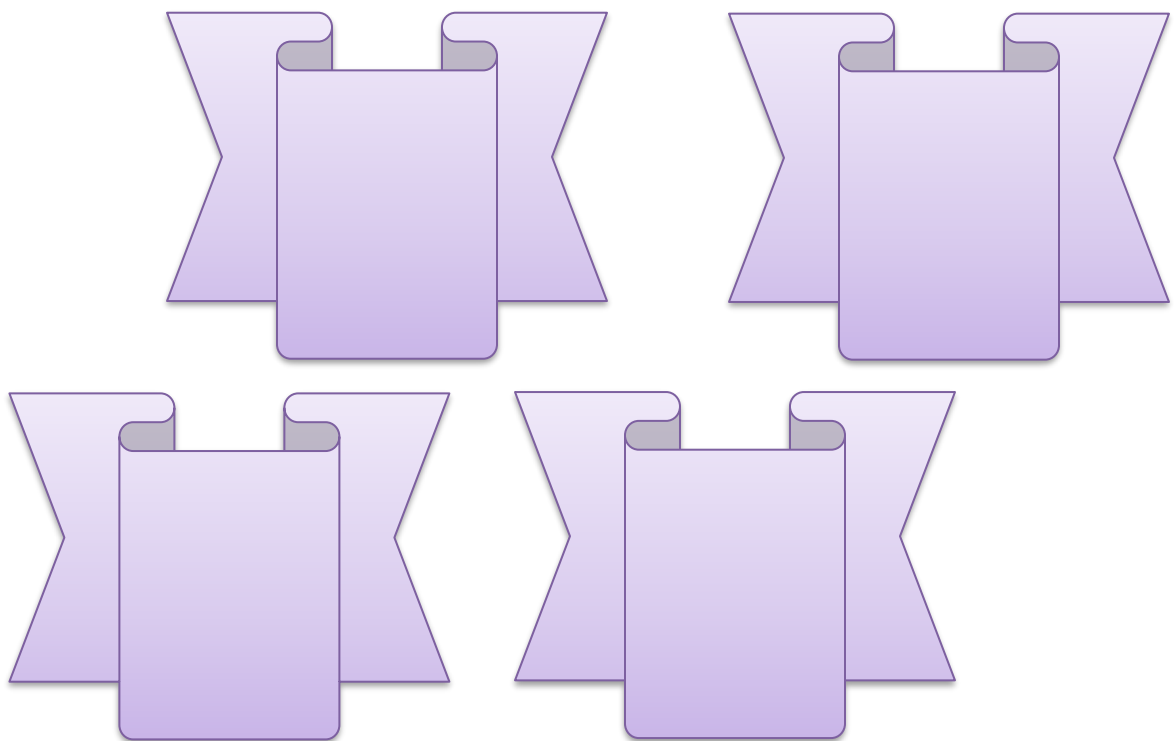


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Original Article

A Stentless Choanoplasty for Bilateral Congenital Choanal Atresia: Endoscopic Submucous Resection of Posterior Septum

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ABSTRACT

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Aim of the work: To evaluate the submucosal resection of the posterior part of septum in the management of bilateral congenital choanal atresia.

Patients and Methods: seventeen new-born infants with bilateral congenital choanal atresia were managed endoscopically by a transnasal repair together with submucosal resection of the posterior part of the septum. On CT scan, 14 infants had mixed atresia, and 3 infants had pure bony atresia. Using a 2.7 mm, 0° sinuscope, the site of the atretic plate and the adjacent part of the posterior septum were infiltrated. A vertical incision was taken at the bony cartilaginous junction of the septum using a round/sickle knife. The bony septum was drilled out along with the atretic plates of both sides. The two septal mucoperiosteal flaps were then approximated and the soft tissue that was occluding the choana was then excised on both sides. The remaining bones of the atretic plates were then removed from the remaining superior, lateral and inferior walls to widen the neo-choana and create a wider than normal choana

Results: A follow-up period for at least one year, revealed that 10 cases remained patent for adequate size bilaterally, four cases were found with bilateral concentric narrowing but still adequate for breathing, one case required revision surgery of the right side, two cases required bilateral revision surgery.

Conclusion: Endoscopic submucous resection of the posterior part of the septum for the repairing of bilateral choanal atresia meets the goals of efficacy and safety, and diminished incidence of restenosis.

Keywords: Endoscopic; Choanal; Atresia.



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INTRODUCTION

Choanal atresia is a congenital obstruction of the posterior nasal opening [it can be unilateral or bilateral]. It is the most common congenital malformation of the nose with the incidence of this disorder estimated to be 1 in 5,000 to 8,000 live births. Unilateral choanal atresia is more common, while bilateral atresia occurs in 30% to 40% of cases. There is a female-to-male predominance of 5 to 1 in Caucasians [1].

The atretic plate is bony in 30% of cases, whereas 70% are mixed membranous and bony, with very rare pure membranous malformations [2].

Roederer in 1755 was the first to describe this malformation. Emmert, in 1853 was the first to surgically approach choanal atresia when he used a trocar and passed it through the obstruction. In 50% of cases, choanal atresia is associated with other congenital anomalies. Choanal atresia is one of the six possible categories of associated malformations, the others being coloboma, cardiac defects, growth retardation, central nervous system developmental anomalies, genitourinary tract anomalies in male patients and ear anomalies [3].

Bilateral choanal atresia can be suspected soon after birth when a new-born infant presents with cyclic asphyxia and cyanosis. Computed tomography [CT] in the axial and coronal views is considered the radiological study of choice for the evaluation of choanal atresia and adjacent structures. Two useful parameters are used: mean vomer width and choanal air space. Typical changes in choanal atresia include thickening of the posterior part of vomer bone and thickening/medialization of the medial pterygoid plate at the level of the choana [4, 5].

For choanoplasty procedure, many approaches have been used, with the transnasal endoscopic approach being the most commonly used approach in the last few years. The ideal procedure should restore the normal nasal passage without damage to the surrounding structures and should have short operative time with minimal morbidity and mortality [6-8].

The exact timing for surgery varies depending on whether the condition is bilateral or unilateral [unilateral cases can nearly always be delayed].

PATIENTS AND METHODS

This prospective study included 17 neonates [13 females and 4 males] with bilateral congenital choanal atresia, from August 2018 to February 2021 at the Otorhinolaryngology Department, Al-Azhar University Hospitals, Egypt. All patients were diagnosed clinically at birth and referred by paediatrician to the Otorhinolaryngology Department for further evaluation and management. A detailed history was taken from the parents; complete general and otorhinolaryngological examination including nasal endoscopy was performed. Immediate high-resolution CT scan in the axial and coronal cuts of the nose and paranasal sinuses was done to confirm diagnosis in addition to the evaluation of the type and thickness of the atretic plate and to exclude other causes of neonatal nasal obstruction [figure 1]. Complete preoperative laboratory tests including complete blood count and coagulation profile were obtained. The fitness for anaesthesia and operation were discussed with the both the paediatrician and anaesthesiologist. Details of the operation were discussed with the parents and a written consent for the procedure and the intervention was taken.

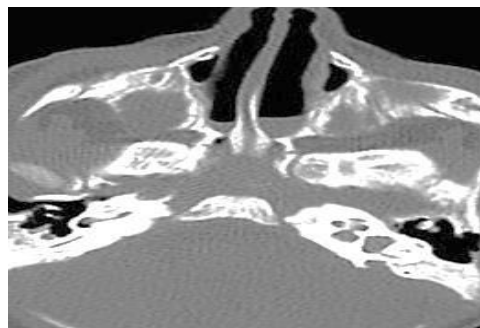


Figure [1]: Axial CT scan of bilateral choanal atresia

Surgical technique: All the procedures were performed under general anaesthesia with the use of oral endotracheal intubation and nasopharyngeal pack placed under direct vision. Every infant was put in the supine position with the head of the table tilted approximately 30°. Oxymetazoline drops were installed into the nasal cavity many times before starting the procedure to achieve the maximal decongestion of nasal cavity. Nasal endoscopy was performed with the 2.7 mm, 0° sinuscope, to confirm the diagnosis and to check the size of the turbinate and the state of the nasal septum. The site of the atretic plate and the adjacent part of posterior

septum were subperiosteally infiltrated. In the left nasal cavity, a vertical incision was taken at the bony cartilaginous junction of the septum using a round or sickle knife. The incision then was extended superiorly as much as possible; and inferiorly to the nasal floor to obtain good exposure. A subperiosteal plane was then created and the mucoperiosteum over the vomer bone was dissected as far posteriorly as possible in order to create a flap. Dissection was continued over the atretic plate as laterally as possible. The cartilaginous septum was then separated from the vomer and subperiosteal dissection was done on the other side of the vomer bone taking care not to disturb the flap on the other side. The major part of the vomer was removed using a bone forceps. A suitable diamond burr was used to drilled out the base of the vomer along with the atretic plates of both sides as much as possible. The two septal mucoperiosteal flaps were then approximated. Through the nasal cavities, the soft tissues closing the choanae were then removed on both sides using an insulated needle-tip electrocautery. The remaining bones of the atretic plates were then removed from the remaining superior, lateral and inferior walls as much as possible to widen the neo-choana and create a larger than normal choana. Care should be taken when working laterally to avoid excess bleeding. The mucosa surrounding the choana was then trimmed and adjusted to the bony margins. To help approximation of the two mucoperiosteal septal flaps and reduce the chance of postoperative narrowing of the neo-choana, the mucoperiosteum of the septum was interrupted by removal of a small triangular strip on the inferomedial border of the neo-choana of one side and the superolateral border on the other side. On completion of the procedure, there are two separate choanae with the nasal septum in between [figure 2]. No need for stenting.



Figure [2]: Six months postoperative [right side]

Postoperative care: It was not necessary to keep the infant in the neonatal intensive care unit postoperatively. Feeding was initiated soon after surgery. Suction irrigation with a saline solution containing steroids and antibiotics was recommended. Oral antibiotics were prescribed to reduce secondary infection. Before discharge to home the parents were trained to irrigate the nose with normal saline and to perform nasal suction. Infant hospitalisation ranged from three to five days for all patients. The infants were followed up every week for one month, then every month for six months, then annually.

RESULTS

Our study included 17 patients; 13 females [76.5%] and four males [23.5%] with the age ranged from 1 to 10 days [mean=4.6]. The prenatal history was irrelevant. Five infants [29.4%] were delivered by normal vaginal delivery, the rest [12 infants, 70.6%] were delivered using caesarean section. All patients were presented with neonatal cyanosis, which had improved upon using oral airway and oxygenation. None of the infants required intubation or tracheostomy. All patients were diagnosed at birth based on clinical suspicion and immediate CT scan. Fourteen infants [82.4%] had mixed atresia, and three [17.6%] had pure bony atresia. On axial CT scan, it was noticed that the base of the vomer was the part causing the main constituent of the obstruction rather than the atretic plate itself. Analysis of the results was based on the clinical improvement and endoscopic examination.

Follow-up period for at least one year revealed that 10 [58.8%] cases remained patent for adequate size bilaterally, four cases [23.5%] were found with bilateral concentric narrowing but still adequate for breathing, one case [5.9%] required revision surgery of the right side and two cases [11.8%] required bilateral revision surgery.

The complications that were found in the 17 operated patients were minimal and included mild intraoperative bleeding in 3 cases [17.6%] in which haemostasis was done using decongestants drops and packing, postoperative local infection and crustations in 7 cases [41%] which was controlled by systemic and local antibiotics and frequent suction irrigation in the early postoperative follow up period [Table 1].

Table [1]: Transnasal Endoscopic Stentless Choanoplasty for Bilateral Congenital Choanal Atresia [2018–2021; No. =17]

No/Age [days]/Sex	Atresia Type	Delivery	Results	Complications
1/3/F	Mixed	NVD	Patent	Bleeding
2/1/F	Mixed	CS	BCN	Crustations
3/5/M	Mixed	CS	BCN	Crustations
4/7/F	Mixed	NVD	Patent	No
5/3/F	Bony	CS	BCN	Bleeding
6/8/F	Mixed	CS	Patent	Crustations
7/4/M	Mixed	NVD	Patent	Bleeding
8/5/M	Mixed	CS	Patent	Crustations
9/1/F	Mixed	CS	Patent	No
10/2/F	Mixed	CS	Patent	No
11/10/F	Mixed	CS	Patent	Crustations
12/6/F	Bony	NVD	Patent	No
13/6/M	Mixed	NVD	Revision [Rt]	No
14/2/F	Mixed	CS	BCN	Crustations
15/9/F	Mixed	CS	BRS	No
16/3/F	Bony	CS	Patent	Crustations
17/4/F	Mixed	CS	BRS	No

BCA = Bilateral Choanal Atresia, M= Male, F= Female. NVD= Normal Vaginal Delivery, CS= Caesarean Section, BCN= Bilateral Concentric Narrowing, BRS= Bilateral Revision Surgery.

DISCUSSION

Choanal atresia is the most common congenital malformation as regards the nose. There is no specific theory about the cause of choanal atresia development. Unilateral atresia may pass unnoticed till adulthood and discovered accidentally during routine nasal examination. Bilateral atresia is usually an emergency situation that necessitates an urgent surgical intervention. Respiratory obstruction with intermittent cyanosis and feeding difficulties are the most common presentations [9-11].

With the high-resolution CT scanning of the nose, the typical findings include thickening of the posterior part of the vomer bone, thickening/medialization of the medial pterygoid plate with or without thin soft tissue or small bony plate in between. It is recommended by many investigators that the removal of only the atretic plate, results in re-stenosis and failure [12].

Removal of the entire vomer with preservation of the mucoperiosteum on both sides [submucous resection], was noticed to maximize the size of the neo-choana, create a near normal two separate choanae and reduce the risk of recurrent stenosis.

Many approaches have been described for treatment of the choanal atresia. The transpalatal and transnasal route are the most commonly

used approaches. Transseptal repair is occasionally used for older patients with unilateral atresia, and the transantral route is only of historical importance [13].

The ideal approach should be safe, effective, with short operative time, early postoperative recovery and minimal morbidity and mortality. Endoscopic repair of choanal atresia fulfils all these advantages in addition to the direct visualization of the operative field and working under direct vision. Endoscopic repair of choanal atresia has the advantage of good illumination, magnification, direct visualization and increased safety by avoiding palatal and dental complications, in addition to reducing the operative time, perioperative bleeding and postoperative pain. The transpalatal approach lacks all these advantages [14].

Septal deviation, turbinate hypertrophy, high arched palate or other anatomical abnormalities can further complicate visualization during the endoscopic transnasal approach and form the principal factors that results in failure of the procedure [15].

The principal factor that resulted in failure of the nasal septal crossover flap technique of **Stamm and Pignatari** [16] for endoscopic repair of choanal atresia was difficult exposure.

Submucous resection of the vomer bone is an essential step in our technique as it provides

an adequate working area for adequate exposure and repair of atretic plate with no reported dental or facial growth problems.

Stankiewicz [7], the first to report endoscopic repair of choanal atresia, reported four cases; two of them were bilateral. Both cases had repeated stenosis that needed revision. In one of them, revision surgery also had failed. He attributed his failures to inadequate vomer resection. Also, **Lazar and Younis** [17] reported two cases of endoscopic repair of bilateral choanal atresia; both had failed.

In the present series, analysis of the data achieved in our 17 patients [34 sides] who underwent endoscopic submucous resection of posterior septum for repair of bilateral choanal atresia during a mean follow-up period for at least one year was satisfactory.

Ten [58.8%] cases remained patent for adequate size bilaterally with normal nasal breathing and normal feeding, four cases [23.5%] were found with bilateral concentric narrowing but still adequate for breathing, one case [5.9%] required revision surgery of the right side, two cases [11.8%] required bilateral revision surgery which were all performed endoscopically. Restenosis was attributed to the postoperative concentric fibrosis due to inadequate trimming of the soft tissues.

In our study, 14 infants [82.4%] had mixed atresia, and 3 [17.6%] had pure bony atresia. On axial CT scan, it was noticed that the base of the vomer was the part causing the main constituent of the obstruction rather than the atretic plate itself. This agrees with results encountered by **Ibrahim et al.** [18] and **Brown et al.** [19]

Many controversies concerning the postoperative nasal stent and its duration. Recently, many investigators recommend against its use. Insertion of nasal stent is associated with longer hospital stay, increased incidence of local infections, pain, granulation tissue, and nasal synechia. Our technique obviates the need for nasal stents.

Conclusion

Endoscopic submucous resection of the posterior septum in repair of bilateral choanal atresia meets the goals of efficacy and safety, and diminished incidence of restenosis without the use of nasal stents. Good history taking,

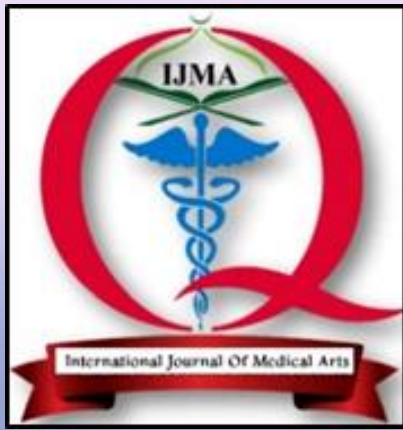
careful endoscopic examination of the nose and careful review of the CT scan, obtaining a bloodless intraoperative field are of paramount importance.

Conflict of Interest and Financial Disclosure: None.

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