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The Deviated Septum: A Review

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ABSTRACT

The final septal configuration in an adult is affected primarily by nasal trauma prior to the stage of growth spurts. Racial, hereditary, developmental and extrinsic factors too influence the outcome.

Keywords: Deviated nasal septum, Submucous resection, Septoplasty

REVIEW OF LITERATURE

Deviated nasal septum is the commonest entity in the clinical practice of rhinology the incidence of deflected nasal septum is quite high. Thiele [1] documented septal deviation in 22% of normal population with a predominance to the left. Research [2-4] studies showed an incidence of 62% in 5096 cases. Researchers [5] reported incidence of 27% in infants & 37% in adults. Another study [6] found nasal septal deviation in 64% cases. Majority showed deviation toward left side 46% while deviation towards the right side was only in 18% cases.

ETIOLOGY

1. Developmental error

Nasal septum is formed by tectoseptal process which descends to meet the two halves of developing palate in the midline.

a) Unequal growth between the palate & the base of skull may cause buckling of the nasal septum.

b) Birth moulding theory: Abnormal intrauterine pressure during pregnancy or parturition causing septal deformity.

In mouth breathers due to adenoid hypertrophy, the palate is often highly ached leading to deflection of septum. Similarly, DNS may be seen in cases of cleft lip & palate & those with dental abnormalities.

2. Trauma

Studies [7] emphasized that nasal trauma may occur at any time after the fourth month of gestation & discussed the continuous pressure on the nose from the intrauterine growth of fetal limbs among other causative factors. Researchers [8] based the existence of intrauterine trauma on the fact that nasal septal deformities are sometimes noted in the neonates born by caesarean section.

Trauma may also be inflicted during birth while passing through the birth [4,7,9]. Trauma to nose later in life can cause fracturing of the septum or displacement of septal cartilage from the vomerine groove & maxillary crest. Alterations in any part of keystone area affects the whole complex. Septal cartilage along with the nasal spine of the frontal bone & two nasal bones form a structure of substantial strength that has been referred to as the Keystone area of nasal support [10].

3. Racial factor

Caucasians are affected more than negroes. In the former, the anterior nasal spine is more prominent [11]. Deformities of this bony prominence can have an unfavorable influence on the configuration of the base of the nose as well as the septum.

4. Hereditary factors

Several members of the same family may have septal deviations.

5. Extrinsic factors

An abnormally large or lateralised premaxillary spine. An abnormally crest-vomer relationship. Asymmetry of upper lateral cartilages. Any lateral nasal structures such as turbinate can impinge on the nasal septum. Narrow high nose.

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Deformity of nasal septum can be either anterior dislocation, spur, C-shaped or S-shaped deviation. Cases of DNS which cause dysfunction in nasal respiration require surgical correction. The operation is either sub-mucosa resection or septoplasty. Most surgeons favour septoplasty as it is a conservative approach, with the emphasis on straightening of the septal cartilage rather than removing it.

To achieve hemostasis & prevent hematoma formation, conventions cotton gauze packing impregnated with antibiotic ointment or antiseptic solution is applied. This packing, apart from causing over packing, also blocks the nose completely, thus greatly aggravating the discomfort of the patient. Moreover, it also causes hypoxia, hypercarbia, Eustachian tune dysfunction and nocturnal oxygen desaturation [12].

Further cotton gauze pack is not biocompatible. It becomes adherent to the surrounding tissue and when removed, leaves some shreds and raw areas which later result in synaechia formation. Also, there are more chances of infection with nasal packing & hospital stay is prolonged.

In order to prevent these complications, newer methods have been employed. These are intranasal tampooning [7], quilt stitching [11,13] and nasal splinting.

EFFECTS OF NASAL PACKING ON EUSTACHIAN TUBE DYSFUNCTION

Eustachian tube serves as twofold function viz. Maintenance of pressure across the tympanic membrane and a drainage route for middle ear. As a consequence of Eustachian tube obstruction, negative pressure is caused in the middle ear resulting in conductive deafness. The lymphatics of the middle ear and Eustachian tube course along the postero-inferior aspect of Eustachian tube, getting afferents from nasal cavity, PNS, nasopharynx and adenoids and form a rich peritubal plexus in the area postero-inferior to torus. Efferents from plexus terminate in the retropharyngeal nodes.

According to studies, [14] inflammation and edema in these areas, cause obstruction to the flow at the level of peritubal lymphatics producing tubal dysfunction and middle ear effusion. Although tubal dysfunction and middle ear effusion may occur simultaneously, but effusion can occur in absence of frank obstruction of Eustachian tube lumen with the development of middle ear vaccum. Lymphatic stasis in peritubal plexus of lymphatic channels and veins has been believed to be a possible etiological factor in Eustachian tube dysfunction in cases of nasal obstruction [15]. He reasoned that because the tympanic cavity, Eustachian cavity Eustachian tube, nasopharynx, adenoid and paranasal sinuses share common lymphatic pathways by virtue of their origin from the first brachial pouch, edema secondary to inflammatory or neoplastic involvement of these structures could result in Eustachian tube dysfunction secondary to lymphatic stasis at level of peritubal plexus and retropharyngeal nodes. Research [16] demonstrated effect of anterior nasal packing on middle ear pressure and study showed that anterior nasal packing causes reversible middle ear pressure with returns to normal within 72 h. After pack removal in majority of cases and become normal to prepack level by 10^{th} day. Chronic nasal obstruction seems to have a detrimental effect on middle ear pressure, which may not return to normal even after removal of chronic obstruction. These appears to be permanent change in peritubal nasopharyngeal mucosa consequent upon chronic nasal obstruction, which needs to be proved histopathologically.

Nasal obstruction per-se, particularly in conjunction with the Toynbee phenomenon-phasic positive and negative nasopharyngeal pressure generated during deglutition has also been implicated as a factor in the pathogenesis of Eustachian tube dysfunction and middle ear effusion [17].

In an effort to determine the effect of these two factors on Eustachian tube, tubal function assessed by tympanometry was studied in patients requiring anterior nasal packing secondary to intranasal surgery. nasal packing produces complete nasal obstruction and induced edema of nose, and paranasal sinuses that may overload lymphatics at the level of the peritubal plexus and retropharyngeal nodes. Thus, if nasal obstruction or lymphatic stasis affects the eustachian tube, patients subjected to nasal packing would be expected to demonstrate abnormalities in tubal function.

Zuckerland [2] observed that posterior nasal packing results in a higher incidence of Eustachian dysfunction than does anterior packing suggests that nasal obstruction per se or in conjunction with Toynbee phenomenon is less important in the pathogenesis the mechanism of this dysfunction of peritubal lymphatics and that a deficiency of tubal surfactant may be a secondary etiologic factor. The phenomenon is temporary, removal of packing results in normalization of tubal function within seven to ten days.

EMBRYOLOGY

The development of the nose and paranasal sinuses is a continuous process which commenced in the third week of gestation & continues until completion in early adulthood, when sinus pneumatization and bony growth have ceased. Knowledge of the intrauterine developmental changes is essential for a basic understanding of the anatomical changes which continue to take place throughout childhood.

In fourth intrauterine week, when embryo is 5.6 mm in size, the sensory epithelium originating within the cranial ectoderm thickens. This is the precursor of paired olfactory or nasal placodes, which are formed lateral to frontal prominence just above the stomatodeum. These placodes sink to form olfactory pits. Deepening of these pits by fifth week separates the frontonasal process into medial & lateral components. These medial components ultimately fuse to

form the primitive nasal septum. Inferiorly the paired maxillary process of the first brachial arches grow anteriorly & Medially to fuse with the medial nasal process & form the primitive palate.

During the sixth week of development, the slit like epithelium lined nasal pits begin to extend posteriorly. These thin out to form the bucconasal membrane separating the nasal from the oral cavity. Subsequently membranes rupture and forms the early choana, which are ultimately located more posteriorly as a result of palatial development.

By 3rd fetal month, mesenchymal condensation begins between forebrain, buccal cavity and cartilage grows in the sphenoid to form two adjacent plates. These plates fuse not only with one another but also centrally within the lateral nasal walls to form the nasal capsule. This capsule is the precursor of the bony cartilaginous structures of the upper & midface, just as the Meckel's cartilage is for the lower face. During the sixth fetal month, in growth of the connective tissue divided the capsule into lower & upper lateral cartilage. These are the only paths of the capsule to remain cartilaginous into adult life.

By the middle of fifth fetal month and extending well into adolescence, ossification of posterior part of the cartilaginous capsule begins and forms ethmoid bones, turbinates, part of the sphenoid bone, maxilla and nasal bones. The cribriform portion of perpendicular plate of ethmoid remains fibrous until the 3rd year, when it ossifies, thereby stabilising the ethmoid complex.

The vomer does not develop by ossification of the cartilage but rather from connective tissue that exists on both sides of septal cartilage. The cartilage between the lamellae of the vomer is absorbed thereby allowing fusion of vomerineplates. These plates grow upward to meet the perpendicular plate of ethmoid & posterior portion of the septal cartilage in the groove of the vomer. On either side of the anterior septum, an invagination of ectoderm forms the vomeronasal organ which largely disappear in man, leaving only a blind tubular pouch, 2-6 mm long. In many mammals, this organ has an important influence on feeding & smelling.

Septal deformity is of two kinds, which may occur independently or together 1) anterior cartilage deformity of quadrilateral septal cartilage, caused by direct trauma or pressure at any age. And 2) combined septal deformity, involving all the septal components, caused by compression across the maxilla from prepare occulting during pregnancy or parturition. This is a part of facial deformity [18]. In a study comprising of 2000 cases conducted by researchers [6] on incidence of nasal septum deviation in Indians, shows nasal septal deviation in 64% of the cases. Majority of cases showed deviation toward left side (46%) while deviation toward the right side was only 18% cases. Mild line septum was found in 36% cases.

Researchers [19,20] reported that the septum is deviated form the median plane but did not specify the commoner side of deviation. Research [6] reveals that the septum was found to be deviated toward left side in majority of cases (46%) which was not concurrent with the findings [21] who reputed deviation of septum more towards the right. The variations in the findings of the study [6] which was conducted only in Indian subject & the available literature, may be due to racial factor because width of nasal opening has been considered as important criteria for identification of different races [22].

Obstruction in the nasal passages had been shown to affect the mechanics of breathing [23]. It follows that pulmonary function may be related to the nose, and that the function of the nose if not that of a mere conduit for the lower respiratory tract.

Interrelationships between the nose and the bronchopulmonary system have been investigated by many physiologists and clinicians from the stand points of air conditioning, aerodynamics, gas exchange and reflex regulation of breathing. Through animal experiments and clinical observations a definite respiratory influence of nose upon the bronchopulmonary system has become known to exist [24] stated that "unnatural mouth breathing, due to the disturbance of nose breathing, either experimental or by disease, results in the acid-alkaline imbalance and a decrease of alkaline reserve in the blood from disturbance of pulmonary ventilation. Thus the breathing pattern has a direct influence upon metabolism. The passage of air into and out of the nose acts as a physiological stimulus for a respiratory regulation reflex [25], and that nose breathing is of benefit, not only for the mixing of alveolar gas, but in pulmonary circulation as well because it is associated with greater pressure difference between inspiration and expiration that is mouth breathing. In mouth breathing the thoracic movement becomes diminished form the lack of normal reflex. This causes change in the pulmonary circulation, decrease in vital capacity and lower blood PO_2 and PCO_2 [26-28] after studying the aspects of aerodynamics and flow resistance, assessed the upper airway (nose,pharynx and larynx) as 54% and the nose alone as 47% of the total airway residence during quiet breathing. Another study [29] measured pressure variations in the nasal cavity by rhino manometry and confirmed the nasal cycle reported by another study [30] in 1895.

DISCUSSION

A deviated septum with varied aetiologies, traumatic being the commonest, necessitates a corrective surgical intervention in extensive static nasal obstruction, which is refractory to decongestive medical therapy. The interventions vary from a minor surgery for a septal spur to a major procedure for an "s" or "c" shaped deformity. A

scoliotic external deformity too is corrected by septal straightening.

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