ANATOMY OF THE SEPTUM

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The finer technical and physiological aspects of rhinologic surgery of the past decade has made it necessary to expand the septal anatomy as presently set forth in text books.

The adult septum is composed of cartilaginous, osseous and mucocutaneous elements. It is the partition wall of the nasal fossae and constitutes the keystone of the external nasal pyramid. The component parts are the medial extensions of the nasal bones, the nasal spine of the frontal process, the perpendicular plate of the ethmoid, the sphenoidal crest, the nasal crests of the palatine bones, the nasal crests of the maxillae, the anterior nasal spine, the premaxillae, the septal or quadrangular cartilage, the membranous septum, and the columella.

Corrective surgery of the nasal septum frequently involves concomitant procedures on the external nasal pyramid. The associated structures of the septum will, in many instances, influence the final results of septum surgery and have to be carefully appraised.

The detailed anatomy of these septal-nasal relationships have been constantly stressed in the teaching and articles of Dr. Cottle (1960); Cottle, Loring, Fischer and Gaynon (1958) as these structures require the most delicate handling in corrective nasal surgery.

It is the intent of this paper to review briefly the anatomy as we now understand it and highlight some of the more important aspects, of the septum and associated structures.

Embryologically (Morrison, 1958), the medial nasal process gives rise to the septal cartilage, the premaxillae, the perpendicular plate of the ethmoid, and the medial crus of the lobular cartilage. As the septum passes through its various stages of development it is at first membranous. Then a lamina of cartilage developes in this membranous substance to form the septal cartilage and another portion will be gradually replaced by bone. Ossification of the perpendicular plate of the ethmoid begins in the 5th of 6th fetal month and it is not completed until the 17th year. In the vomer the ossification centers are observed about the 8th week of fetal life.

Jacobsons organ is vestigial in man. It first appears in the six week embryo as an out pocketing of the olfactory epithelium that forms a tubular pocket in the lower anterior part of the septum where it reaches maximum development by the fifth fetal month and then becomes a mere vestige. Jacobsons organ is enclosed by a scroll of cartilage at its location in the lower anterior part of the septum. The origin of this scroll of cartilage which supports Jacobsons organ is from the paraseptal cartilage. The paraseptal cartilage

may persist and develop. In lower animals Jacobsons organ plays an important role but in man is insignificant and atrophic.
At birth the septum is almost all cartilage. The only bony parts are the vomer and the premaxillae and their processes (Mosher and Harris (1907). Embryonic paraseptal cartilage (Eloff, 1952) may endure as such after birth and form an extra layer of cartilage on each side or one side of the septum. This paraseptal cartilage may survive posteriorly and attach to the vomer to cause obstructions and impactions.
Embryologically then, the following anatomical facts need further discussion in depth. First, the caudal portion of the septal cartilage which lasts throughout life as cartilage forms a suture line inferiorly where it rests on the groove of the anterior nasal spine, premaxilla and anterior portion of the vomer. The criss-crossing perichondrial and periosteal fibers through this suture line remain throughout life as a very dense thick envelope (Klaff, 1956). Surgically this is very significant, as the anterior tunnels should not be connected to the inferior tunnels by elevation directly from tunnel to tunnel. The envelope fibers are much too dense for penetration by elevation and invariably will result in a perforation of the septal mucosa.
The embryological significance of the gradual ossification of the perpendicular plate of the ethmoid takes fact in that this process gradually thins out the suture line fibers between the ethmoid plate and posterior part of the vomer so that it becomes surgically feasible to elevate directly and connect an anterior ethmoid tunnel with an inferior vomer tunnel.
Secondly, a deficiency in the ossification of the perpendicular plate of the ethmoid would be manifested not only by a persistant dense suture line but also a permanent cartilaginous ethmoid plate. In many instances this infantile characteristic results in a very thick wide septum and even occasionally a bulla like air cell within the thick ethmoid cartilaginous septum.
Lastly, a long-lived paraseptal cartilage will cause an anatomical situation such that the surgeon will be required to perform more than one connection of anterior and inferior tunnels. Each existing paraseptal cartilage is enclosed by its thick dense fibrous envelope independent of the usual normal septal anatomical relationships and may require multiple septal operative procedures.

In reviewing the literature it is confusing to encounter two or more terms applied to the same anatomical entity, therefore a need for uniformity of terminology (Petrillo, 1956). The septal cartilage is also known as the quadrilateral or quadrangular cartilage. The lobular cartilages are called the lower lateral or the greater alar cartilages. The upper lateral cartilages are referred to as the triangular cartilages or roof cartilages.
Another confusion arises from the nomenclature of anatomical entities. Therefore, a definition of the more frequently encountered anatomical terms (Cottle, 1960).
"Columella: The inferior part of the septum separating the nostrils and the vestibules.
Caudal border of the septum: The part of the septal cartilage projecting forward into the tip anterior to the nasal spine, also designated as the free border.
Membranous septum: The soft septum between the anterior-inferior border

of the septal cartilage and columella. The membranous septum appears insignificant to casual inspection, but is actually 6—10 mm. long.
Mobile septum: The inferior part of the septum formed by the columella and the membranous septum".
The septum has complex and important connections to external nasal components which are the bony vault, the upper lateral cartilages, the lobular cartilages, the piriform apertures, and the turbinates.
The upper lateral cartilages are fused with the septal cartilage in their cephalic two-thirds but join to the septum by a fibrous union in their caudal portion to form an acute angular slit like valve. These angles formed by the union of the upper lateral cartilages to the septal cartilage increases from the valvular 10° angle to a 40° angle at the roof area to a 90° angle at the "K" area. The attachment at the valve area varies with the ethnic group, being more anterior and closer to the anterior inferior corner of the septum in the leptorrhine group and more posterior in the platyrrhine group.
The caudal end of the septum usually projects beyond the point of the anterior nasal spine and its anterior inferior corner is normally located at the coronal plane of the cephalic midline point of the lobular cartilages. This configuration of the caudal end of the septum identifies the length of the septum and consequently its effects on the mobility of the columella and lobule. Any excessive length of the septum can safely be appraised by the following method. After undermining the base of the nose, uncovering the dorsum, and completion of the transfixion with complete preservation of the membranous septum the lobule is allowed to seek its own degree of rotation. It will be found that the columella overrides the cartilaginous septum and the latter can be marked along this line. That portion of the cartilaginous septum caudal to the line, so marked, may be considered as increased length of the septum.

Reference to the thick septum is found in the literature but precise definition is never presented. Joseph (1967) measured the septal thickness in the valve area and in a series of three hundred patients made the following observation: The total septal width in leptorrhine noses was 5 to 8 mm., 10-13 mm. in the platyrrhine. Children had relatively wide septa, measuring 4-8 mm., which, compared to the size of the whole nose, is very thick.
The mucosa of the nasal septum is in continuity with the lining of the nasal roof and can be elevated completely. It is thicker along the air current pathways, that is, in the superior and inferior parts. Below the caudal end of the septum the mucosal flaps are continuous with the firmly attached skin lining the columella on each side.
One may occasionally observe the onset of widening of the base of the nose when this progression of mucosa and skin with underlying fibro-muscular attachments is interrupted by a hemitransfixion or complete transfixion.
Superiorly the mucosa goes from the septum to the inner surfaces of the nasal bones and inferiorly from the septum onto the inner surfaces of the upper lateral cartilages. These mucosal attachments help support the nasal pyramid and keeps intact the cylinder of mucosa in each nasal cavity.
The cartilaginous and osseous components of the septum contributes significantly to the architecture of the internal ostium (lumen vestibuli). An oblique direction of the anterior nasal spine, premaxilla and vomer will alter the

shape of each os internum. A lack of height of the caudal end of the septal cartilage from its supporting area at the premaxilla to the dorsum may cause a smalling of the os internum due to the necessarily low attachment of the upper lateral valve to the dorsum septi.

There are significant septal reflex connections with most of the major cranial nerves via the nasopalatine, anterior ethmoidal and olfactory nerves. Also reflex pain pathways to the face and head may originate from the septum via these nerves.

The blood vessels supplying the nasal septum run in a diagonal direction and are located just lateral to the perichondrium. Vertical incisions in the nasal mucosa would therefore sever these vessels. This vascular supply is derived from the anterior ethmoid, posterior ethmoid, sphenopalatine, and anastomosing branch to the anterior palatine arteries.

SUMMARY

Some salient notes emphasizing the septal anatomical relationship to associated external nasal structures has been presented. The concept of this type of anatomical presentation is intended to alert the rhinologic surgeon to important anatomical details necessary for physiological septal-nasal reconstruction procedures. No attempt has been made to detail anatomical structures in the usual text book orientation.

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