Transnasal Endoscopic Repair Of Choanal Atresia

Systemic Review For Partial Fulfillment

Of Master Degree In Otolaryngology

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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Weal Gomaa Elkelany

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Introduction

Choanal atresia is a developmental failure of the nasal cavity to communicate with the nasopharynx. It is a relatively rare congenital anomaly and occurs in approximately 1 in 5000 to 8000 live births, with a female to male ratio of 2:1. Generally, 65% to 75% of patients with choanal atresia are unilateral, whereas the rest are bilateral. About 30% are pure bony, whereas 70% are mixed bony-membranous. The atretic plate is usually sited in front of the posterior end of the nasal septum. The anatomic deformities include a narrow nasal cavity, lateral bony obstruction by the lateral pterygoid plate, medial obstruction caused by thickening of the vomer, and membranous obstruction ***(*Petkovska et al, 2007).**

Acquired posterior choanal atresia rarely occurs. It is usually caused by scleroma, rhino pharyngeal injury, radiotherapy for nasopharyngeal carcinoma, tuberculosis or syphilis of nasopharynx ***(*Ku et al, 2001).**

Bilateral Choanal atresia is a life-threatening situation since, if not promptly recognized, it can lead to severe asphyxia and death immediately after birth. Patients with bilateral choanal atresia present at or shortly after birth with cyclic cyanosis relieved by crying, the improved respiratory distress after crying may delay the diagnosis. Respiratory collapse may occur, and feeding difficulties may lead to failure to thrive. Patients with unilateral choanal atresia rarely present with immediate or severe airway obstruction, they normally present

within the first 18 months of life with feeding difficulties and nasal discharge, but may present with unilateral nasal obstruction and discharge in later life ***(*Voegels et al, 2002*).***

Computed tomography (CT), especially axial plane, is the radiographic procedure of choice since it can demonstrate the nature (bony or membranous), position, and thickness of the obstructing segment, which helps the surgeon in designing a plan for repair, and other abnormalities. Patients may also be examined with a rigid or flexible endoscope, operating microscope, mirror examinations, or digital examination ***(*Contencin et al, 2003).***

Management of these patients varies and depends on age, type of atresia, and general condition of patients. Transnasal and transpalatal approaches are common surgical techniques used. Transnasal approach with the use of a rod-lens telescope is the method of choice and has been used successfully in newborns and infants and is suitable for membranous or very thin bony atresia, while transpalatal approach is normally reserved for the older children, thick bone, or case with restenosis **(Assanasen and Metheetrairut, 2009).**

Nasal endoscopy is beneficial in the management of choanal atresia since it helps to confirm the diagnosis, characterize the extent of lateral nasal wall contribution to the stenosis or atresia, evaluate the composition of the atresia (bony and/or membranous), guide surgery and provide postoperative surveillance **.**

The main advantages of the transnasal procedure are that it is minimally invasive, quick (avoiding the need for prolonged anesthetic agents), less traumatic with minimal blood loss, and provides excellent visualization especially with the use of endoscope, moreover, it carries the ability to perform exact surgery on patients of all ages, its disadvantage is limited field of vision (which risks injury to sphenopalatine artery or skull base), even with a microscope **(Assanasen and Metheetrairut, 2009).**

Possible complications of the transnasal approach include restenosis, pressure necrosis of anterior nares or columella, plugging and displacement of the indwelling stents, cerebrospinal fluid leaks, meningitis, and granulation tissues around the stents ***(*Pasquini et al, 2003).**

After surgery, patients should be closely followed-up for a long time to check restenosis. If re-stenosis occurs, transnasal revision surgery or dilations can be safely and easily repeated. This will help to break up the forming scar, and will eventually lead to better patency ***(*Randall et al, 1997).**

With the use of best possible techniques of surgical correction, medication, and stenting, the surgeons may decrease the possibility of postoperative stenosis formation , the need for dilatation and revision surgery in the future ***(*Vickery et al, 1997*).***

Aim of the work

The aim of the work is to systematically review the transnasal endoscopic approach as a minimally invasive method to treat unilateral or bilateral choanal atresia, to analyze and discuss the outcome and causes of restenosis to be avoided.

Embryology

The first 12 weeks of fetal development are the critical time for the development of the face. During the first 4 weeks of this period, 95% of embryonic formation occurs, and the majority of congenital deformities are initiated. The remaining 36 weeks of fetal development are devoted to the proliferation and definition of what has been already created. The neural crest cells that form and migrate at about 3-5 weeks of fetal development are more important in facial development than any other region of the body **(Petkovska et al, 2007).**

Neural crest migration occurs to preordained locations in the branchial arch mesenchyme by the end of the 4th week of development. During the subsequent 2 weeks, cellular proliferation and migration within the various facial processes occurs, leading to the appearance of a recognizable columella, philtrum, and upper lip. Concomitantly, the nasal processes grow around the nasal pits. The nasal pits burrow deeper within the mesenchyme, and subsequently overlie the roof of the frontal portion of the stomodeum with a thin sheet of tissue separating them. This thin sheet of tissue is known as the nasobuccal membrane, and normally it will rupture to create a nasal cavity with the primitive (or primary) choana **(Hengerer et al, 2008)**.

Later in development, the primitive choanæ will undergo alteration as further fusion between the septal elements and palate moves the choanæ from the original position to the more posterior (permanent or secondary) choana **(Hengerer et al, 2008)**.

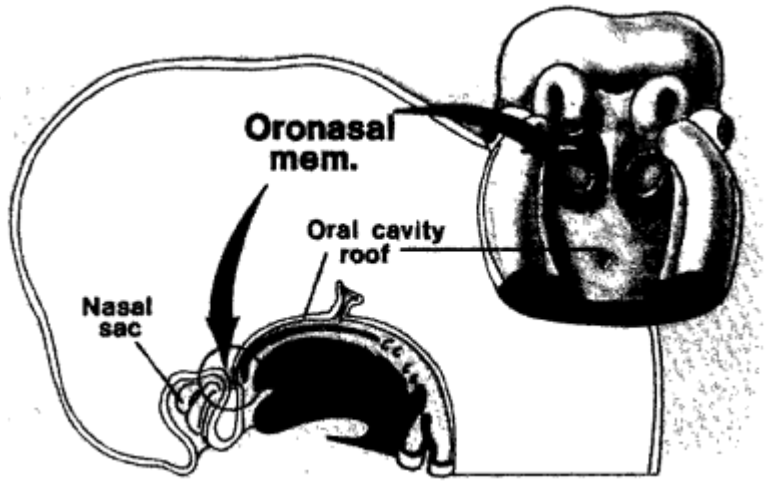

Fig. 1*: persistence of oronasal membrane at seventh week of gestation, quated after* **(Stahl and Jurkiewics, 1985)**

Embryogenesis

There have been several theories regarding the embryogenesis of choanal atresia, but it is generally thought to be secondary to persistence of either the nasobuccal membrane of Hochstetler or the buccopharyngeal membrane from the foregut. This membrane normally ruptures between the fifth and sixth weeks of gestation to produce choanae. Failure of this membrane to rupture causes atresia of choanae (**Fig.1**) **(Dunham and miller, 1982).**

Other theories are abnormal persistence of mesoderm causing adhesions in the region of the nasal-choanæ or misdirection of mesodermal cell migration secondary to local factor. In addition, a defect in the region of the nasal and palatal processes surrounding the nasobuccal membrane probably plays a role, leading to the associated findings of an accentuated arch of the hard palate, a medial location of the lateral and posterior nasal walls, and thickening of the vomer **(Hengerer, 2008).**

Applied anatomy

Posterior choana are the opening between the nasal cavity and the nasopharynx. Each choana bounded *above* by the under surface of the body of the sphenoid and ala of the vomer, *below*, by the posterior border of the horizontal part of the palatine bone, *laterally*, by the medial pterygoid plate, they are separated from each other by the posterior border of the vomer ***(*Fig. 2) (Harner et al, 1981).**

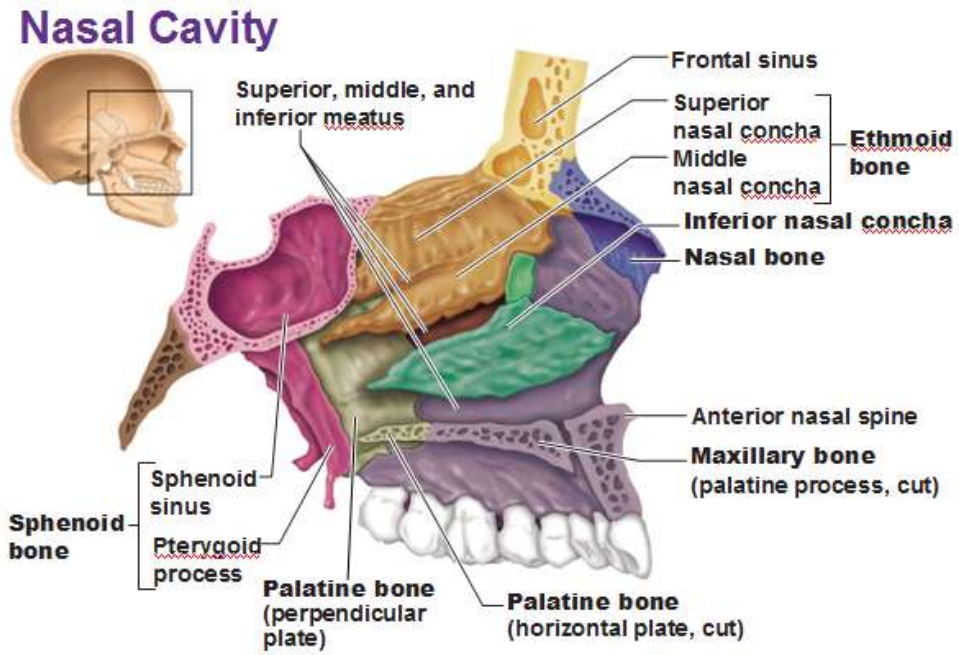

Fig.2: Anatomy of the nasal cavity, *quated after* **(Harner et al, 1981).**

The greater palatine artery is a terminal branch of the maxillary artery, It branches off the maxillary artery in the pterygopalatine fosse and descends through the greater palatine foramen along with the greater palatine nerve (from the pterygopalatine ganglion), and supplies the hard palate. It also anastmoses in the incisive canal with the sphenopalatine artery, to supply the nasal cavity.

The sphenopalatine artery passes through the sphenopalatine foramen into the cavity of the nose, at the posterior part of the superior meatus. Here it gives off its posterior and lateral nasal branches which spread forward over the conchæ and meatuses, anastomose with the ethmoidal arteries , the nasal branches of the descending palatine, and assists in supplying the frontal, maxillary, ethmoidal, and sphenoidal

sinuses, crossing the under surface of the sphenoid sinus. The sphenopalatine artery ends on the nasal septum as the posterior septal branches, these anastomose with the ethmoidal arteries and the septal branch of the superior labial, one branch descends in a groove on the vomer to the incisive canal and anastomoses with the descending palatine artery. So both the sphenopalatine artery and the greater palatine artery should be carefully avoided during transpalatal approach for posterior choanal atresia correction (**Brown et al, 1996).**

Clinical presentation

Since the newborn is an obligate nasal breather, respiratory distress occurs in patients with bilateral choanal atresia at or shortly after birth. They present with cyclic cyanosis. Airway obstruction during feeding relieved by crying, which demonstrates that the oral airway is intact while the nasal airway is obstructed. The improved respiratory distress after crying may delay the diagnosis, but respiratory collapse may occur, and feeding difficulties may lead to failure to thrive. Most patients with bilateral choanal atresia are detected within the first month of life. However, it can be diagnosed in adults with long-term bilateral nasal obstruction and rhinorrhea ***(*Voegels et al, 2002).**

Patients with unilateral choanal atresia rarely present with immediate or severe airway obstruction. They normally present within