

## CHOANAL ATRESIA – A PERMANENT CHALLENGE IN RHINOLOGY PATHOLOGY

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**Abstract.** *Choanal atresia is the most frequent nasal congenital malformation, which, depending on the unilateral or bilateral location, has a different symptomatology. The diagnosis is confirmed through the patient's medical history, nasal endoscopy and imagistic examination (computed tomography). The treatment is surgical and aims the (fibrous and bone) tissue disintegration which blocks the choana, and is performed through endoscopic surgical techniques. The blocked area is maintained functional by mounting a stent at the choanal tunnel level. The authors aim to describe their own experience regarding both the diagnoses as well as the treatment of this pathology, the results being compared to those from the quoted literature. The surgical technique differs depending on the type of choanal atresia: bone or membranous. The duration to maintain a fix position of the stent and the material used for the stent represent the variables which provide the success of the endoscopic surgical intervention of the choanal atresia. Subsequently, the patient is followed up at 2, 6, 12 months in the first year and then annually until 18 years of age. Choanal atresia is solved through endoscopic surgical techniques by mounting a silicone stent which shall be maintained in position for a minimum period of 3 months. The endoscopic approach of the unilateral choanal imperforation is the method of choice with minimum complications, increased success rate and fast recovery.*

**Keywords:** Choanal atresia, endoscopic sinus surgery, choanal stent

## 1. INTRODUCTION

Choanal atresia represents the absence of communication between the posterior nasal cavity and the nasopharynx. It was first described by Roederer in 1775 in a newborn with nasal-choanal obstruction. In 1854, Emerson performed his first successful surgical intervention on the choanal atresia [1] and the first endoscopic surgical technique used was performed by Stankiewicz in 1990 [2]. Along the history, multiple surgical treatment methods have been used with various approach versions: trans-palatine, trans-nasal and trans-septal, which aimed to provide an airflow between the nasal cavity and the nasopharynx.

Its incidence varies between 1:5000 and 1:8000 births [3]. The choanal atresia is most frequent in women (2:1) with predominance on the right side [4] and recent studies highlight a recessive autosomal transmission [5]. This disorder may also be associated with other craniofacial malformations, most frequent being CHARGE syndrome

in approximately 70% of cases, with an incidence of 1/12500 cases in America [6].

The lack of absorption of the buccopharyngeal membrane in the 7th week of the intra-uterine life is considered to be the cause of choanal atresia [5]. The bilateral choanal atresia may endanger the newborn's life, as he suffers from hypoxia, with episodes of respiratory distress with cyanosis improved by crying (paradoxical cyanosis) [6]. The unilateral choanal atresia may be discovered later in life with a clinical aspect of unilateral chronic nasal obstruction, muco-purulent rhinorrhea that may be mistaken with other disorders.

In accordance with specialty literature data, it was noticed that 29% of the choanal atresia cases are with bone structure and 71% have a bone-membranous structure [6]. The same authors claim that there are no purely membranous choanal atresias [6]. The diagnosis of choanal atresia is clinically highlighted through the impossibility of introducing a 6F catheter at this level. It is necessary to perform the nasal endoscopy investigation and an imagistic exam (computed tomography). The nasal endoscopy can confirm the atresia, and the computed tomography is useful to highlight the thickness and nature of the blocking membrane.

The bilateral choanal atresia requires a fast intervention in order to provide the physiologic nasal breathing passage. In case of the unilateral atresia the surgical intervention may be postponed in case of infants, for a few months for a better nasal development, thusly avoiding post-surgical complications and reobstruction [3].

The surgical treatment aims an endoscopic approach which includes the excision of the obstructed area and mounting of a stent in order to maintain the permeability of the nasal fossa. Multiple types of stents may be used: silicone, Teflon, Portex endo-tracheal stents.

## 2. MATERIALS AND METHODS

Patients with choanal atresia who attended our clinic were both children and adults. At the anterior rhinoscopy they present a unilateral nasal obstruction, persistent mucopurulent viscous, unilateral rhinorrhea and unsystematized unilateral headache.

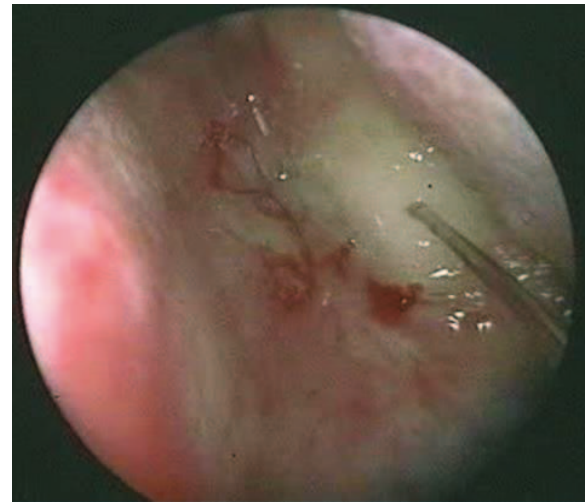
Pursuing the medical history, the nasal endoscopic exam was performed with a 0° endoscope, followed by a computed tomography of nasal sinus region with sections cut at 1 and 2 mm in order to provide a good image on the consistence of the choanal atresia and adjacent structures (Figure 1) [7].



**Figure 1. CT aspect for left bony choanal atresia**

The differential diagnosis of the unilateral choanal atresia firstly includes the chronic adenoiditis (an important percentage of the patients suffering from choanal imperforation have undergone surgical procedures for adenoidectomy), followed by pyriform aperture stenosis, cyst of nasolacrimal duct, hypertrophy of inferior nasal turbinates, nasal septum deviation, antro-choanal polyp or nasal tumor formations [8].

The transnasal endoscopic surgical intervention is the current method of choice, the other surgical methods being performed less and less nowadays [9]. The endoscopic technique may be performed in young ages, presenting low bleeding and decreased morbidity [6]. In order to remove the bone structure, drilling of the bone which blocks the nasal choanal and the resection of the posterior portion of the vomer are practiced aiming to obtain a comfortable breathing space. The thinnest portion of the blocking membrane is searched (usually at the junction between the hard palate and the vomer) from where the resection starts in order to prevent hemorrhagic complications (sphenopalatine artery, vidian artery) (Figure 2).



**Figure 2. Endoscopic aspect of the choanal atresia**

A silicone stent is mounted in the newly created space, which shall be maintained in position with a suture wire at the columella level. The recommended duration for maintaining the silicone stent in position is of minimum 3 months in order to avoid reobstruction (Figure 3).



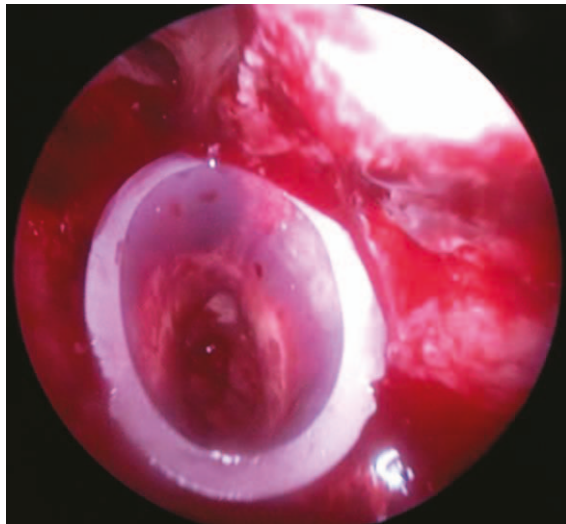
**Figure 3. Stent in position**

Complications which may occur are the forming of granulations, nasal crusts, septal perforation, persistent nasal discharge.

### 3. RESULTS

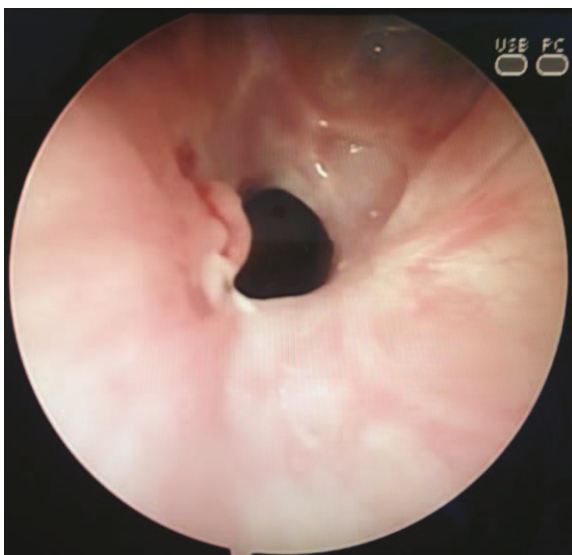
After creating a comfortable choanal opening, in most of the cases it is preferred to insert a unilateral or bilateral stent inside the nasal cavity depending on the choanal atresia type.

In order to be better tolerated, it is recommended that the stent is made of silicone material. The diameter of the newly created orifice must be equal to the stent's outer diameter in order not to allow its mobilization during swallowing or coughing and sneezing effort (Figure 4).



**Figure 4. Endoscopic aspect of the stent**

The posterior moving of the choanal stent is prevented by mounting an anchoring wire fixed in front to the columella. After surgery the patient does not require a nasal packing, as he shall breathe comfortably through the initially blocked nasal fossa. Moreover, the important decrease of the mucopurulent discharge from the blocked nasal fossa level was also noticed. The best results in this pathology were obtained by maintaining the silicone stent in position for at least 3 months. It was observed that, after this period, even though there have been decreases in the choanal opening, we have not faced a choanal atresia relapse, thusly being provided with comfortable nasal permeability (Figure 5).



**Figure 5. Endoscopic aspect 6 month postop.**

The complications we encountered were represented by intolerance for the stent's material (Portex endo-tracheal cannula), the presence of the granulation tissue with crusts and false membranes (in cases of vomerian resection) and mounting of stents with length of over 10 mm), the accidental removal of the stent (1 case) when the newly created opening's sizes was reasonably higher than the

stent's, as well as the reobstruction when the stent was removed earlier than 1 month.

#### 4. DISCUSSIONS

According to a study conducted by Dobrowski, the ratio of unilateral: bilateral choanal atresia is of 2:1, the unilateral one being most frequent on the right side [10].

Barbero and staff have concluded in a study that there is a connection between the choanal atresia and maternal hyperthyroidism treated with antithyroid medication (methimazole, carbimazole) [11].

The bilateral choanal atresia is quickly diagnosed by the neonatologist when the aspiration of the secretion from the nasal level is possible however the nasal fossa – rhinopharynx passage is blocked. The severe symptoms of nasal obstruction and cyclic cyanosis is improved during crying and worsened during breastfeeding. The first measure is to provide a free upper breathing airway using the Guedel pipe and in case of emergency the surgical treatment is applied. The unilateral atresia may be later diagnosed, as the patients present congestion or unilateral mucopurulent rhinorrhea.

Depending on the bone, membranous or mixed nature of the choanal atresia, the therapeutic treatment varies. The bone atresia requires the use of surgical drilling, with preserving of the nasal mucosa by performing flaps and their application over the cropped bone edges in order to prevent the forming of the granulation tissue. Studies show that the reblocking degree in patients with vomer resection is low [12].

With respect to the mounting of the stent, there are pro and against opinions. The major benefit of mounting the stent is provided by the low reblocking rate. The local infections, nasal synechias and the occurrence of the granulation tissue are counted among the risks undertaken by a stent carrier, complications that occur especially in patients that are incorrectly followed-up after the surgery.

Gujrathi and staff have conducted a study of a 52 newborn lot with bilateral choanal atresia and have reported a success rate of 94% after the endoscopic surgical treatment with stent mounting [13].

A meta-analysis of 238 cases of choanal atresia comprising 20 studies has proved that the use of stent or the lack of it does not considerably influence the surgical outcome [14].

A meta-analysis type study of 154 studies concluded that the success rate for treating the bilateral choanal atresia is similar regardless of whether the nasal stent is used or not [15].

The current availability of some stenting methods from the point of view of the material used is diverse: silicone tube adapted to the new choanal diameter (fragment of



Montgomery tracheal cannula), Portex tube made of PVC or the Teflon stent (also known as „little gun”) [16]. The stent's length was adapted to the choanal tunnel, however the size of 6-8 mm was tried not to be exceeded.

The alteration of the choanal membrane resorption process in the intrauterine life is determined genetically. The issue debated is the existence of a genetic memory of the patient with choanal atresia to include the information of the permanent forming of the membrane. The keeping of the stent for 3 months has proved to lead to good outcome, which makes us believe that this time interval is the best in order to amend the genetic memory of forming the membrane.

We have continued with the follow-up at 2, 6, 12 months in the first year pursuing the surgical intervention, then annual controls until 18 years of age. Although there have been reductions of the choanal space, there have not been cases of complete choanal obstruction, as all patients had a comfortable nasal permeability.

Besides the surgical methods, the studies indicate the possibility to use Mitomycine C, an anti-proliferative – antitumor agent which prevents the growing and proliferation of fibroblasts. The using of Mitomycine C locally, as aid in the surgical repairing of choanal atresia may improve the permeability of the nasal fossa, which shall lead to a decreased rate of stenting and surgical reintervention [17].

## 5. CONCLUSIONS

The diagnosis of bilateral choanal atresia in newborns is of vital importance. The endoscopic diagnosis may state the difference between adenoid vegetation, diagnosed very frequently in children, and choanal atresia.

The unilateral form may be discovered later in life, the treatment being surgical, with a transnasal approach with removal of the blocking membrane. The surgical method used is the endoscopic approach with the mounting of a silicone stent for a minimum time period of 3 months. The nasal endoscopic surgery to remove the choanal blocking membrane is a well-defined surgical technique, with minimum intra and post-surgical complications, thusly being the election surgical method in treating the choanal atresia.

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