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Review Article

Deviated nasal septum in children: a review

Santosh Kumar Swain*

Department of Otorhinolaryngology and Head and Neck Surgery, IMS and SUM hospital, Siksha "O" Anusandhan University, K8, Kalinga Nagar, Bhubaneswar, Odisha, India

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***Correspondence:**
Dr. Santosh Kumar Swain,
E-mail: santoshvoltaire@yahoo.co.in

ABSTRACT

Deviated nasal septum (DNS) is a common clinical entity in human beings. Deviated nasal septum (DNS) may also result in upper respiratory infection, sinusitis, headache, epistaxis, middle ear infection, and hyposmia which increase the morbidity of the child and hamper the quality of life. The common clinical symptoms associated with DNS among children are nasal obstruction and postnasal discharge. The chronic nasal block in DNS has an adverse effect on the development of the child. DNS has an important effect on the faciomaxillary growth and development, particularly in the first decade of life. The treatment of DNS in childhood has received challenges among otolaryngologists because of its concern about the role of the nasal septum in the overall growth of the midface. So, otolaryngologists are often cautious during the correction of the DNS in children. DNS and its impact on nasal breathing impairment in children are often underestimated by clinicians. Clinicians often have little knowledge on the impact of DNS, its clinical manifestations in children, and its appropriate management. Early intervention for DNS in children is helpful to prevent morbid symptoms and their complications. This review article discusses etiopathology, epidemiology, clinical presentations, diagnosis, and current treatment of the DNS in children.

Keywords: Deviated nasal septum, Children, Septoplasty, Nasal obstruction

INTRODUCTION

Deviated nasal septum (DNS) is defined as a deviation of bone or cartilage (or both) of the nasal septum from the midline of the face.[1] Trauma is a common cause for DNS which may happen during childbirth by forceps placement or narrow pelvic passage where excess pressure is exerted on the nose or midfacial area of the head. DNS is one of the commonest causes for nasal breathing impairment in the pediatric age group.[2] DNS plays a vital role in a child's life by manifesting nasal obstruction, increased nasal resistance, the aesthetic appearance of the nose, and sometimes snoring.[3] Other than nasal obstruction DNS in children postnasal drip, mouth breathing, crusting, epistaxis, recurrent sinusitis due to mechanical obstruction of the drainage of the paranasal sinuses.[4] DNS even causes eustachian tubal catarrh and/or middle ear infection and leads to hearing impairment in children.[5] The nasal septal deviation can affect the development and growth of the faciomaxillary area and vice versa, so it is suggested that examination of the nasal septum should be done by a clinician as part of the systematic health examination of the children. The role of early diagnosis and intervention of DNS in children is helpful for long-term relief of this morbidity clinical entity in a pediatric patient. DNS in the pediatric age group is less described in the medical literature with a lack of standard description of DNS in children. The objective of this review article is to discuss details about DNS in children including its etiopathology, clinical manifestations, diagnosis, and current treatment.

METHODS OF LITERATURE SEARCH

Literature review of the deviated nasal septum in children was done from the database of Pub Med, Medline,

Scopus, and Google scholar search with the use of the terms deviated nasal septum, pediatric age group, epidemiology, etiopathology, clinical manifestation, diagnosis, and treatment of deviated nasal septum in children. Different current articles of DNS in children published in national and international journals were reviewed. All the articles were read and analyzed, with relevant data being extracted. A flowchart of the selected articles is given in Figure 1. This manuscript reviews the details of DNS in children with its epidemiology, etiopathology, clinical manifestations, its implication in facial growth, diagnosis, and treatment This review article surely makes a baseline from where further prospective studies can be designed for the DNS in children which can help to standardize its diagnosis and treatment.

EPIDEMIOLOGY

There are numerous epidemiological studies done over the last decades on the prevalence of the DNS in human beings from the newborn period to the adult age group. The prevalence varies from 0.93% to 55%.[6] Approximately 58% of the newborn babies have some sort of DNS and 4% of which have the presence of external nasal deformity.[7] The prevalence of septal deformities in newborns is approximately 0.93% in India. 8 The prevalence of nasal septal deformities in Belgium is 12.4% among children with the age group of 2.5 to 6 years.[9] The prevalence of DNS is approximately 2.6% in the 6 to 11 years.[10] In one study, the nasal septal deviation was found in 75% of cases and there was no difference in the prevalence of the septal deviation between males and females.[11] DNS is associated with an increased chance of maxillary sinusitis.[11]

ETIOPATHOLOGY

In comparison to adult noses, the nose of the children is usually unprojected and foreshortened. The cartilaginous part is more prominent in the nose of the child. So, the child is more prone to develop greenstick and avulsed fracture after a mild trauma because of its anatomical difference.[12] Following trauma in children, the nasal bone tends to splay and disarticulate which may lead to underdiagnosis. In children, untreated DNS eventually leads to soft tissue contracture and fibrosis, which cause further challenges to correct the septal deformity.[12] Minor trauma in early life is often overlooked and causes microfractures of the quadrangular cartilage of the nasal septum; healing of these microfractures results in bending of the cartilage away from the side of the trauma. If this happens in early life, it may cause asymmetrical growth of the entire nasal structure as a result of chondrocyte growth interruption. One of the important risk factors for DNS in children is trauma to the nose.[13] The earliest nose trauma occurs before, during, and after labor. No evidence of birth trauma favors the etiology of congenital nasal deformity. It has been found that the incidence of DNS increases with an increase in birth weight and baby delivered by vagina route. However, one study showed no statistically significant correlation between the weight of the newborn and DNS.[8] The incidence of DNS in the newborn is lowest in caesarian section delivery. High incidence is also seen in breech malposition and newborns of primipara. The incidence of DNS in the newborn is less as the parity increases. The chance of the DNS in relation to parity of the mother showed that the DNS is highest in primipara (48%) and reduces as the parity increases.[7] It has been observed that the pressure effect on the external nose during the birth of the baby is not commonly associated with bony obstruction but with bending of the cartilage from the maxillary crest. The frequency of extrauterine nasal injury is more as the nose is the most exposed and prominent structure of the face. Gross DNS may affect the drainage of the paranasal sinuses and obstruct the eustachian tube. If the ventilation of the paranasal sinuses is hampered, it results in sinusitis and eustachian tube opening obstruction at nasopharyngeal opening cause middle ear disorder.[14,15]

CLASSIFICATION OF DNS

The nasal septum separates the nasal cavity into right and left. The deviated nasal septum refers to the deviation of the nasal septum in the nasal cavity. There are several types of DNS such as Type I: A slight deviation of the nasal septum in the vertical or horizontal plane that does not stretch through the vertical dimension of the nasal septum; Type II: Vertical anterior deviation; Type III: Vertical posterior deviation; Type IV: S-shaped nasal septum; Type V: Horizontal deviation on one side with or without distortion on the opposite side; Type VI: Type V with a deep groove on the concave surface and Type VII: Any combination of Types II to VI. 11 The comprehensive evaluation of the nasal septum is a critical factor for surgical planning, restoration of function and reconsidering the cosmetic issues. Cottle et al classified DNS into 4 types such as subluxation, large spur, caudal deflection, and tension septum.[16] Guyuron et al classified DNS into six types such as septal tilt, anteroposterior C-shaped, cephalocaudal C-shaped, anteroposterior S-shaped, cephalocaudal S-shaped, and wide spur.[17] DNS can be classified on the basis of position or location of the deviation into anterior and posterior deviation. There is a higher incidence of anterior DNS in clinical practice.[18]

CLINICAL PRESENTATIONS

DNS in many children gives rise to no symptoms or mild symptoms. However gross DNS (Figure 2) in children provides physiological, anatomical, psychological, cosmetic as well as systemic disturbances.[6] It causes nasal obstruction leading to slow or difficult feeding with colic due to aerophagy in the newborn baby.[6] Sever nasal obstruction due to DNS mimics to choanal atresia and subsequent sequelae in the newborn child. The symptoms of DNS in children include nasal block, mouth breathing, epistaxis, rhinorrhea, and hyposmia or anosmia.[19] It can

result in sinusitis, epistaxis, eustachian dysfunction, chronic otitis media, facial asymmetry, dental malalignments, and malocclusions with poor general health.[20] The children with DNS have been reported to cause dental abnormalities, malocclusion, palatal asymmetry, middle ear diseases, and even recurrent upper respiratory tract infections.[21] Despite the never-ending debate, nasal septal deformity results in mouth breathing and nasal obstruction.[22] Children with unilateral nasal septal deviation may complain of nasal obstruction in the contralateral side, because of turbinate prominence, a phenomenon called paradoxical nasal obstruction.[23] This causes open mouth and lips with a lowered tongue, eventually resulting in reduced maxillofacial muscle tone. Subsequently, it affects growth at the midfacial area leading to maxillary hypoplasia, micrognathia, retrognathia, and protrusion of the upper incisors. The anterior lower vertical face height is increased while the posterior portion of face height is reduced.[24] There are negative effects reported such as disturbed somatic and psychic development including voice perturbation and sleep disturbance.[25,26]

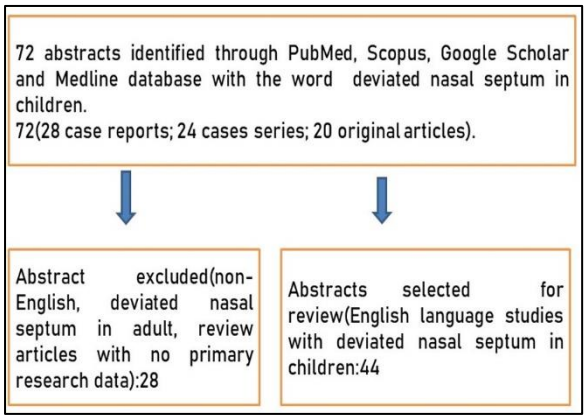

Figure 1: Methods of literature search.

Figure 2: A child showing gross DNS to left side.

DIAGNOSIS

Clinical diagnosis of the DNS is straightforward. Clinical presentation and examinations often give a diagnosis of DNS. The Cottle's maneuver is a test in which the cheek is pulled laterally with one to two fingers to open the nasal valve.[27] This test is helpful to determine if the most significant site of the nasal obstruction due to DNS is at the valve area or farther inside the nasal cavity.[27] Computed tomography (CT) scan of the nose and paranasal sinuses should be performed before surgical planning in the children with DNS.[28] Diagnostic fiberoptic nasal endoscopy along with a CT scan of the nose and paranasal sinuses are ideal for diagnosis of the DNS in the nasal cavity such as DNS. [29] Diagnostic endoscopy and CT scan of the nose and paranasal sinus is useful to rule out inflammatory pathologies such as sinusitis and mass lesions in the nose and sinuses. A DNS can be found easily via coronal and axial CT scans of the nose and paranasal sinuses. A 3-D image of the midline structure is helpful for direct evaluation of the DNS. Rhinomanometry analysis is useful to assess the airflow in the nasal cavity with DNS. This test is helpful to evaluate the improvement of the nasal airflow following nasal septal corrective surgery for DNS.[30]

TREATMENT

Nasal septal surgery in children is controversial because of its adverse effect on craniofacial development.[31] However, early nasal septal correction prevents midfacial and nasal growth deformity which is the inevitable consequence of nasal septal surgery. Nasal septal surgery in the pediatric age group has been documented to lead to significant improvement in quality of life. Septoplasty is an important surgical option for correcting the nasal septal deformity. The main target of the treatment of the DNS in children is to restore the patency of the nasal cavity. Septoplasty is the choice of surgery for DNS in children.[32] Septoplasty although safe, sometimes may be associated with nasal and facial growth problems. This creates some controversy among otolaryngologists during managing the pediatric DNS. When the surgery for DNS in children is performed before adolescence, the clinical indications should be very well-founded and the surgery should be very limited comprising only resection of an obstructing spur or realignment of the septum with minimal resection of the cartilage so as not to hamper nasal pyramid growth.[28] Severe traumatic nasal septal deviation can be corrected early in childhood for preventing future nasal and systemic complications. Closed manipulation of the nasal septum in the first 1 to 2 days of an infant's life has been practiced by many otolaryngologists with a good outcome. The application of this technique is usually limited to those subluxations of the anterior cartilage which are diagnosed immediately or very shortly after childbirth. The Septoplasty is a conservative surgical procedure where the deviated septal cartilage is removed and the bony crests are only trimmed and refractured to the medial position without removal of the bony septum. The growth of the quadrangular cartilage of the nasal septum ends at 5 to 6 years of age whereas the bony component such as vomer and perpendicular lamina grow until adolescence.[33] So, in patients of DNS with the age of 5 to 16 years, the bony part of the nasal septum should not be removed for

avoiding any depletion of active facial growth and alterations of the nasofacial development.[28] On the contrary, the cartilaginous portion of the nasal septum can be resected, even though the resection should be conservative. In currently, the otolaryngologists remove enough septal cartilage only to improve the nasal airway, but not so much that the dorsal support is affected or the postoperative maxillofacial development is hampered.[34] Making a single tunnel on the left side of the septal cartilage is tried by a few surgeons. This is possible because of the flexibility and elasticity of the septal cartilage which makes the cartilage straighten after removal of the excess in length and height, which can be done with a single tunnel approach. Such a single tunnel technique is characterized by a low rate of complications.[35] This approach perseveres the blood supply to the cartilage in the right side by leaving the mucoperichondrium intact with septal cartilage and also avoids the chance of septal perforation and septal hematoma postoperatively. The DNS in children should be informed to the caregivers or parents as it is important to prevent developmental problems such as facial growth, snoring, and recurrent upper airway infections.

IMPACT OF SEPTAL SURGERY ON FACIAL GROWTH

Nasal surgery of children needs dedicated anatomical and physiological knowledge of nasal growth. The bony part of the nose consists of the nasal process of the frontal bone, nasal bones arising from the frontonasal process, and nasal process of the maxilla which arises from the first pharyngeal (or mandibular) arch.[36] The midface area comprises membranous structures, frontonasal process and the mandibular arch. Growth of the nose and midface continues till the age of 14 to 17 years.[37] However, the nasal septum has been reported to grow till 36 years of age.[37] The shape of the nose changes from infancy to adulthood. The nasal septum is the growth center of the face. There are two growth zones are seen, the sphenospinal and sphenodorsal zones.[38] The sphenodorsal zone is responsible for the normal increase in length and height of the dorsum of the nose whereas the sphenospinal zone is for the forward outgrowth of the premaxillar area, is responsible for sagittal growth. When planning for corrective nasal septal surgery in children, caution is exercised to avoid devastating deformity of the face which may need further surgery. One study showed that pediatric patients have normal facial and nasal growth after septoplasty and reconstructive nasal surgery. 19 One contrast report showed facial and nasal deformity have been found in children with significant nasal obstruction after delayed corrective septal surgery.[39] Careful and conservative nasal septal surgery in children of age between 8 to 12 years has been proved to be successful with no evidence of facial deformity.[40] Children operated on 7 years earlier showed no nasal septal deformity in the follow-up period.[41, 42] One study demonstrated that female patients have better outcomes and improvement in symptoms in comparison to male patients.[43] With respect to age, both older and younger children have an equal improvement in symptoms.[44] Open versus closed surgical methods showed equal improvement, thus favoring the less invasive endoscopic approach for septoplasty.

CONCLUSION

The deviated nasal septum is a common cause of nasal obstruction and may follow nasal and midfacial trauma in children. Deviated nasal septum in children should be corrected to avoid unnecessary facial deformity, morbidity nasal symptoms and provide harmonious growth of the nose and face. DNS is an important cause of nasal obstruction. Other than nasal symptoms, it may result in headache, nasal bleeding, nasal discharge, postnasal drip, and hyposmia or anosmia. Diagnostic fiberoptic nasal endoscopy and imaging like CT scan of the nose and paranasal sinuses are important investigations for assessing the DNS in children. Management of DNS in children contributes to significant improvement in quality of life. Septoplasty is a safe and conservative surgery in children with DNS.

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