A survey of the diagnosis and treatment of congenital choanal atresia

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SUMMARY

Congenital choanal atresia is a hereditary developmental anomaly in which a bony or membranous wall closes one or both choanae. In bilateral cases asphyxia will occur if the condition is not recognised and correct emergency measures taken at once.

No exact figures are available of the incidence of the anomaly. Until such time as a systematic study of the choanae of newborn is carried out at autopsy, it must be considered as being rare, although several authors suggest that the condition is more common than normally suspected.

Since the deformity was first diagnosed a little more than 100 years ago the treatment, in the majority of cases, has been emergency operation often performed within the first 24 hours of life. These operations could be dangerous or a failure and cause further deformity of the nasal and oral cavities. The present day treatment should consist of a conservative approach, the child being attended by pediatric, anaesthetic and E.N.T. specialists. An airway together with a feeding tube should suffice to carry the child over the first few critical weeks, after which masterful inactivity replaces former emergency treatment until the child has reached an age at which surgery becomes optimal.

CONGENITAL atresia of the choanae, forming the connection between the nasal cavity and the nasopharynx, is an unusual but not extremely rare abnormality. This malformation is presumed to have been first described by Roederer in an article published in Göttingen around 1775 (Quoted by Schwartz and Isaacs). Since then several hundred cases have been reported, at first singly, later as larger and larger series. There is little doubt that the deformity is being diagnosed more often as obstetricians, pediatricians, anaesthetists and otologists become more familiar with the symptomatology and realize its importance as a possible cause of neonatal asphyxia.

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No exact figure for the incidence of the abnormality has ever been given, as no systematic search has ever been carried out at autopsy. Richardson wrote in 1913 "Many cases of this kind of deformity have been in the past, and even at the present time, are unrecognised at birth as such, and when speedily dying, as a result of the obstruction to respiration, are placed under the general class of asphyxia neonatorum". Diamant and Kinnman wrote in 1963 "Aversion to mouth breathing is based on the congenital impulse to draw the air towards the olfactory organ in the nose. When the choana are obstructed the newborn does not open its mouth to inhale. On the contrary, the lips are pressed more tightly together, the nasal alae are dilated and the auxilliary respiratory muscles are brought into action. Unless the infant cries, however, or sucks in its lips so far that they become separated, inspiration will not take place and the infant will die of suffocation. If at autopsy the nasal passage is not closely examined, the diagnosis will be atelectasis".

The subject of sex distribution is difficult as only relatively small series are available. The series of Flake and Ferguson (1964) consisted of 40 cases and had an incidence of 1 : 2 in the relation between male and female. In the series of Diamant and Kinnman (1963) there were 12 males and 17 females. According to them there were twice as many right as left sided unilateral malformations.

THEORIES OF ORIGIN

Choanal atresia is osseous in 90% of the cases, possibly with membranous or cartilaginous parts, while only 10% are purely membranous.

The theories of the origin of choanal atresia must all be based on speculation, as the abnormality has never been seen during foetal life.

The nasal cavity is of ectodermal origin, it develops from the foetal placodes, the central parts of which invaginate, with an inward growth of epithelial pouches, which form the primitive nasal cavities. These are divided at the posterior from the nasopharynx by the bucconasal and naso-pharyngeal membranes, which normally rupture in the 3rd to 5th week of foetal life. If this does not occur a choanal atresia develops, possibly with the ingrowth of mesodermal tissue from which the bony structures originate. The objection to this theory is that the atresia should then be attached to the rear edge of the premaxilla (Wright, Shambaugh and Green, 1947), which is obviously not the case. Craig and Simpson (1959) state: "one would expect that the persistence of structures which normally disappear early in embryogenic life would entail many associate abnormalities in the region of the nose and mouth."

Other theories suggest that a contraction occurs during the formation of the posterior parts of the nasal cavities, which together with synechia formation or closure by an epithelial plug later give rise to atresia of the posterior nares.

Some have objected to the theory that bone developing in the bucconasal membrane must be membranous bone on the grounds that cartilage is found in some cases in the atretic wall. This assumption erroneously implies that the bucconasal and nasopharyngeal membranes are part of the membranous cranium, the em-

bryologic structure from which all membranous bones develop. Since the structure occluding the choana is an abnormal structure it is reasonable to assume that its condensed mesenchymal tissue may either become part of the membranous cranium or part of the chondro-cranium. If this assumption is correct, the occluding structures could contain either membrane or cartilage formed bone.

Finally there is the theory suggesting that the atresia is formed by hypertrophy of the vomer, sphenoid body, pterygoid and palatine processes. The supporting argument is that the body of the sphenoid is the only bone forming the boundry of the choana ossifying in cartilage. An outgrowth from the vomer containing cartilage is also possible as this bone develops from ossifying centres on each side of the cartilagenous septum. Thus cartilagenous parts may well be incorporated in the deformity. According to this theory an outgrowth from the palatine bone is impossible as this is a membranous bone (McKibben, 1957).

MALFORMATIONS IN THE NASAL AND BUCCAL REGIONS

The atretic structure consists of a wall, which slopes upward and backward, in such a manner that in the horizontal plane it will run from 10 o'clock to 4 o'clock (Owens). At the top it is connected to the lower surface of the sphenoid body, laterally to the internal lamina of the pterygoid process, medially to the vomer and at the bottom to the horizontal part of the palatine process. The atretic plate can be in the choana itself, however, generally it is slightly anterior so that it lies 1 to 3 mm in front of the rear edge of the vomer. The wall can vary in thickness from a thin membrane to a bone up to 12 mm. The thickness can be uniform throughout, but usually the central part is thinner than the periphery. In such cases it is possible to see a depression, or at times, a central perforation when the patient is examined by posterior rhinoscopy. These openings, however, are never large enough to be of any functional value, as they do not permit the patient either to respire or to remove secretion from the nasal cavity.

Choanal atresia may be seen in combination with a narrowing at the rear of the nasal cavity with hypoplastic turbinates, deviation of the septum towards the atretic side and an encroachment of the lateral nasal wall owing to hyperplastic development of the sinus on the affected side. The palate is high and small in cases of double sided atresia, while with unilateral atresia asymmetric development of the palate occurs, so that the bottom of the nasal cavity can be up to 1 cm higher than the normal side. Often there is very little room in the nasopharynx on the affected side and the internal ostium of the Eustachian tube is nearer the midline (Brunk, 1909; White, 1918; Kazanjian, 1942; Rudy, 1945; Wright, Shambaugh and Green, 1947 and others).

These changes are presumably purely mechanical, owing to the presence of the atresia and its restrictive effect on the surrounding structures, in combination with the functional changes caused by mouth respiration. Should this be correct then early operative treatment would prevent the occurrence of these deformities.

In 1909 Brunk studied the high palate in a series of 32 cases of bilateral choanal atresia. He came to the conclusion that the high palate is not congenital, but first becomes manifest after mouth respiration has taken place for some time.

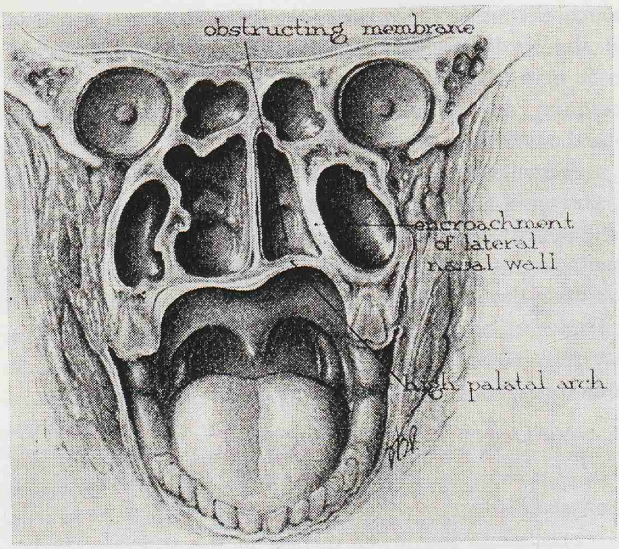

Figure 1. Choanal view at the level of the choanae (after Owens, 1951). The rear part of the nasal cavity is narrowed, the hard palate is elevated and the maxillary sinus enlarged on the affected side.

The cause of the high palate is attributed to the pressure of the cheeks on the alveolar arch, the lack of modelling by the tongue (Beinfield, 1959, Block et al.) and the absence of negative pressure in the oral cavity during mouth respiration. These effects result in a high arched palate, often accompanied by irregular teeth. Owens concluded, on the basis of a follow-up study of his seven cases, that early surgical correction with restoration of normal nasal physiology might prevent the poor development of the nasal and pharyngeal cavities on the obstructed side.

CHOANAL ATRESIA ASSOCIATED WITH OTHER CONGENITAL ABNORMALITIES. HEREDITARY OCCURRENCE

Choanal atresia can be seen in combination with other deformities such as asymmetry of the face, fistula of the ear, double tragus and atresia of the outer ear and also with coloboma of the iris. Cases have in addition been reported together with thalidomide embryopathy and with Ulrich-Turner syndrome, and also in a single case together with Treacher-Collins syndrome.

Choanal atresia may be associated with other congenital anomalies such as the tetralogy of Fallot, defect of the intraventricular septum or patent ductus arteriosus. In the presence of these more conspicuous anomalies, atresia may go undetected, even when it constitutes an important factor in the symptomatology (Diamant and Kinnman, 1963).

In addition to the sporadic occurrence of cases together with other congenital deformities there also appears to be a hereditary trend in the disease. Choanal atresia has been observed several times in siblings (Stewart, 1931; Johnsen,

1960) and in twins (Umlauf, 1939; Dickson, 1950). Dirlewanger (1966) considers the hereditary to be irregular dominant, but he himself published a case that appeared to have a recessive pattern with consanguinity in the two families involved.

SYMPTOMS

McKibben has, after careful study of the available literature, divided patients with bilateral choanal atresia into 4 groups. 1) Infants with cyclic dyspnea, the symptoms of which are severe; 2) Infants who have dyspnea while suckling, 3) Infants who have no dyspnea; and 4) Older patients.

1. *Infants with cyclic dyspnea*

In 1914 Richardson described a special form of dyspnea that was typical for infants with bilateral choanal atresia. This form of respiration, that was later termed "cyclic dyspnea", consists of very severe dyspnea with the lips and cheeks being sucked in with a ballooning of the soft palate downwards towards the root of the tongue, which alternates with crying, this then gives the child the possibility of breathing through the mouth, as long as the crying lasts. The condition is usually untenable as the cyclic dyspnea tires the child and prohibits feeding and suckling. Without suitable treatment the condition may be fatal owing to exhaustion, hunger and dyspnea.

2. Infants with dyspnea while suckling

This group have difficulty during suckling or feeding. They often have an audible snoring respiration and can develop dyspnea at night. These children usually learn to use a feeding bottle within the first 3 weeks of life, as they alternately suck and breathe.

3. Infants without dyspnea

This group is said to be very rare, as few infants have previously been reported without dyspnea or difficulty in feeding. The respiration is often audible during the first year of life, but then becomes normal. The assumption that these infants are very rare is refuted to some degree by Diamant and Kinnman, who had 8 cases that remained undiagnosed throughout the neonatal period, in their series of 14 patients with bilateral choanal atresia.

4. Older patients with choanal atresia

Adult patients with bilateral choanal atresia have, at times, no symptoms whatsoever, and the diagnosis of the condition is often incidental.

The case history of these patients often tells of a period with difficulty in breathing, difficulty in feeding or gaining weight during infancy. They always have mouth respiration and there is an absence of nasal quality to the voice. There can be discomfort in the ears, as the pressure cannot be equalized in the nasopharynx when swallowing. The olfactory senses are affected and normally there are changes in taste. Some patients complain of excessive nasal secretion, while others only

have problems when bending forward. There is often a very uncomfortable irritation of the upper lip and vestibules together with the excessive nasal secretion. Many complain that they are unable to blow their nose, and that they become dry and irritated in the mouth and throat owing to the constant mouth respiration.

SYMPTOMS OF UNILATERAL ATRESIA

In these patients the symptoms can vary between those seen in the severe cases of bilateral atresia to cases where neither the patient nor any others notice the abnormality, all depending on the passage in the patent nasal cavity. The patients often first become aware of the abnormality when they reach an age at which they are able to observe for themselves that they cannot blow their nose on one side. A number of these patients only consider the condition a nuisance and refuse surgical treatment.

A viscous gelatine-like secretion is formed in the obstructed nasal cavities of patients with bilateral or unilateral choanal atresia. This secretion can flow out, either spontaneously or when the patient bends forward and it gives rise to irritation of the nares. Some patients learn to remove the secretion by a rapid twisting of the head, while it continues to cause discomfort for others. Dolowitz and Holley (1949) have described severe mental disturbances in an 8 year old girl with congenital obstruction of one side of the nose. This patient, from the age of 5, was increasingly affected by the condition and to such a degree that she finally refused to take part in any form of activity that entailed bending forward. Her condition eventually caused her class mates to make remarks about her with the result that she became isolated and developed nervous symptoms such as nasal twitching, facial grimacing and periods of nocturnal enuresis. After successful surgical treatment with the removal of her choanal atresia the symptoms disappeared completely.

DIAGNOSIS

The diagnosis of choanal atresia is not normally difficult, providing the condition is borne in mind.

If, after shrinking the nasal mucous membranes, it is impossible to push a thin catheter through the nasopharynx then this strongly indicates the presence of choanal atresia. Careful palpation with an orange stick with cotton wool or a probe along the bottom of the nasal cavity will permit localization and provide an impression of the character and consistency of the obstruction. The hard resistance caused by bone tissue can easily be distinguished from the soft pliable consistence of a membranous atresia. It is also possible to notice that a catheter or probe will be stopped some 30 to 32 mm from the entrance to the nose, and the typical feeling of the catheter passing through the choana to the nasopharynx is absent.

A number of investigators recommend the use of posterior rhinoscopy in order that the choanal atresia may be observed directly, and the differential diagnosis

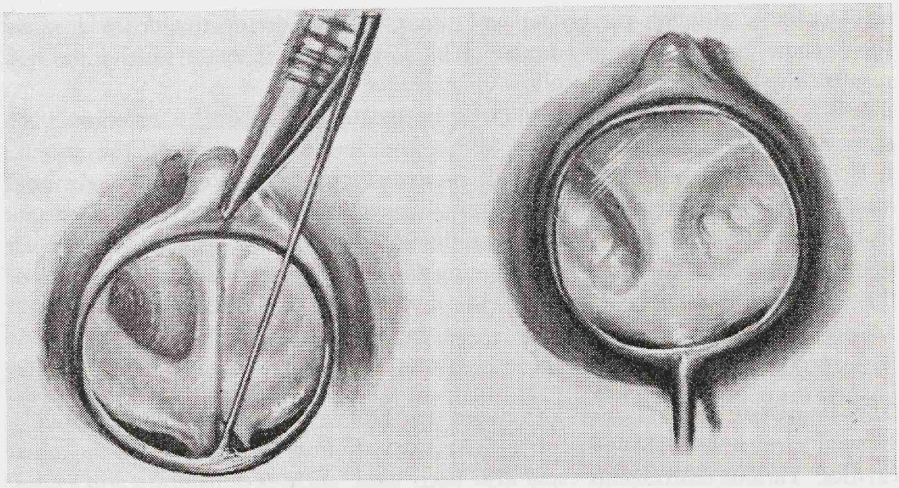

Figure 2. A. Nasopharyngeal "mirror exposure" of a unilateral choanal atresia.
B Nasopharyngeal "mirror exposure" of a bilateral choanal atresia. (After Kazanjian, 1942).

be made with regard to other diseases such as choanal polyps, foreign bodies, septum dislocations and neoplasms. It may be necessary to carry out this examination under general anaesthesia, with retraction of the soft palate in cases where there are difficulties owing to excessive reflexes of the palate or lack of patient co-operation. This method of examination will presumably be of greatest interest in children and adults, while it is difficult to carry out on infants because of the confined space.

Despite the fact that the differential diagnosis with regard to other diseases causing obstruction of the nasal cavity is comparatively simple there have been several examples of patients being subjected to repeated adenotomies, tonsillectomies, submucous resection and operations on the sinuses (Kazanjian, 1942; Uffenorde, 1960).

OPERATIVE METHODS

Methods for the operative treatment of choanal atresia can be divided, according to the path of entry, into: transnasal, transseptal, transantral and transpalatal approaches.

The transnasal method with instrumental perforation and removal of the atresia via the nasal cavities is the oldest of the methods. This has been used, in particular, by surgeons who consider bilateral choanal atresia as being an emergency case, requiring immediate operation preferably within the first 24 hours of life. The transseptal method was developed after Killians method of septum resection appeared; removal of mucosa and a part of the septum skeleton will permit the rear of the nasal cavity to be exposed. The transantral method with entry via the maxillary sinus appears to be that most rarely used, while the transpalatal method

with entrance through the palate and direct observation of the operative field has become more and more popular in later years, and it seems to give the best results when judged by the follow-up examination.
The emergency management should also be mentioned, where by insertion of an airway and feeding tube together with very close observation of the patient, it is possible to ensure that the infant survives the first few difficult weeks until mouth respiration has been established. This treatment should be carried out in the pediatric department. A single author (Toremalm, 1968) advocates the use of prophylactic tracheotomy, thus avoiding the feeding and breathing problems of the child.

TRANSNASAL METHOD

The transnasal method was introduced by Emmert in 1853. He removed a choanal atresia with the help of a curved trocar, inserted via one of the nasal cavities. Various instruments have also been used, such as a hammer and chisel, burrs and drills, curettes, cauteries, etc. The most detailed description of the transnasal method was given by Beinfield in 1959. This author used a curette for the removal of the bony atresia, after which star shaped incisions were made in the pharyngeal mucosa using a knife, introduced along the centre and bottom of the nasal cavity, where the distance to the posterior wall of the nasopharynx is greatest. The opening thus made in the choana is retained open with the help of a plastic tube inserted from behind.
There are a certain number of risks entailed in this method, as the distance from the choana to the spinal columm is only 12 mm and the danger of perforation

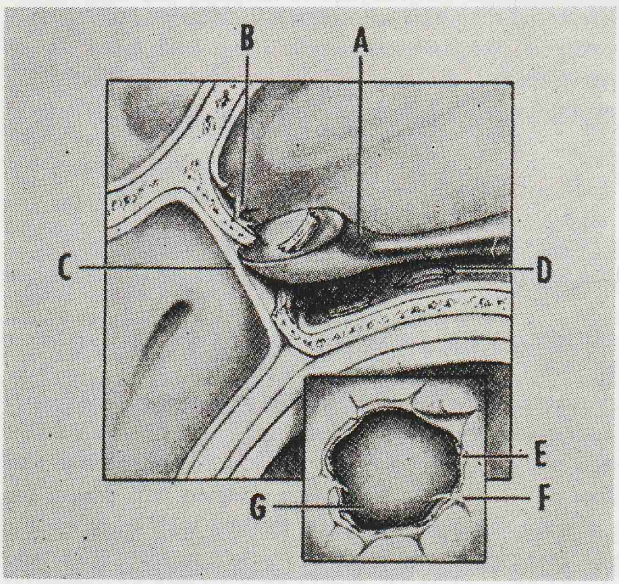

Figure 3.
Diagram showing the transnasal method (after Beinfield, 1959). A & B curette removing bony portion of atresia together with the nasal mucous membrane.
C. pharyngeal mucous membrane. D. removed particles of bone on the floor of the nose.
Insert: Bony atresia almost completely removed. F. shreds of nasal mucosa. G. intact pharyngeal mucous membrane.

between the atlas and the axis or through the base of the crainium exists. Therefore some surgeons insert a finger or metal shield into the nasopharynx.

The intranasal method is quite satisfactory in cases of membranous atresia, but with the bony forms there is a considerable tendency for the choanae to close again owing to synechia formation or scar tissue resulting from unremoved bone fragments, lacerated mucosa and open wound surfaces, and this happens despite the use of bougies, tampons, dilatators and galvanocausis etc. Several authors state, that the majority of the transnasal operations have been a failure and a few even caused death (White, 1918; Ruddy, 1945; Dolowitz and Holley, 1949; Owens, 1951 and others). Newborn infants are rately able to tolerate plastic tubing. Such tubes often make feeding difficult and in addition it is often necessary to use such a narrow calibre that they easily become clogged (Craig and Simpson, 1959; Johnson, 1960; Sjövall, 1963).

THE TRANSSEPTAL METHOD

The transseptal method was introduced by Uffenorde in 1909 and used by von Eichen in 1911. This procedure entails removal of part of the septum. The muco-periosteum is raised from the septum as far down as to the obstructing plate, from the anterior surface of which it is gradually separated until its outer border of attachment is reaced. The flap is then pulled well outwards and the bone plate together with a portion of the pharyngeal mucosa removed by chisels and conchotomes. After the bone partition is cleanly removed the flap is replaced. An incision is made vertically through the middle of the flap, covering the nasal surface of the atresia. Expanding forceps are then introduced and the redundant muco-periosteal flap is made to coapt and cover the whole margin of the bone wound.
The method has later been used by White (1918), Kazanjian (1942) and Blegvad (1954) apparently with good results. Owens (1951) and Ruddy (1945) state that the method is suitable in cases where there is sufficient room to work in the nasal cavities. Ruddy questions the advisability of removing too much of the septal skeleton and Toremalm (1968) does not recommend the method because it, similar to the intranasal method, can give rise to developmental anomalies of the finer nasal structures.

THE TRANSANTRAL METHOD

This method was described by Wright, Shambaugh and Green in 1947. The first step in the operation consists of opening the maxillary sinus after the mehod of Caldwell-Luc. The window to the nasal cavity is made as far back in the posterior wall of the sinus as possible, which together with the resection of the posterior part of the turbinates gives a good view of the atresia. The advantages with the operation should be, good visualization of the operative field, ease of access, together with the possibility of ligating the internal maxillary artery if necessary in case of haemarrhage, also the risk of damaging the pterygopalatine artery is reduced.

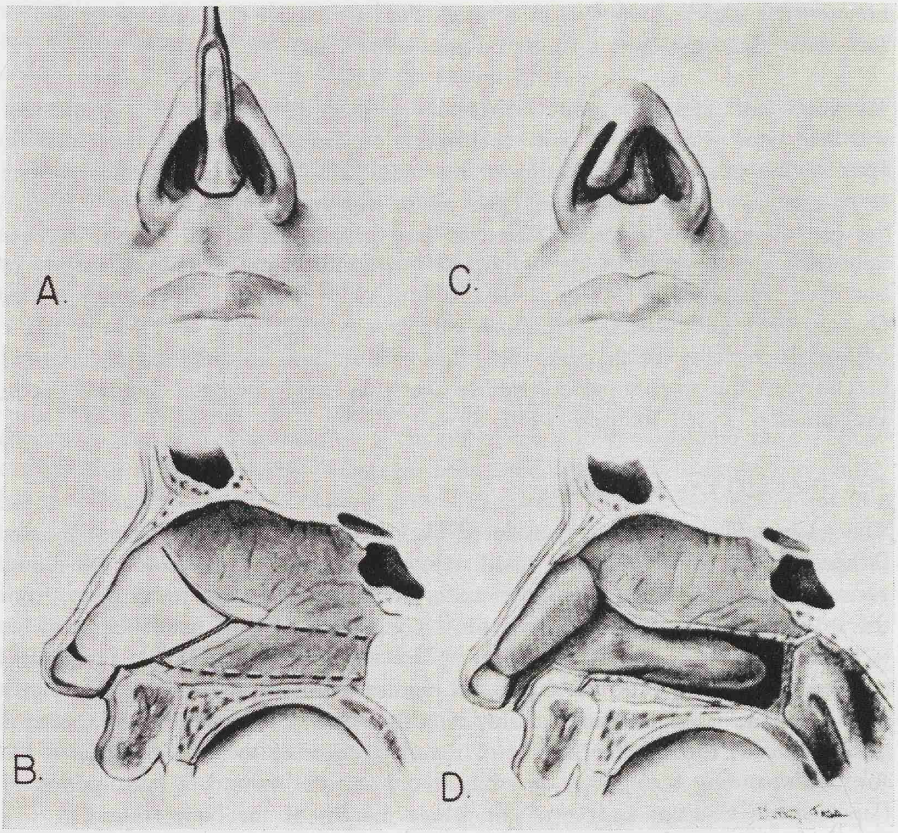

Figure 4. Transseptal method. A. The incision through the base of the columella is in three distinct planes so that when the cut is resutured it will approximate exactly, and leave a minimum amount of scarring. B. In extending the through-and-through incision of the septum backward it is carried parallel to the vomer ridge to the tubercle where it turns at right angles to continue through the quadrilateral cartilage up to the nasal bones. C. The flap thus created hinges along the dorsum and may be pushed to either side exposing the rest of the septum. It creates a large opening through which an excellent exposure is optained. D. The septum pushed to the opposite side, the vomer removed back to be atresia and then the atresia has been removed laterally to the outer wall of the nose. (After Kazanjian, 1942).

THE TRANSPALATAL METHOD

This method was described for the first time by Brunk in 1909 and several modifications have been suggested, mainly with regard to incision of the hard palate. After freeing the mucosal flaps a sufficiently large area of the bone is removed from the hard palate to provide a good view.

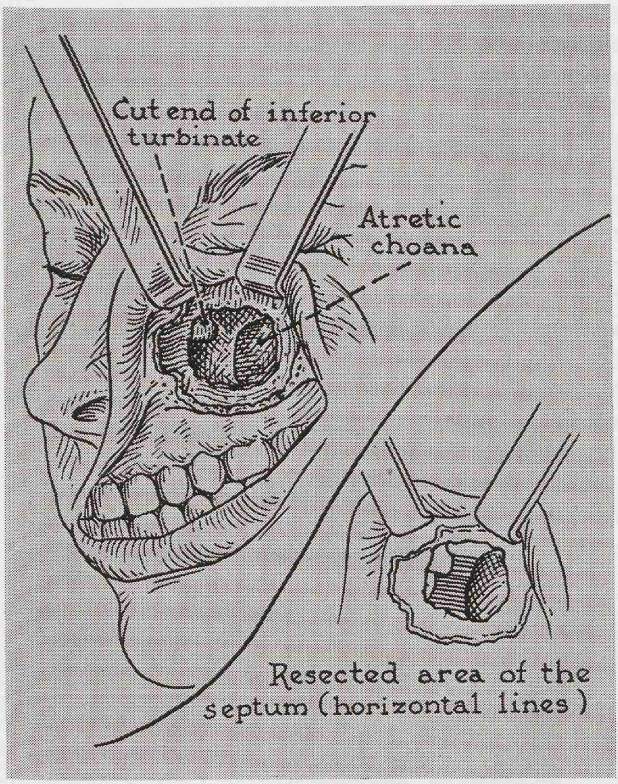

Figure 5. Diagram of the transantral approach to the choana (after Wright, Shambaugh and Green, 1947).
The choanal atresia is exposed by resecting the posterior part of the medial wall of the maxillary sinus together with the posterior tip of the inferior turbinates.

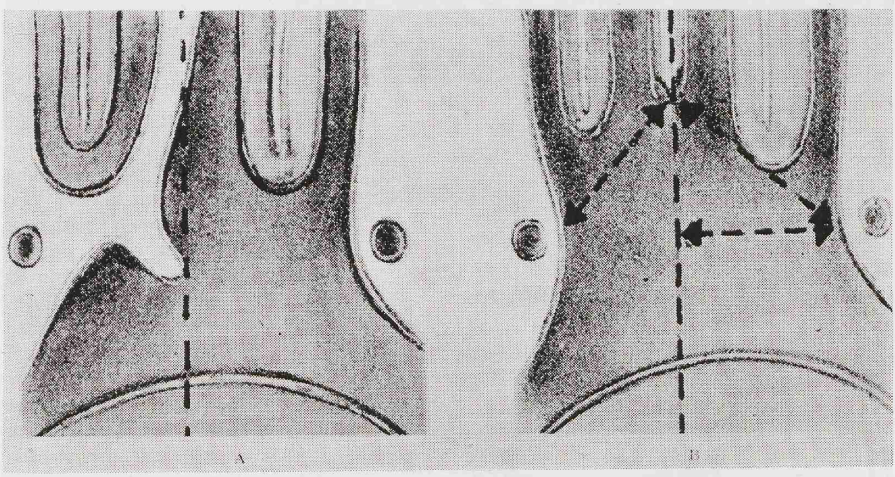

Figure 6. Diagram of the horizontal section through the nose (after Wilson, 1957). The affected side of the nose cannot be enlarged without removing the posterior part of the septum. Widening the area to any extent in a lateral direction is restricted by the posterior palatine canal.

The transpalatal method is now that most commonly employed and has quite a number of enthusiastic supporters. Rawdon and Baade wrote in 1960, "The transpalatal approach to posterior choanal atresia follows the principles and practices of good surgical technique by allowing complete visualization of the operative field and eliminates guesswork surgery by feel and instrumentation in an area which is at best difficult to approach with precision and positive control by any other method".

The first operation by Brunk in 1909 was unsuccessful owing to scar tissue formation. It was therefore a considerable step forward when Blair in 1931 improved the method by removing the posterior part of the bony and cartilaginous septum and forming flaps of mucosa to cover the raw wound surfaces. An additional improvement of the method was introduced by Ruddy (1945), who removed bone from the hard palate on both sides of the vomer, thus giving better access to the rear portion of the bony septum, in this manner making removal of the bone and preparation of the mucosal flaps more precise. The work of Blair was carried even further by amongst others Wilson (1957), who's preparation of the mucosal flaps represents some of the very best with regard to transpalatal operative surgery. The importance of the various incisions that have been used and described

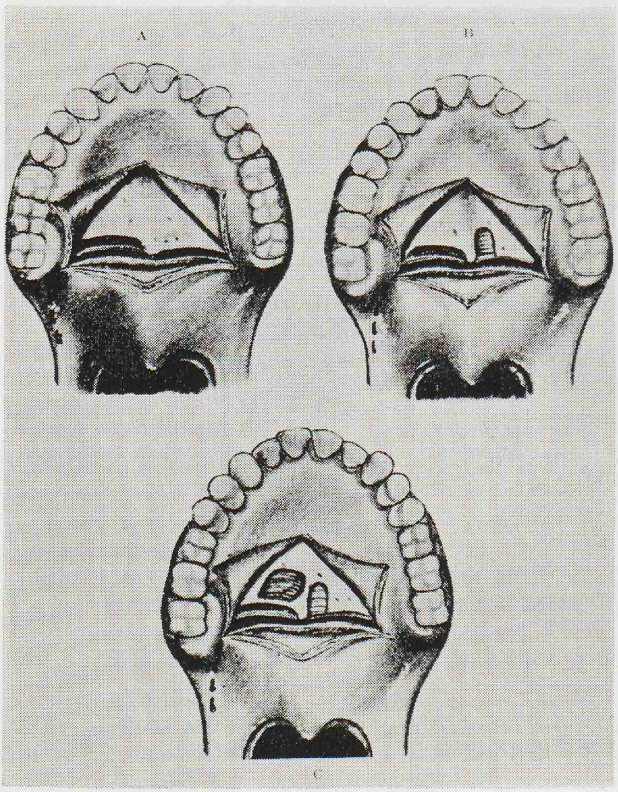

Figure 7. Stages in the removal of the bone in the hard palate according to Wilson, 1957.
The posterior border of the hard palate on the affected side is removed first, then the juxta septal portion of the hard palate on the normal side. The third stage is the removal of the bone from the hard palate anterior to the atresia. Then the bony atresia is removed whereas the mucosal flaps are retained in order to cover the raw surfaces.

by Steinzeug, Neto, Owens and others are difficult to assess. However, it is essential that the palatine artery is incorporated in the mucosal flaps, otherwise a fitula will occur, possibly accompanied by necrosis, resulting in delayed healing and scar formation.

The complications associated with the transpalatal method have mainly consisted of fistula formation in the palate together with contractions due to scar formation, owing to more bone than necessary having been removed. In addition there is inadequate exposure of the operative field in cases where the palate is high, and because the nasal cavity of the newborn infant is very small. The latter difficulty appears to have been overcome, at least partly, by Flake and Ferguson (1964), who have used the transpalatal approach to obtain a good view of the operative field while the actual removal of the atresia and preparation of the mucosal flaps is carried out via the transnasal route. In this manner it has been possible, in their series of 40 patients, to operate on 5 within the first month of life and 21 within the first year, apparently with just as good results at the follow-up examination as with those obtained in older patients.

EMERGENCY MANAGEMENT

This method does not appear to have been introduced by physicians but by the parents of a child with bilateral choanal atresia. The child was originally treated in the neonatal period with tracheotomy and removal of the atresia using the transnasal method. As the choanal opening apparently remained patent the can-

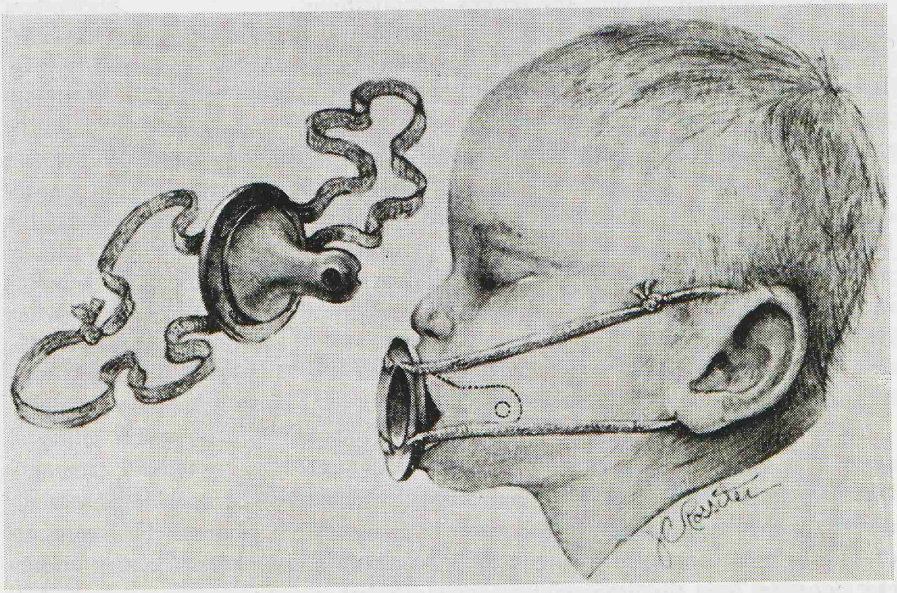

Figure 8. A simple device to secure feeding and mouth breathing (after McGovern, 1961).

nula was removed. However, the choanal opening closed after discharge, and the parents provided the child with a nipple that was fastened behind the ears with tape. The nipple permitted the child to respire through the mouth and the small bowl in the nipple was filled with liquid food for feeding. As the child was in such good condition after this treatment the parents refused further operation (McGovern, 1961).

McGovern emphasizes the fact that surgical treatment may be contra-indicated in cases where there is concurrent heart disease, if the child is premature or in cases where the child is exhausted from lack of food caused by delayed diagnosis of the condition.

The advantage of emergency management of a condition that can only be remedied by surgical intervention is that the child is permitted to survive and grow, that the surgeon has time in which to make sure the diagnosis is correct, to examine the patient for other associated abnormalities, and have optimal conditions under which to correct this rare anomaly. The size of the operative field alone in the neonatal period makes operation difficult and in this connection it should be remembered that the operative area will be twice the size when the child reaches the age of 1 year.

Sjövall (1963) examined premature infants having a birth weight of less than 2000 grams and found that nasal stenosis from acute rhinitis or congenital choanal atresia can cause fatal asphyxia in the first 2 to 3 weeks of life, a period in which the child is normally unable to breathe through the mouth. These children can be successfully treated with an airway, possibly with a feeding tube inserted through it. There is little doubt that this method of treatment can be continued for months without causing any serious complications.

TREATMENT WITH TRACHEOTOMY

It is possible, by using tracheotomy, to avoid the difficulties of both respiration and feeding. At the same time there is better access to the operative field, as the intubation tube can be introduced through the tracheotomy. Toremalm recommends prophylactic tracheotomy, but at the same time suggests that this is very carefully carried out and that crust formation is avoided by moistening the inhailed air, for example with a heat- and moisture-exchanger, a so-called artificial nose. The majority of surgeons, however, do not recommend the use of tracheotomy in newborn infants owing to complications and the difficulty encountered when removing the cannula.

DISCUSSION

New articles still appear on choanal atresia, which must be considered advantageous, as the majority of surgeons rarely have the chance of observing the results of the different operative methods on a larger series of patients having such a rare anomaly. It is also important to point out that pediatricians and anaesthetists are becoming far more involved in the treatment of this disease and have given

considerable help in removing the drama previously associated with the condition. Thus the surgeon is relieved of the responsibility of performing an operation under duress, that can be both dangerous for the patient and unsatisfactory for the surgeon, requiring supplementary tracheotomy and later reoperation.

This disease should be borne in mind when confronted with a case of dyspnea in a newborn infant, and it is necessary to remember that these children have no innate reflexes permitting mouth respiration should normal respiration fail. This type of respiration must be learned by the child and takes some weeks before being secured. The acute often very dramatic cases with cyclic dyspnea and apnea can be saved by using an airway, after which the pediatric department will be able to help the patient through the critical period and allow the surgeon to choose the most opportune time for operation.

The transpalatal method has become very popular and given good results in later years, however, it appears that the transseptal method has several advantages providing the septum skeleton is not injured. Recently the transseptal method has been used, modified in such a manner as to reduce the operative procedure on the septum skeleton to a minimum, thus causing no damage to the growth centres (see Greisen, House and Stoksted, this issue p. 20). The patients were operated on using hypotensive anaesthesia, thus permitting direct visualization of the choanal atresia. In addition it allows one to work at right angles to the obstruction and thus obtain clean cut surfaces both of the bone and mucosa. In order to maintain the choanal opening patent and let the mucosa heal over the site of resection portex tubes were inserted into the choana from the rear. These tubes had no irritative effect on the mucosa and permitted free respiration.

None of the patients could be operated on before the age of 18 months owing to the size of the nasal cavities and it was not necessary to perform emergency operation on any of them. In cases in which early operation is desirable it would presumably be necessary to use a combined approach, the operation being performed through the nose while visualization is obtained through transpalatal openings as stated by Flake and Ferguson (1964).

RESUMEN

Atresia choanal congènita es una anomalìa hereditaria de desarollo en la cual un muro huesudo o membranoso cerra el uno o ambos de los choanae. En casos bilateralos occuriré asfixia si el estado no es reconocido y medidas propias urgentes estan tomados immediatamente.

Nùmeros exactos no son disponibles de la incidencia de la anomalìa. Hasta que la hora cuando un ensayo sistemàtico de los choanae de todos infantes està realizado en autopsia debe ser considerado como rara, aunque varios autores indican que el estado es mas comùn que ordinariamente sospechado.

Desde que la deformidad en primer lugar fuè diagnosticado hace poco mas que un siglo el tratamiento en la mayorìa de casos ha estado operaciòn de emergencia,

frecuentemente ejecutado dentro las primeras 24 horas de la vida. Estas operaciones pudieron ser peligrosas o fracasas y pudieron causar deformidad adiciones de las cavidades nasales u orales.

Presentemente el tratamiento deberà componerse de un acceso moderato. El nino debe ser cuidado por especialistas pediatricas, anaestesicas y de E.N.T.

Un conducto para aire junto con un tubo de alimentaciòn serian suficientes para llevarle dentro las primeras semanas criticas, despues de lo cual inactividad rigurosa reemplaza el tratamiento de emergencia anterior hasta que el nino llega a un edad en la cual cirugia serà la mejor-optimal.

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