Management of choanal atresia and personal experience: a retrospective review

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Abstract. Management of choanal atresia and personal experience: a retrospective review. Objective: To evaluate the outcomes of the transnasal repair of choanal atresia with stenting. Patients and methods: A retrospective chart review was performed on all patients with choanal atresia from 1994 to 2006. Records were then analysed with respect to age at time of surgery, sex, type of atresia, complications, stenting time and follow-up time. Results: Eighteen children aged between 1 day and 22 months old with choanal atresia were evaluated and treated. Ten patients had bilateral (55.6%) and 8 unilateral (44.4%) disease. There were 11 females (61.1%) and 7 males (38.9%). All the patients underwent transnasal repair. There were no intra-operative and postoperative complications. Only one patient required a revision procedure. Conclusion: Despite the advances in endoscopic technology, the puncture, dilation and stenting technique is still the senior author’s preferred method of repair for choanal atresia.

Introduction

Newborn infants are obligatory nose breathers for the first few days after birth and are unable to breathe through the mouth. Major nasal airway obstruction is a relatively rare but important cause of respiratory problems in the neonatal period, particularly if bilateral and complete. In the differential diagnosis of major nasal airway obstruction in the newborn, choanal atresia (CA) is by far the most common aetiology.

Congenital choanal atresia (CCA) can be defined as a failure in the development of communication between the nasal cavity and the rhinopharynx. It is an uncommon anomaly, occurring in approximately 1 in 5000 to 8000 live births. Unilateral CA is twice as common as bilateral CA. It occurs in females twice as often as in males and there is a preponderance towards the right side.

Bilateral CA presents as a medical emergency at birth. Obvious airway obstruction, stridor, and cyclic cyanosis with crying are the usual presentations. Initial emergency treatment in such cases is not surgical but medical, ensuring a patent oral airway until surgery is undertaken. The introduction of an oral airway or orotracheal intubation will suffice as initial treatment when bilateral CA is suspected. Unilateral CA may go undiagnosed until childhood or even adulthood, the symptoms being mainly those of nasal obstruction, mucoid nasal discharge, anosmia, disturbed sleep and daytime fatigue.

Turning to the clinical symptoms, CCA can be diagnosed in several ways; the simplest test is to pass a catheter through the nose into the nasopharynx. A diagnosis of CCA can be confirmed by a positive radiopaque nasal radiographic examination (contrast choanography), flexible endoscopy and an axial CT scan. A modern analysis by Brown et al. using a computed tomography (CT) scan determined a 29% incidence of pure bony anomaly, a 71% incidence of mixed bony-membranous anomaly, and no pure membranous atresia.

The definitive treatment of CA requires surgery. The ideal procedure should be quick and safe, while restoring a normal nasal passage without damaging any surrounding craniofacial structures. The literature describes four different ‘classical’ surgical approaches for the treatment of choanal atresia and the creation of a patent nasal airway: 1) transnasal; 2) transpalatal; 3) transseptal and 4) transantral. Endoscopic endonasal surgery for CCA was first reported by Stankiewicz. A 2.7 mm endoscope is used in neonates and the use of the endoscope minimises the recurrence rate and the need for revision surgery. The use of nasal stenting in CA surgery is by no means universal but is most often used in bilateral cases. This paper will review the experience of 18 cases
of CA repaired with the puncture, dilation and stenting technique.

Patients and methods

A retrospective chart review was performed for all patients with choanal atresia from 1994 to 2006 at the University of Istanbul, Cerrahpasa Medical School, ENT Department Istanbul, Turkey. Eighteen patients were identified who underwent repair with the puncture, dilation and stenting technique by the senior author (Devranoglu). A full history and physical examination, including fibre-optic flexible nasal endoscopy ± contrast choanography, was performed to establish the diagnosis of choanal atresia. Records were then analysed with respect to: (1) age at time of surgery, (2) sex, (3) type of the atresia, (4) intra-operative or postoperative complications, (5) stenting time and follow-up time.

Surgical technique

The procedures were performed under general anaesthesia with orotracheal intubation. The atretic plates/membranes were punctured with a Pierce curved trocar (Aesculap – Germany) (Figure 1). When the obstructing plate was touched, the trocar was carefully forced through it using uniform pressure. The procedure was repeated for the other side if there was a bilateral CA. Next, serial dilations were performed using a Ritter-Halle dilator (Medicon – Germany) through the nasal cavity with palpation through the neonate’s mouth (Figure 2). Initially, the smallest dilator is used to dilate each side separately. Once the largest dilators are inserted, 8 or 10 French gauge suction catheters (Jiangsu Kaishou Medical Apparatus-China or Biçakcılar Tibbi Cihazlar-Turkey) were passed transnasally and out through the mouth. The size of the anterior nares is a good approximation of the endotracheal tube size used to make the stent. This is most commonly a 3.0 or 3.5 mm inner diameter endotracheal tube (Maersk Medical-Denmark or Biçakcılar Tibbi Cihazlar-Turkey). A fenestration was created at the middle part of the endotracheal tube to allow for bilateral airflow (Figure 3a). Both ends of the endotracheal tube were connected with the oral ends of suction catheters by suturing with silk sutures (Figure 3b). When the nasal ends of the suction catheter were pulled out of the nose, the fenestrated part of the endotracheal tube was placed on the posterior end of the septum. The outer...
nasal ends of the endotracheal tube were shortened, and a small piece of an endotracheal tube was sutured between the two nasal ends of the endotracheal tube for better fixation (Figure 3c). The distance between columella and fixation point should be approximately 1 cm to facilitate the to-and-fro movement of the stent. The possibility of restenosis is therefore reduced with the help of these movements due to the formation of additional fibrous tissue. This projection of the stent did not interfere with breastfeeding.

Postoperative care

The parents were taught to irrigate and suction the stents regularly with a syringe and portable suction devices. Parents were also taught to move the stents back and forth twice a day.

Results

Twenty-two children were initially identified for the reported study period; four subjects were excluded due to misdiagnosis, lost to follow-up after their initial surgery, or their primary surgeries were performed at another hospital. A total of 18 children with choanal atresia, ranging from 1 day to 22 months old, were therefore evaluated and treated. Ten patients had bilateral (55.6%) and 8 unilateral (44.4%) disease (5 right-sided, 3 left-sided). There were 11 females (61.1%) and 7 males (38.9%). Age at the time of surgery changed according to type of the atresia. Average surgery age was 14.3 days (range 1 to 26 days) for bilateral disease, and 10.6 months (range 2 months to 22 months) for unilateral disease. Five patients (27.7%) had associated malformations. Of these, one had CHARGE association, one had Down syndrome, one had VATER association, one had cerebral palsy, and one had truncus arteriosus (Table 1).

All the patients underwent transnasal repair. The mean operation time was 13.2 minutes (range,
tion tissue. These results demonstrate the success of the procedure, which achieved nasal patency in 94.4% of patients (17 of 18).

**Discussion**

Choanal atresia can be a life-threatening cause of nasal obstruction in neonates and the aetiology of unilateral rhinorrhea in older children. It is thought to arise sometime between the 4th and 11th week of gestation and its aetiology is still unclear. Some theories have been proposed to explain this clinical entity of embryological origin. Among the most widely accepted ones, four stand out: (1) buccopharyngeal membrane persistence, (2) physiological rupture failure of Hochstetter’s bucconasal membrane, (3) abnormal adherence of mesodermic tissue within the nasal choana, and (4) vertical and horizontal processes of the palatal bone medial growth. While most cases are isolated malformations, its association with other anomalies is well-known. In our study, five patients (27.7%) had associated anomalies.

The definitive treatment of CA requires surgery. Pirig provided a very thoughtful and historical review of the literature in 1986. Of these, the transpalatal and transnasal approaches provided the best result with least morbidity. There is a reported 52% incidence of dental malocclusion (cross-bite) resulting from narrowed maxillary dental arches in patients younger than 5 years managed with the transpalatal approach. With the advent of miniaturised endoscopic equipment and powered instrumentation, the most popular and successful method over the past decade has been the transnasal endoscopic technique. However, the small size of the neonatal nose and limited experience with working with this age, as well as any structural abnormalities such as septal deviation, turbinate hypertrophy and a high arched palate can challenge even the most experienced endoscopic surgeons.

The ideal procedure should be safe, quick and simple with minimal blood loss and a high rate of success. There should be no palatal complications and the procedure should be appropriate for early use as a definitive therapy. The literature includes descriptions of the perforation of the atretic plate with trocars, chisels, drills, microdebriders and lasers, and with or without endoscopes.

The technique that we used takes approximately 10 minutes of operating time. Complications from this technique have been documented in the literature, including cerebrospinal fluid leakage and meningitis caused by the penetration and fracture of the perpendicular plate of the ethmoid cribriform plate. In this series of 18 patients, there were no neurological complications. Bleeding was not a significant problem because there is no tissue excision during the procedure and stents that are left in situ maintain a circumferential haemostatic pressure.

The use of stents in patients with choanal atresia is a controversial subject. Some surgeons believe that stents are useful as a way of stabilising the nasal airway in the postoperative period; however, others believe that stents may act as a nidus for infection and may induce a foreign body reaction. The use of various different materials has been described, such as endotracheal tubes, soft silicone, self-inflating silastic tube, silicone suction tube and metal reinforced rubber silicone.
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was 6-8 weeks and, during follow-up, there was only one patient who needed dilatation.

Van Den Abbeele et al. analysed the outcome of the transnasal endoscopic repair of 40 patients with CA. Thirty-two patients (80%) had normal nasal patency and a satisfactory choanal diameter, and 8 (20%) had restenosis or complete choanal closure. In a study by Yaniv et al., seventeen patients underwent endoscopic repair using a mucoperichondrial flap developed from the nasal septum. There was one case of complete restenosis and one of partial restenosis; the success rate was 91%.

In the present series, only one neonate required revision after the primary procedure, while 17 remained patent. These results demonstrate the success of the procedure, with nasal patency being achieved in 94.4% of patients.

Conclusion

Long-term nasal patency with a simple procedure and minimal morbidity can be achieved with this puncture, dilation and stenting technique. Despite the advances in endoscopic technology, the puncture, dilation and stenting technique is still the senior author’s preferred method of repair for choanal atresia.

References


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