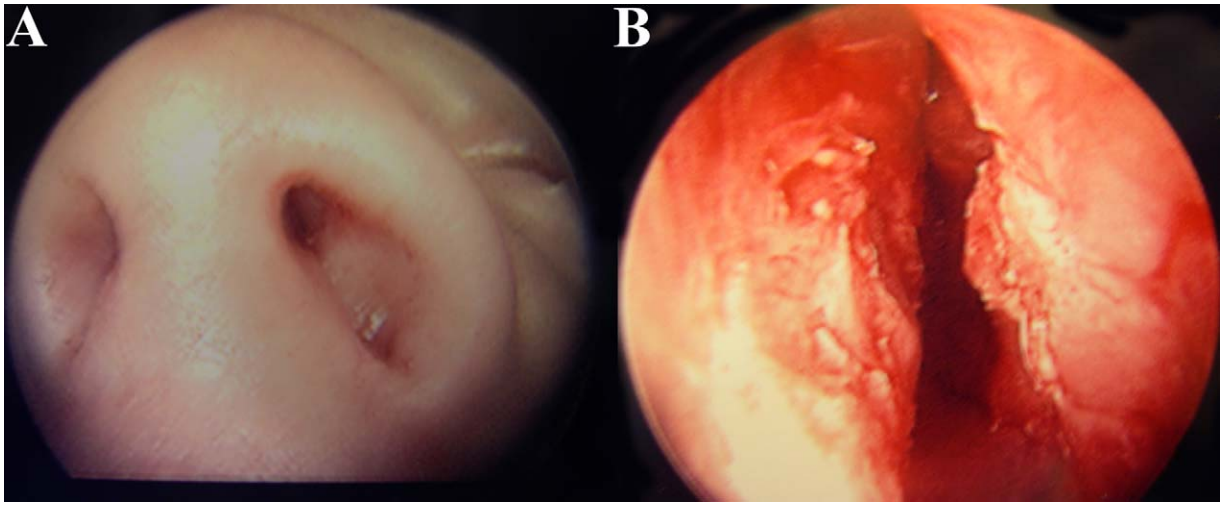

Fig. 1 (A) Pre-operative view of left nasal vestibule demonstrating 80% nasal vestibular stenosis. (B) Endoscopic view of left nasal cavity following lysis of adhesions.

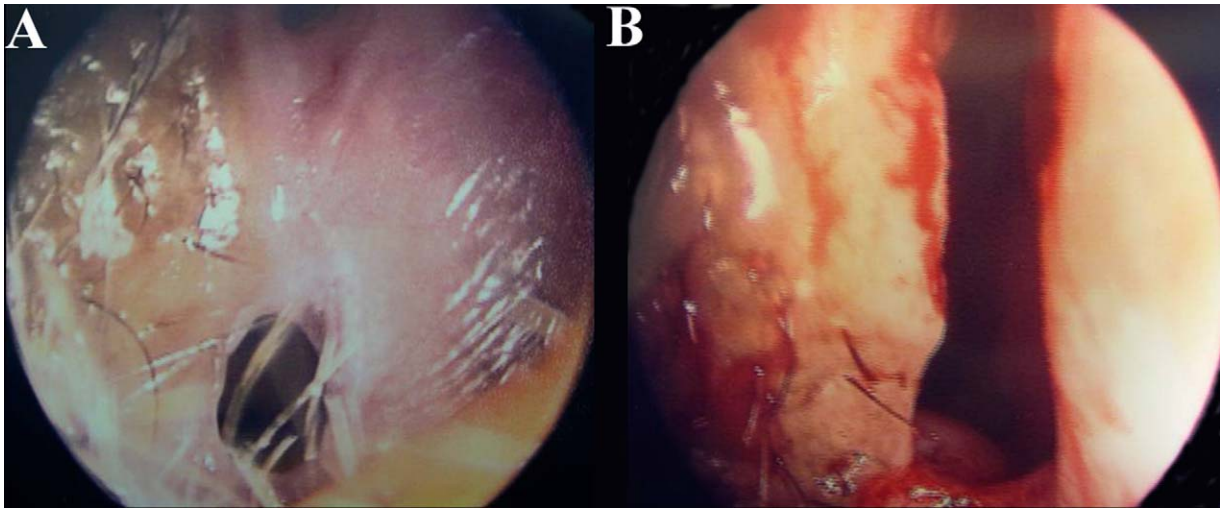

Fig. 2 (A) Pre-operative view of right nasal vestibule demonstrating 70% nasal vestibular stenosis. (B) Post-operative view of right nasal vestibule after lysis of adhesions.

during respirations and right-sided nasal vestibular retraction. Physical examination revealed adhesions within her right nasal vestibule obscuring 70% of her airway and causing a significant cosmetic deformity from collapse of the right nasal alar cartilage (Fig. 2A). Pre-operative CT-scan confirmed the diagnosis of iatrogenic nasal vestibular stenosis (Fig. 3). Operative findings revealed a right-sided nasal vestibular stenosis with additional synechia between the anterior aspect of her inferior turbinate and nasal septum on the right side. After lysis of adhesions her nasal ala returned to the normal anatomic position (Fig. 2B). A silastic sheet (Technical Products Inc. of Georgia, Decatur, GA) was placed in the right nostril preventing apposition of the two raw surfaces as a stent and secured to the nasal septum with a 4.0 prolene suture. The patient returned to the clinic 10 days later for stent removal. Intranasal examination revealed slight restenosis at the superior aspect of her vestibule, which matured to obscure 10—20% of her nasal vestibule at the 6-month post-operative visit. The patient and family were pleased with the functional and cosmetic outcome and declined further treatment.

2.3. Patient #3

A 5-month-old ex-25 week premature infant presented with a chief complaint of difficulty breathing during feeds and bilateral nasal vestibular retraction. Physical examination revealed adhesions within her nasal vestibule obscuring 95% of her nasal

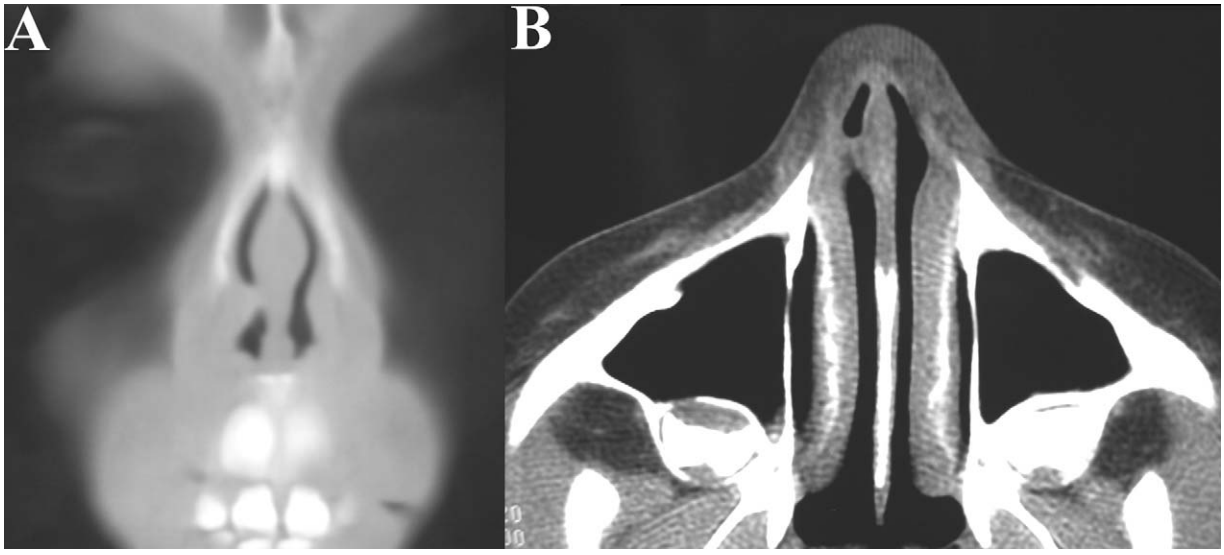

Fig. 3 (A) Coronal and (B) axial CT scans demonstrating an isolated soft tissue synechia within the right nasal vestibule causing a vestibular stenosis.

airway bilaterally and causing a significant cosmetic deformity. The patient was diagnosed with iatrogenic nasal vestibular stenosis and brought to the operating room for surgical correction. After lysis of the vestibular adhesions, the nasal ala returned to the normal anatomic position. An endoscopic exam of her nasal airway revealed additional synechia bilaterally between the anterior aspect of her inferior turbinates and nasal septum. The intranasal synechia were lysed with endoscopic assistance and a pledget soaked in MMC (0.4 mg/ml) was applied to the raw mucosal surfaces bilaterally for a period of 2 min. Customized 3.5 ETT stents were placed bilaterally (as described for patient #1). Stents were removed in clinic 6 weeks later. Intranasal examination revealed no residual stenosis. The patient remained asymptomatic, with an excellent cosmetic outcome and without recurrence of synechia at her 6-month post-operative clinic visit.

3. Discussion

In this article we present our recent experience with iatrogenic nasal vestibular stenosis in young children. Although our series involves three patients, the uncommon occurrence of this problem impedes the accumulation of a large series of patients. Indeed, Gowder et al. [1] looked at 72 premature infants treated with nasal prongs and found zero cases of vestibular stenosis. In the same series, 5.8% of 136 patients who received nasotracheal intubation developed nasal deformities, a group which included several cases of nasal vestibular stenosis. Very low birth rate ($<$1000 g) and prolonged intubation ($>$7 days) were correlated with an increased incidence of deformities [1]. Over the past 25 years improvements in nursing care and the preference of orotracheal intubation or nasal CPAP over nasotracheal intubation has decreased the incidence of nasotracheal intubation as a cause of vestibular stenosis [2]. Loftus et al. present eight patients with nasal deformities attributed to nasal CPAP use, highlighting the increased use of CPAP in neonatology. These deformities included, but were not limited to nasal vestibular stenosis. Patients were collected over a period of 2 years, from a pool of 2000 patients treated in their institution over a period of 15 years [2]. Despite increased survival of premature infants, nasal vestibular stenosis remains an uncommon consequence of prolonged instrumentation of the nasal cavity.

Iatrogenic nasal vestibular stenosis results from an insult to the nasal vestibular lining with resultant scarring and healing with contracture [13]. It has been described following nasal CPAP use [2], nasotracheal intubation [1,11], nasal packing [13], overzealous cauterization for nasal bleeding [8,9], rhinoplasty [13], birth trauma [3] and correction of a cleft lip/nose deformity [13]. Various techniques have been applied for treatment of this deformity, with the most common involving lysis of adhesions and closure of the resultant defect with a skin graft, mucosal grafting or local flap [2,6—12]. These techniques may be difficult secondary to the small size of the nasal vestibule and the limited availability of donor tissue, factors, which are magnified in young children. Furthermore, additional intranasal incisions can lead to increased scarring. Irrespective of the technique, nearly all authors recommend long-term postoperative nasal stenting. Notably, Karen et al. [13] achieved excellent results in sixteen adult patients using an auricular composite graft without long-term stenting [13], a concept, which would be technically challenging in a young child.

In this study we present our recent experience with this uncommon entity. Our experience suggests that iatrogenic adhesions after nasal CPAP typically involve the nasal vestibule and anterior aspect of the inferior turbinate. However, adhesions may extend throughout the nasal cavity. Thus, following release of the nasal vestibular stenosis, we advocate endoscopic examination of the entire nasal cavity bilaterally to rule out intranasal synechia. When intranasal scarring is identified, it can usually be released with endoscopic guidance using microinstrumentation and stenting. Mitomycin C has been used regularly to prevent scar tissue formation at sites of mucosal injury throughout the pediatric airway [14—20]. A recent report describes the first complication in the otolaryngology literature resulting from the use of topical MMC in the glottic airway. Hueman and Simpson describe four cases where fibrinous debris accumulated at the operative site, resulting in partial airway obstruction and the need for emergent airway intervention [16]. Nevertheless, in cases of extended synechiae throughout the nasal cavity, MMC may be a useful adjunct to prevent restenosis between the nasal septum and turbinates or wherever synechiae are encountered intranasally.

In conclusion, simple lysis of the adhesions appears to correct the cosmetic deformity with the nasal ala springing back into anatomic position once the synechia has been disrupted. The one patient who had residual stenosis had stenting with a silastic sheet for only 10 days. Circular stents would more effectively prevent inadvertent apposition of raw surfaces decreasing the likelihood of restenosis. Thus, we advocate stenting with an appropriately sized modified ETT for 4—6 weeks,

similar to what might be used following choanal atresia repair. Finally, skin grafts and local flaps appear to be unnecessary when long-term stenting is utilized.

References

[1] K. Gowdar, M.J. Bull, R.L. Schreiner, J.A. Lemons, E.L. Gresham, Nasal deformities in neonates. Their occurrence in those treated with nasal continuous positive airway pressure and nasal endotracheal tubes, Am. J. Dis. Child 134 (1980) 954—957.

[2] B.C. Loftus, J. Ahn, J. Haddad Jr., Neonatal nasal deformities secondary to nasal continuous positive airway pressure, Laryngoscope 104 (1994) 1019—1022.

[3] J.H. Jablon, J.F. Hoffman, Birth trauma causing nasal vestibular stenosis, Arch. Otolaryngol. Head Neck Surg. 123 (1997) 1004—1006.

[4] A. Kotzur, W. Gubisch, R. Meyer, Stenosis of the nasal vestibule and its treatment, Aesth. Plast. Surg. 23 (1999) 86—92.

[5] W.T. Lee, P.J. Koltai, Nasal deformity in neonates and young children, Pediatr. Clin. North Am. 50 (2003) 459—467.

[6] P.A. Adamson, B.L. McGraw-Wall, H.D. Strecker, G.S. Gillman, Analysis of nasal airflow following repair of vestibular stenosis, J. Otolaryngol. 27 (1998) 200—205.

[7] M.M. Al-Qattan, G.A. Robertson, Acquired nostril stenosis, Ann. Plast. Surg. 27 (1991) 382—386.

[8] P.S. Bajaj, B.N. Bailey, Stenosis of the nostrils: a report of three cases, Br. J. Plast. Surg. 22 (1969) 269—273.

[9] D. Blandini, C. Tremolada, M. Beretta, M. Mascetti, Iatrogenic nostril stenosis: aesthetic correction using a vestibular labial mucusa flap, Plast. Reconstr. Surg. 95 (1995) 569—571.

[10] A. Kotzur, W. Gubisch, R. Meyer, Stenosis of the nasal vestibule and its treatment, Aesth. Plast. Surg. 23 (1999) 86—92.

[11] A. Naasan, R.E. Page, The double cross plasty: a new technique for nasal stenosis, Br. J. Plast. Surg. 45 (1992) 165—168.

[12] J.O. Stallings, D.G. Sessions, Stenosis of the nostril: repair by triplanar w-plasty, Arch. Otolaryngol. Head Neck Surg. 93 (1971) 525—530.

[13] M. Karen, E. Chang, M.S. Keen, Auricular composite grafting to repair nasal vestibular stenosis, Otolaryngol. Head Neck Surg. 122 (2000) 529—532.

[14] D.J. Annino, L.A. Goguen, Mitomycin C for the treatment of pharyngoesophageal stricture after total laryngopharyngectomy and microvascular free tissue reconstruction, Laryngoscope 113 (2003) 1499—1502.

[15] B.W. Holland, W.F. McGuirt, Surgical management of choanal atresia improved outcome using mitomycin, Arch. Otolaryngol. Head Neck Surg. 127 (2001) 1375—1380.

[16] E.M. Hueman, C.B. Simpson, Airway complications from topical mitomycin C, Otolaryngol. Head Neck Surg. 133 (2005) 831—835.

[17] I. Perepelitsyn, S.M. Shapshay, Endoscopic treatment of laryngeal and tracheal stenosis-has mitomycin c improved the outcome? Otolaryngol. Head Neck Surg. 131 (2004) 16—20.

[18] M. Prasad, R.F. Ward, M.M. April, J.P. Bent, P. Froehlich, Topical mitomycin as an adjunct to choanal atresia repair, Arch. Otolaryngol. Head Neck Surg. 128 (2002) 398—400.

[19] R.F. Ward, M.M. April, Mitomycin-c in the treatment of tracheal cicatrix after tracheal reconstruction, Int. J. Pediatr. Otorhinolaryngol. 44 (1998) 221—226.

[20] R. Rahbar, S.M. Shapsay, G.B. Healy, Mitomycin: effects on laryngeal and tracheal stenosis, benefits, and complications, Ann. Otol. Rhinol. Laryngol. 110 (2001) 1—6.