THE NASAL SEPTUM: SOME OBSERVATIONS ON ITS RELATIONSHIP TO PALATAL DEFORMITIES [1]

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THE nasal septum has been the subject of increasing interest to rhinologists in recent years, with newer techniques and modifications of the submucous resection being advocated with the objective of relieving obstruction without impairing the form and stability of the nasal organ. I am sure that maxillofacial surgeons are equally interested in the topic, although I must confess finding their literature less redundant than ours.

The septum normally develops *pari passu* with the other facial bones, reaching its full stature in early adult life. At this time it should normally consist of a bony cartilaginous wall placed in the midline on the crest of the maxillæ and palatal processes and dividing the nasal cavity into two equal portions. Unfortunately, it is rarely that one sees a perfectly straight septum, and deviations giving rise to symptoms are all too frequent. The reasons for this may be found in an analysis of the histogenetic and embryologic factors.

In early fœtal life the septum consists wholly of cartilage which is a part of the entire chondrocranium. Ossification of the vomer begins in the second month from two centres situated posteriorly near the floor of the nasal fossæ, developing anteriorly and superiorly in two distinct bony plates which later unite, leaving a groove along the ventral border to receive the quadrilateral cartilage. Ossification is complete within a few months after birth, at which time it is firmly united to the hard palate. The perpendicular plate develops enchondrally at a much slower rate from above downward, and is not complete until the sixteenth year. Frequently the perpendicular plate is not firmly united to the vomer until later in adult life.

FIG. 1

a, Oral cavity.
b, Oral mucosa with superficial epithelium (*c*).
f, Irregular median palatal suture.
h, Inferior border of vomer fitting into palatal groove (*i*).

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Thus at birth, while the maxilla is more or less united with the premaxilla, the septum is for the most part cartilaginous except for the vomer.

Fuchs (1930-31) has shown that the union between the vomer and the palatal crest is a true suture. The former narrows down to a thin wedge of bone which fits into a Y-shaped trough formed by the latter. Fig. 1 shows a typical synostosis. The intermaxillary suture line runs irregularly upward until it divides into the fork just mentioned. A thin layer of connective tissue fills the space between the lamellæ.

The quadrilateral cartilage, on the other hand, rests directly on the bone,

FIG. 2

a, Maxilla.
b, Quadrilateral cartilage.
c, Intermaxillary suture.
f, Spaces between the cartilage and bone filled with fluid.
h, Huschke's or Jacobson's cartilage.

from which it is separated by a loose connective tissue containing numerous lacunæ (Fig. 2). The two are bounded laterally by accessory cartilages, sometimes referred to as Huschke's cartilage or Jacobson's cartilage. Farther back, the quadrilateral cartilage rests in the groove on the ventral border of the vomer, from which it is separated by connective tissue, often thick enough to appear as a perichondrial layer. Rarely is the bone directly united to the cartilage, in which case one will find a number of recesses into which the cartilage is projected with only the barest suggestion of a connective tissue barrier.

As stated before, one rarely finds a perfectly straight septum. Bends and curves of various degrees are commonly seen in individuals who are unaware of any nasal obstruction, while cases of marked deflections giving rise to symptoms are common everyday occurrences. Fig. 3 shows what happens to the vomerian

FIG. 3

V, Vomer.
h, Mucosa.
d, Quadrilateral cartilage.
e, Normal lip of vomerian groove.
h, Lip of vomer absorbed through pressure of displaced cartilage.

groove as a result of pressure of the growing cartilage. One lip of the groove may be completely obliterated, and the cartilage then slips down parallel to the bone. Fig. 4 shows other types of union between the vomer and the superimposed cartilage. Various theories have been advanced to explain this phenomenon. The most plausible one is based on a study of comparative anatomy and goes back

to the evolution of man from the lower species. As the quadruped developed into a biped, assuming the erect posture, a great change took place in the brain bulk. Brain volume increased because of the development of the stereoptican sense and the necessary development of sensory and motor centres required for the maintenance of this new posture. Further increase was demanded because of the newer association centres. All these increases took place in the supratentorial masses, causing the brain to push upward and forward. As a result, a kyphosis of the cranial base developed, causing a shortening of the pituitary angle. Virchow described this as the angulus sphenoidalis, representing the intersection

FIG. 4

c, Cartilage. *v*, Vomer.

at the planum sphenoideum of a line running from the midline of the nasion backwards and another from the anterior border of the foramen magnum running upward and forward. It is important to note that this angle is greater in prehistoric peoples, in negroes and aborigines, than in the white race. Coincidentally, deviations of the septum are extremely rare in the former while very common in the latter. Measurements in a large series of cases have shown that when this angle is less than 135 degrees, it is generally associated with a deviated septum. In other words, the higher the state of development, the narrower the angle and the greater the likelihood of a septal deviation (Fig. 5).

Another important factor contributing to septal deviations is also the result of evolution. In assuming the erect posture the human being lost more and more of the animal sense of smell, and with increasing cunning was able to select foods requiring less and less massive jaw action. As a result, the chewing apparatus and its neural connections became atrophic and recessive. The neural apparatus, which in animals occupies a portion of the neurocranium, is in man reduced to a relatively small area located below the anterior fossa. Reduction in the size of

the mandible as a result of the above-mentioned evolutionary changes caused a change in the Huxley angle, which is measured at the intersection of two lines, one of which is drawn from the middle of the foramen magnum to the junction of the sphenoid with the presphenoid, the other running from this point to the middle of the symphysis menti. In vertebrates this angle measures 180 degrees, while in the human it is reduced to 80 to 120 degrees. Experience has shown that when this angle approaches the minimum just mentioned, one will inevitably find a deviated septum.

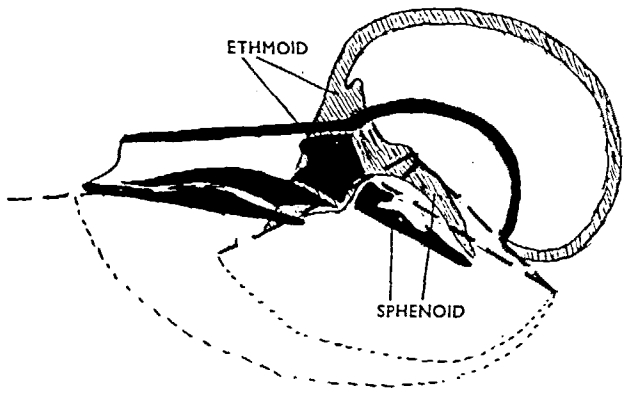

FIG. 5

Smaller arc shows sphenoid angle in man. Larger arc shows angle in primate.

Sercer (1932) has shown that the base of the sphenoid is the focal point above and below which these angles are developed. Since the vomer is firmly attached to the sphenoid close to its base, stresses will develop along its border, depending on the degree of the angulations described above. Deviations appear in two principal directions, the "trajectorium vomerale" following the upper border of the vomer from the rostrum of the sphenoid to the nasal spine, and the "trajectorium nasale" which runs from the nasal spine to the nasal bones and root of the nose. Thus, practically all septum deviations can be related to these two lines, that is, either sagittal or vertical. Stress in the vertical direction results in luxation of the lower border of the quadrilateral cartilage or perpendicular plate or both, whereas stress in the sagittal plane results in crests or spines along the upper border of the vomer.

FIG. 6
Facial asymmetry.

Another factor having to do with the development of septal deformities is the occasional asymmetrical growth of the face. We quite frequently see asymmetry of the face in which one half is longer or more prominent than the other (Fig. 6). This is always associated with a nasal asymmetry in which we find the ala nasi longer on one side than the other, and the septum running diagonally from the nares of the long side upward

and outward toward the shorter side. Thus, frequently the free border of the septum projects to one side of the columella, while the angle of curvature is found high up on the opposite side.

Finally, trauma in early life plays some part in the development of septum deformities. Children so frequently sustain falls that are overlooked or neglected, in which the septum is either dislocated from the vomerian groove or becomes bent as it is pushed inward between the immature nasal bones. As the cartilage continues to grow toward maturity it will develop at a vicious angle, which becomes pathologic as the patient attains his full growth (Fig. 7).

There is one item bearing on the relationship of the septum to the hard palate

FIG. 7
Deviated septum in a child of 2 years.

that merits some comment. It has been frequently stated in the past that a high-arched palate, or so-called Gothic palate, necessarily crowds the nasal cavities and is the cause of a deviation of the septum. Theoretically this could be true if the septum and facial structures were developing at different rates. Actually, however, this is not always the case. In most cases of Gothic palate we find that the septum and facial bones have been retarded in their development to the same degree as the hard palate. Consequently the septum is generally found to be in the normal median position, though smaller in dimension than normal. Evidence of under-development is manifest in the small size of the nose and limited expansion of the maxillary sinuses.

When it comes to developmental anomalies such as cleft lip and cleft palate, we find that the septum suffers marked degrees of distortion which not only affect the contour of the nose but also interfere markedly with normal nasal respiration. We are all familiar with the typical external deformity associated with cleft lip, in which the ala on the affected side is flattened and the septal border is projected diagonally toward the opposite side. At the same time the quadrilateral cartilage and perpendicular plate are markedly curved toward the affected side. Thus,

the patient suffers from obstruction on both sides (Fig. 8). The condition is even more marked in the unilateral cleft palate cases. In these cases the vomer remains attached to the palate on the unaffected side, which is usually steeply inclined, thus throwing the vomer into a diagonal plane toward the unaffected side so that at times, instead of being in the vertical plane it is almost horizontal. Occasionally, however, the situation is reversed. Stupka (1938) describes just such a case.

The situation that presents itself in cases of complete median cleft is entirely different. Here the caudal border of the septum is unattached to either side; consequently, it may project free into the oral cavity and grow downward in the midline, since there are no counter-forces to drag or push it to either side. Nevertheless, a deviation can occur because when the vomer is ossified it can offer

FIG. 8
Nasal deformity after closure of lip cleft.

resistance to the superimposed quadrilateral cartilage that shows a tendency to overgrowth.

Stupka states that deviations are often due to factors inherent in the tissues themselves, although they may result from mechanical factors, such as traction or failure of certain tissues to unite. The absence of counter-pressure on the side of the cleft is in most cases the cause of the abnormal direction of the vomer and palatal processes.

The diagnosis of these conditions is quite simple, but their correction is another matter. This is because of the several factors involved, such as the age of the patient, degree of deformity, extent of functional impairment, and state of nutrition.

We are all aware of the fact that surgical trauma to growing structures, bone and cartilage especially, may retard their further growth, thus doing permanent damage. On the other hand, we have to consider the danger to the patient's health resulting from impaired function. Rhinologists have for many years advised against submucous resections in children on the assumption that such surgery will interfere with the growth and development of the structure. Similarly, I find recently a tendency among some maxillofacial surgeons to avoid surgery on the bony deformity of the palate, contenting themselves with early correction of the soft tissue deformities in the early years of life, with the help of orthodontic procedures designed to direct the growing bones in the proper planes. Whether this point of

view is generally accepted or not is beyond my ken, since it is out of my field. However, since the septum is directly involved I am keenly interested in the attitude of maxillofacial surgeons with regard to its disposition. Shall we attempt to restore normal nasal respiration by early operation on the septum, or shall we permit the child to breathe through its mouth until it reaches puberty or adult life?

My own attitude is more or less that of a compromise which is based on the conditions as they exist in the individual case. In general, I agree that the septum had better not be resected if it is at all possible to wait until the patient has attained his growth. I agree that early closure of the lip defect should come first. I further agree that as long as the premaxilla is still ununited to maxillary bones, the septum had better be left alone. However, once these two conditions have been corrected

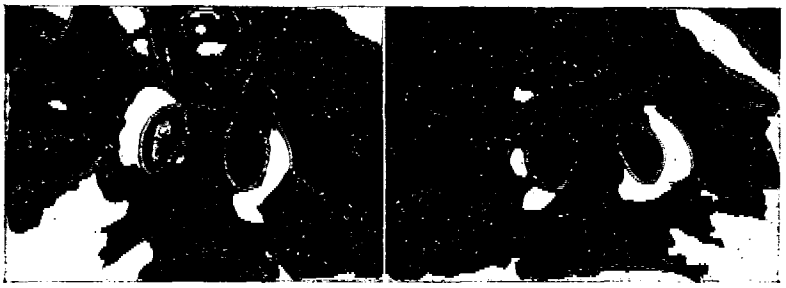

FIG. 9

Correction of deviated septum in a boy of 9 years by repositioning of dislocated cartilage.

we may safely consider the problem of the septum irrespective of the age of the patient. In the first place, the correction of the alar deformity, which may be done as soon as the lip has been closed, carries with it the problem of what is to be done with the septal cartilage which is usually projected into the nostril of the unaffected side. It is my contention that an attempt should be made to reposition this portion of the septum. This I have done in children by dissecting the mucoperichondrium free on the projecting side, severing the cartilage from its attachment to the vomer and perpendicular plate, and repositioning it in the midline (Fig. 9). No cartilage is removed and no damage is inflicted, because the severed portion remains attached to the mucoperichondrium of the opposite side as well as to the upper lateral cartilages above. Neither the vomer nor the perpendicular plate is disturbed, and the repositioned cartilage is maintained in the midline by a wax plug which is left in the nose for a week. This allows sufficient time for the displaced cartilage to become fixed by fibrous union. This procedure will free the nares of the lower obstruction and, as a rule, nasal respiration will be sufficiently improved to permit deferring the complete resection until the patient has attained his growth.

I am aware of the fact that some surgeons advocate fracturing the deviated vomer to relieve the lower obstruction. I do not find this procedure either necessary or satisfactory. In the first place, a low-lying crest caused by the oblique position of the deviated vomer seldom reaches high enough up in the middle meatus to block the normal inspiratory current. In the second place, the mere infracting of the vomer, while freeing the lower meatus on the deviated side, will only add to the obstruction on the opposite side, because in all of these cases the entire septum

is too big for the bony cage in which it is held. To free both sides for respiration one has to remove at least some of the excess, and this we are unwilling to do until the patient reaches puberty.

Summing up, it is my contention that much can be done even in young children to alleviate nasal obstruction due to deviated septum in association with lip and palate deformities, without the risk of permanent damage to growing structures. Procedures designed to correct alar deformities and deformities affecting the quadrilateral cartilage can be done any time after the lip has been closed and the premaxilla united to its bony neighbours, provided the procedure is one which will not involve the sacrifice of any of the growing cartilage.

The timing of the various procedures required for the rehabilitation of the individual is a matter that normally requires close co-operation between the pædiatrician, the surgeon, and the orthodontist. Certainly, so far as the septum is concerned, we feel that its rôle in the function of respiration is one that should not be overlooked, and that whenever possible the correction of obstructing deformities should be co-ordinated with the other therapy.

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