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Choanal atresia

Clinical considerations for management

by

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Abstract

Taking cognizance of the embryology and newer diagnostic techniques, the transpalatal route is strongly recommended as the optimal surgical procedure for the management of choanal atresia. It should be performed as soon as general anesthesia can be safely administered. In selected instances, but particularly when a patient is at increased surgical risk, necessitating surgical brevity, the endonasal puncture technique should be considered as the initial procedure. Parents must be appraised of the potential for subsequent growth deficiencies, mental retardation, and crossbite.

Introduction

An obligate nasal respiratory reflex frequently predisposes the infant with choanal atresia to significant airway obstruction. Although its existence has been known for more than 200 years, it is only of late that newer insights into diagnosis and embryogenesis have helped define the usually preferred surgical approach. In addition, these considerations have given credance to an older technique formerly considered blind.

Embryogenesis and anatomy

Recently it has been reported that embryologically bony atresia, accounting for 90 per cent of all atresias, can be attributed to a misdirected flow of mesodermal elements that originate in neural crest cells (Hengerer and Oas, 1980). Usually occurring between the fourth and twelfth weeks of gestation, there is a failure in the precision with which normal cellular elements migrate to genetically preordained positions in the facial processes. This can lead to significant structural alterations. The clinical import of the latter rests on the fact that choanal atresia is more than an isolated plate of bone, but a component of a skull base anomaly. It may vary in its thickness from one to twelve mm and have islands of cartilage or membranous bone.

Structurally, there is a medial compression of the lateral and superior walls, with greater thickness of bone in these regions. Of profound clinical import is the frequent finding of a narrowed nasopharyngeal vault. In addition, the palate is usually elevated, further diminishing the nasal passage, and structural abnormalities of the posterior septum are not infrequent. The atresia itself is in a tangential plane and is bordered laterally by the medial pterygoid plate, superiorly by the sphenoid, inferiorly by the palatine bone, and medially by the vomer.

Diagnosis

The immediate respiratory distress noted at birth, cyclic in nature and relieved by crying, needs no further elucidation. Many

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FIG. 1

CT scan of a four-year-old child with a persistent right atresia and left stenosis. Five transnasal laser procedures and a limited transpalatal repair preceded a second opinion (MS) and this film. Note the thickness and medial compression of the right lateral nasal wall and the septal length. Both were corrected at revision.

other clinical considerations and diagnostic techniques have been espoused, most having been frequently reported and, as such, will not be reiterated, However, deserving of special emphasis are the following: 1) Polyhydramnios has been reported in 53 per cent of deliveries associated with choanal atresia; 2) Unilateral atresias are frequently associated with stenosis on the patent side and may not present with obstructive symptoms until an upper respiratory tract infection precipitates such, 3) A mucous cast of the nasal passage, aspirated at birth is very suggestive of atresia; 4) Passing a nasal catheter is a poor diagnostic technique, more often delaying than enhancing early recognition. A small catheter readily curls up in the nasal chamber, giving an unwarranted false sense of security; 5) Contrast instilled into the nasal chamber after suctioning residual mucus will give a definition of the atresia plate, an assessment of its depth relative to the alar rim, and an estimate of the dimensions of the nasopharynx; 6) The CT scan has had a profound impact upon the diagnosis and subsequent management of atresias. The angulation and thickness of the plate, the compression and density of the lateral walls as well as septal aberrations can be defined preoperatively (Figs. 1 and 2). Predicated upon the anatomy detailed, the specifics of surgery can be considered in advance.

Associated anomalies

In our recently reported series of 37 cases, 40 per cent had associated anomalies (Hengerer and Strome, 1982). The majority had multiple defects, many involving other

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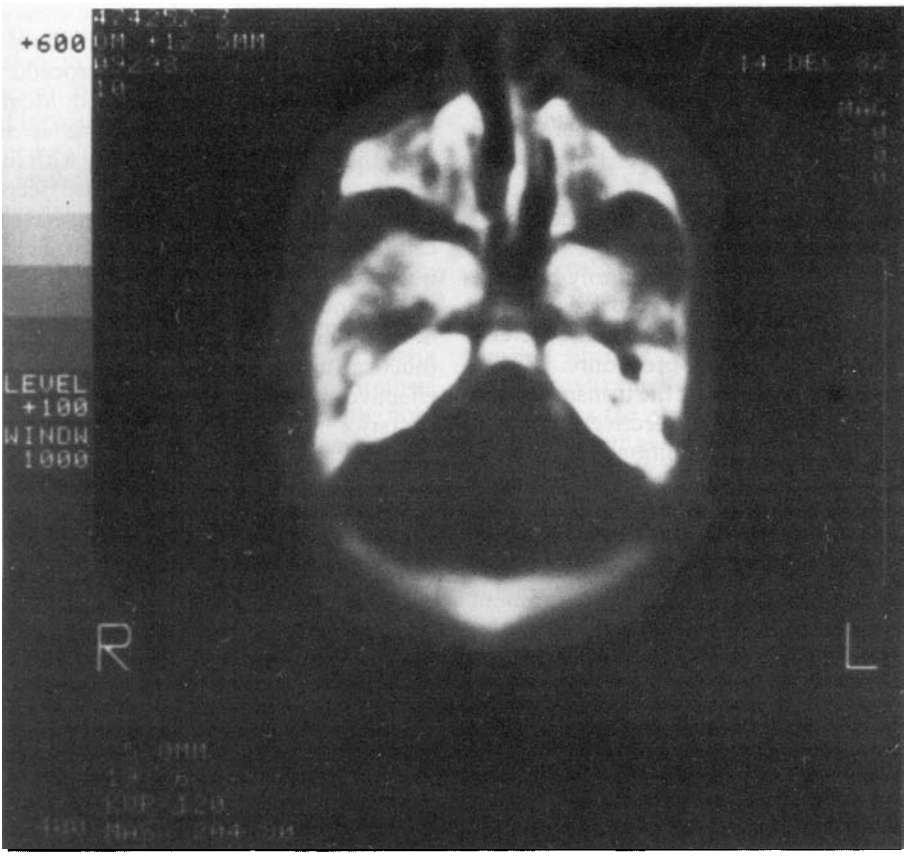


FIG. 2*

CT scan of a 1660 gm infant, 35 week gestation, suspected of having bilateral choanal atresia from a choanagram. The CT scan documented the anatomical abnormalities showing anterior compression of the lateral nasal wall on the left and atresia on the right. Dilatation and left stenting were performed.

*Courtesy of Dr. Glenn D. Johnson, Hitchcock Clinic, A Component of Dartmouth-Hitchcock Medical Center, Hanover, N.H. 03756

midline structures. The incidence of these was greater in the bilateral atresias. Hall (1979), reporting on 17 cases of bilateral atresia, in addition to the well-known incidence of cardiac anomalies (71 per cent in his series), detected a 40 per cent incidence of deafness and a 23 per cent incidence of facial paralysis. Noting this pre-operatively can save significant post-operative consternation. Evoked response audiometry should be a pre-operative consideration, in addition to a thorough pediatric evaluation. For the older child, growth deficiencies and mental retardation are frequent.

Treatment

Therapy must take cognizance of the acute obstructive episode and subsequently the definitive repair. An oral pharyngeal airway suffices in relieving the acute obstruction. Once secured, the airway is satisfactory and the infant can be gavage-fed at selected intervals until cleared for anesthesia. Taping an oral feeding tube in place is potentially problematic as it can lead to palatal ulceration, thereby mitigating consideration of the transpalatal approach until healing ensues. The McGovern nipple is of historic significance only. Endotracheal tube place-

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ment is rarely a consideration, and tracheotomy is only entertained when associated multiple craniofacial anomalies preclude the management techniques detailed.

For years, conservative therapeutic measures had support. Yet today, fortunately, this is infrequent. Maintaining an oral airway and gavage-feeding as necessary, until oral breathing became a learned response, was championed primarily because waiting until one year of age afforded a significant increase in intraoral dimensions, thereby simplifying the definitive procedure. Microscopic techniques, both for the transnasal and transpalatal approaches, effectively negated this consideration. In addition, there were negative aspects to the latter. Prolonged hospitalization was not infrequent during the period of adaptation and was associated with increased parental stress. Additional concerns included the documentation of intermittent aspiration, decreases in height and weight at the time of definitive repair when compared with the norm and, in some instances, cardiac enlargement (Strome, 1976). These findings are not surprising, recognizing that all have been similarly detected with choanal obstruction secondary to adenoidal hypertrophy.

Bilateral atresias should be definitively repaired as soon as the child can tolerate general anesthesia. Successful transnasal and transpalatal approaches have been performed within the first day of life. When a unilateral atresia is associated with partial stenosis of the functioning side, repair should also be performed shortly after detection, thereby eliminating the potential for acute respiratory distress secondary to a viral illness. When the CT scan documents a normal anatomic dimension for the functioning side, repair can be delayed until one year of age. Waiting longer adds needless burdens to the school-age child that include persistent unilateral rhinorrhea, hyponasality, and the psychological repercussions of these problems.

Surgical Approach

We feel strongly that the transpalatal approach is the surgical procedure of choice in most instances. Based on the embryology as discussed, if a long-term functional result is to be achieved with one procedure, the palatal route must be considered. Most often with bilateral atresias, one side is smaller than the other, and the chamber with reduced dimensions is more prone to secondary failure with any of the transnasal procedures. The palatal approach unquestionably provides the best visualization of the anomalous skull base. Realistically, it is the only procedure where meaningful mucosal flaps can be created. It is the most effective approach for the removal of the posterior septum in the neonate and poses the least risk for fenestration of the clivus of any reported technique. The most important new fact is that the superior lateral nasal wall can be readily approached with a microdrill, thereby effecting the maximal achievable choanal dimension.

Clinically in the post-operative period when compared with transnasal approaches, we have reported a decreased incidence of restenosis and diminished granulation tissue related in part to the ease of resurfacing with mucosal flaps. A shortened period of stenting and a reduced need for outpatient dilatation was also noted.

The technique is not without some relative limitations. Feeding is delayed for 24–48 hours following transpalatal surgery. Fistulization of the palate did occur in our series, although infrequently, and all did heal spontaneously. A return to an earlier technique using permanent palatal sutures and adding penicillin in the post-operative period, has seemingly obviated the problem. The development of a crossbite has been attributed to removal of the mid palatal suture line (Freng, 1978). If this occurs, the several millimeters of crossbite can be readily corrected with standard orthodontic techniques, i.e. a palate expander at a relatively early age. The multiple advantages of the transpalatal approach outweigh any concern about the development of a potential problem that is relatively correctable. An awareness and indication of this to the parents is all that is warranted.

The details of our operative approach have

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been reported (Strome, 1982), and only pertinent considerations follow: 1) An awake intubation in the neonate precedes general anesthesia; 2) Under six months of age, a T-shaped incision is preferred, and thereafter, a U-shaped palatal flap; 3) Hemostasis is aided with a midline injection of physiologic saline and bipolar microforceps; 4) The pterygomaxillary fossa instruments are ideal for use in neonatal palates; 5) Ronguers are preferred for the palate and posterior septum, and drilling is used only when necessary for the thickened lateral wall; 6) A new choana should readily admit a number 16 urethral dilator; 7) The palate is closed with non-absorbable sutures, removed at the time of stent removal; 8) Penicillin is now routinely used post-operatively and until the sutures are removed; 9) The stents are routinely removed under general anesthesia as an outpatient, and the choana assessed. If the choana is not completely mucosalized and/or granulation tissue is present, antibiotics are continued and steroids are introduced. Both are continued until mucosalization is complete. A number 16 Haslam urethral dilator can be used to calibrate the choanal dimensions in the office without anesthesia. Dilatations can be similarly performed if necessary.

With the popularization of microsurgical techniques over the past 15 years, many authors propose the transnasal route. Recently the endonasal puncture technique has again received recognition.

The transnasal route should be considered in patients with narrow high-arched palates, oral microstomia, and ulcerations of the hard palate caused by inappropriate feeding techniques. It should be strongly considered when time is a factor relative to the risk of anesthesia.

There are many reported transnasal approaches including the laser, the benefits of which, for choanal atresia, are circumspect (Fig. 1). Special microsurgical sets have been developed (MS), yet there is relatively little meaningful technical difference between most because of the anatomical constraints dictated by the approach. A shortened surgical procedure is the one real benefit of this route and only approaches similar to the endonasal puncture technique recently reported by Lantz and Birck (1981) significantly decrease that time interval. A pre-operative CT scan detailing the choana and nasopharyngeal anatomy will assist in determining the efficacy of the technique. Although not discussed in their article, a flexible fiberoptic scope passed orally permits visualization of the advancing dilator as it traverses the atresia plate. Having the dilator calibrated as to the measured distance of the plate from the alae is an additional precaution that is recommended. Alternatively combining general anesthesia with fluoroscopic monitoring of the advancing dilator assures proper positioning and negates any consideration that the procedure is 'blind'. With this approach, stenting has been recommended for three months. Previously reported (MS) is the concept of increasing the stent size at monthly intervals as growth and resorption of adjacent bone permit (Strome, 1976). The rationale for considering other transnasal approaches is limited. All, including the aforementioned, have limitations relative to the transpalatal route. As detailed in our earlier publication (Strome, 1982), these include decreased exposure, decreased fenestra size, limited access to the posterior septum, reduced potential for preserving mucosal flaps, the need for prolonged stenting, four times the number of dilatations post-stent removal and an increased incidence of re-stenosis. Thus, for the poor surgical risk in whom a functioning nasal airway is the primary concern, the endonasal puncture should be considered, heeding the safeguards described. Then, should the limited approach fail, the long-term solution, a transpalatal revision could be performed as the clinical condition stabilizes.

References

FRENG, A. (1978). Growth in Width of the Dental Arches After Partial Extirpation of the Mid-Palatal Suture in Man. *Scandinavian Journal of Plastic and Reconstructive Surgery*, **12**: 267-275.

https://doi.org/10.1017/S0022215100148285 Published online by Cambridge University Press

HALL, B. D. (1979). Choanal Atresia and Associated Multiple Anomalies. *Journal of Pediatrics,* **95:** 395-398.

HENGERER, A. S. and OAS, R. E. (1980). Congenital Anomalies of the Nose: Their Embryology, Diagnosis and Management. *Manual American. Academy of Otolaryngology,* 1st Ed.

HENGERER, A. and STROME, M. (1982). Choanal Atresia: A New Embryological Theory and Its Influence on Surgical Management. *Laryngoscope,* **92:** 913-921.

LANTZ, H. J. and BIRCK, H. G. (1981). Surgical Correction of Choanal Atresia in the Newborn. *Laryngoscope,* **91:** 1629-1634.

STROME, M. (1976). Choanal Atresia—An Updated Approach. *Transactions of the American Academy of Ophthalmology and Otolaryngology,* **92:** 1499-1503.

STROME, M. (1982). Management of Choanal Atresia. In: *Current Therapy in Otolaryngology—Head and Neck Surgery (Gates, G. A., ed).* pp. 309-312 B. C. Becker and Company, San Antonio.

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