AESTHETIC AND FUNCTIONAL RECONSTRUCTION OF THE NOSE

THESIS

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BY

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Abstract

- As the nose is the most prominent structure in human face. So any small defect in it causes great facial disfigurement.
- Causes of nasal defects are classified into four types: congenital, infection, trauma and post tumour excision .
- The nasal defects are evaluated according to their component layers. there are multiple techniques to restore nasal skin coverage defects which vary from skin grafts, local flaps, distant flaps and free flaps, while lining defects can be treated by tissues obtained from intranasal source (bipedicle vestibular skin advancement flap, septal mucoperichondrial hinge flap , …..) or from extranasal source (S.T.G., hard palate mucosal grafts and local in turned flaps), while skeletal framework defects are replaced by rib or cranial bone grafts for the upper 2/3 and by conchal or septal cartilage graft for the lower 1/3.

Key Words :

Reconstruction Of Rasal Lining .
Reconstruction Of Rasal Framework .
Reconstruction Of Rasal Coverage .

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Introduction

As facial appearance plays a pivotal role in the formation of one's sense of self-esteem, we are recognized by our faces more than any other single feature and as the nose is the most prominent, visible and central feature of the human face even a small defect in it causes great facial disfigurement, so since the dawn of history, man has been searching for a method to reconstruct nasal defects. (Barron and Saad, 1980)

Nasal defects: may be caused by

* Congenital: e.g. congenital notching of nostril margin.
* Physical and chemical agents: as
  - Mechanical trauma in motor car accidents, a method of punishment of captured prisoners of war in olden days, and by human or animal bites.
  - Burns especially chemical burns.
  - Radiation.
* After neoplastic excision e.g. basal cell carcinoma, squamous cell carcinoma. (Oscar et al., 1999)

In nasal reconstruction the surgeon take into consideration the preservation of nasal functions. As the nose serves as a natural respiratory pathway, ensures heating and humidification of inspired air and its mucociliary lining guards against invasion by bacteria in inspired air, acts as vocal resonators and contains peripheral receptors for smell so it will be a big price to pay to regain morphologically acceptable nose in expense of omitting its functions. (Baily and Calhoun, 1991)

According to the subunit principle, the nose is divided into nine topographic subunits comprised of the: dorsum, tip, columella, paired side walls, alae, and soft triangles. (Fig 14) each subunit has a characteristic skin quality, unit outline, and three-dimensional contour.

The normal nose is reestablished only if each of these characteristics is restored so during reconstruction the surgeon must create a unit not fills the defects. This approach puts scars in the expected shadows or reflections of subunit borders and ensures a uniform skin quality to the unit. (Burget and Menick, 1985)

EMBRYOLOGY OF THE NOSE

Origins and Early Migrations of Facial tissues:

During the 3rd week of gestation the embryo consists of two epithelial sheets of cells: endoderm atop of which lies the ectoderm. A third layer (mesoderm) formed by mass migration of ectoderm cells toward and into a midline groove (primitive streak). The cells that migrate anteriorly give rise to the notochord. Whereas cells adjacent to the notochord form paraxial mesoderm (which later form cranial base, all voluntary muscles of craniofacial region and most of the meninges) and the more lateral cells called lateral plate mesoderm (which later form pharyngeal arches). The notochord induces its overlying ectoderm to thicken forming neural plate then neural folds which fuse to form neural tube. The cells of the neural crest will undergo extensive migration and form the mandible and skeleton of midface (cartilage, bone, sensory neruomas, glandular stroma, dermis and dentine). This is a specific feature of neural crest cells which form structures formed by mesodermal cells elsewhere in the body (Fig. 1). (Moore, 1988)

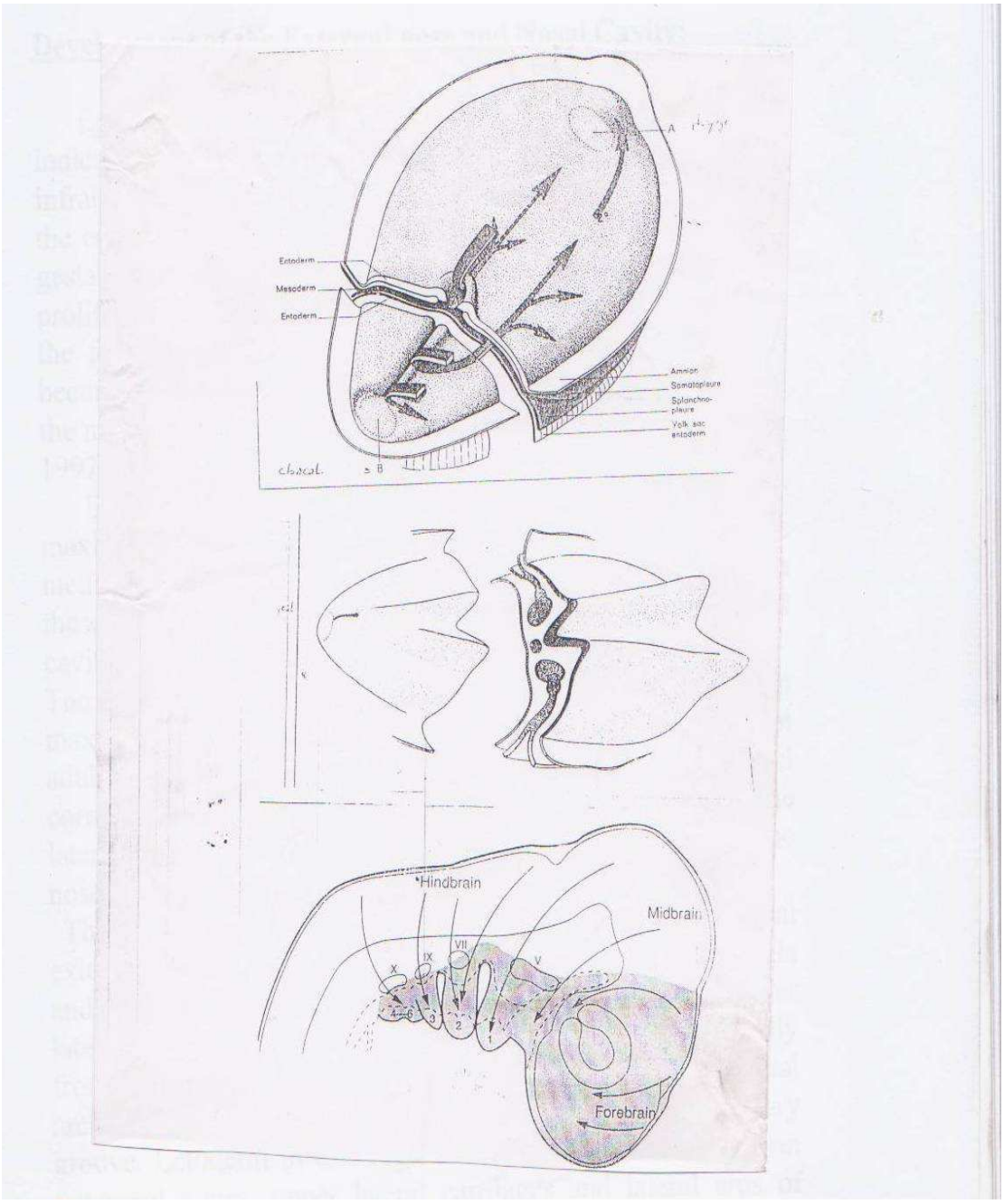


Fig.1*: Schematic representation of a dorsal view of human embryo during: a) Fifteenth to sixteenth day depicting cell migration at time of gatsrulation. b) Twentieth day depicting elevation of the lateral edges of the neural plate as neural folds. c) 4th week depicting migration of neural crest cells. (Langman's Medical Embryology (6th) ed. Baltimore: Williams & Wilkins, 1990.P.298).*

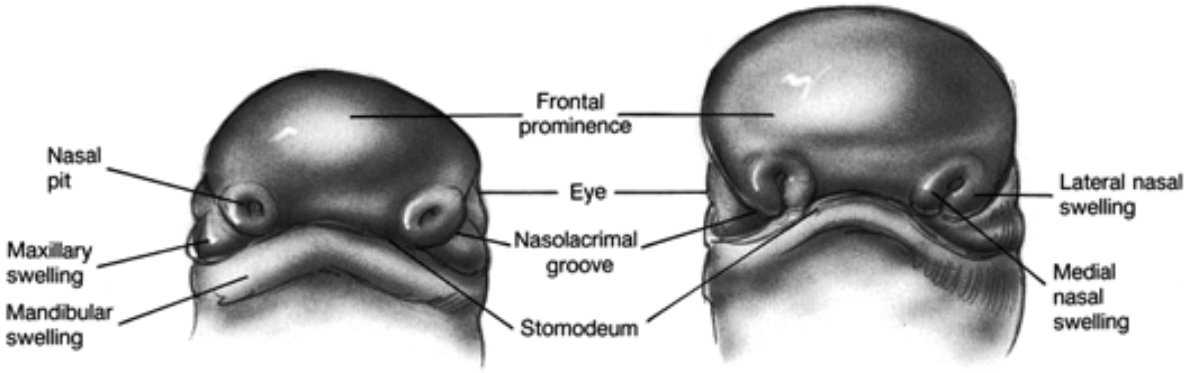
Development of the External nose and Nasal Cavity:

Epithelial thickening, known as nasal placodes, are the first indication of nasal development. These appear in the infralateral side of the head region above the stomatodum in the embryos of 5-6mm C.R. Length, which is about 4 weeks gestational age. Initially, the placodes are convex but with proliferation of surrounding mesenchyme which accompanies the formation of lateral & medial nasal folds, the placodes become deeper forming olfactory pits then olfactory sacs while the medial nasal folds fuse to form frontonasal process. (Lund, 1997)

During the fifth to sixth weeks of development, the maxillary processes enlarge, grow medially, compressing the medial nasal processes toward the midline, and fuse with theses processes converting the nasal pits into primitive nasal cavity. (Sadler, 1990)

The lateral nasal processes are initially separated from maxillary processes by the nasolacrimal groove which in adults forms the nasolacrimal duct connecting the medial corner of the eye with inferior meatus of the nasal cavity. The lateral nasal processes ultimately form the upper sides of the nose. (Sadler, 1990)

The floor anterior to the choana forms from mesenchymal extensions of the medial nasal folds to produce the premaxilla and ultimately the upper lip and medial crus of the lower lateral cartilage. The maxillary process also grows ventrally from the dorsal end of the mandibular process (first visceral arch) to join the lateral nasal fold around the nasomaxillary groove. Ectoderm in this region eventually canalizes to form the nasal bones, upper lateral cartilages and lateral crus of lower lateral cartilages (Fig. 2). (Lund, 1997)



A) *B)*

FIGURE2. A: *Frontal view of a 5-week embryo.* ***B:*** *Frontal view of a 7-week embryo. During the fifth week, the nasal placodes sink to become the nasal pits. Mesodermal growth centers proliferate and fuse around the pits. During the sixth through eighth weeks, the pits deepen to the ectoderm at the roof of the mouth to form the bucconasal membrane at the choanae. The septum forms from the mesoderm between the pits. (Langman J. Medical embryology: human development—normal and abnormal. Baltimore: Williams & Wilkins, 1963.)*

Development of the Inside of the Nose:

As the apices of the maxillary processes fuse with the median nasal process around the invaginating olfactory placode, primitive anterior nares form. This invagination leads posteriorly into an anterior nasal cavity. Posteriorly and inferiorly, a posterior nasal cavity, communicating with the superior cavity superiorly, develops as the inner as maxillary processes form. Theses give rise to the palatine processes which fuse in midline to form the palate. Anteriorly, this

fusion is completed first as theses processes fuse with premaxilla and then zip posteriorly.

The septum is thought to arise because of the dual origin of olfactory placodes. In the midline, the mesenchyme grows download from roof of nose to fuse with palatal processes derived from maxillary mesoderm which initially grow vertically on either sides of the tongue then undergo a series of movements, which result in their fusion with one another, with the septum superiorly and with primary palate inferiorly (Fig. 3). (Jafek, 2001)

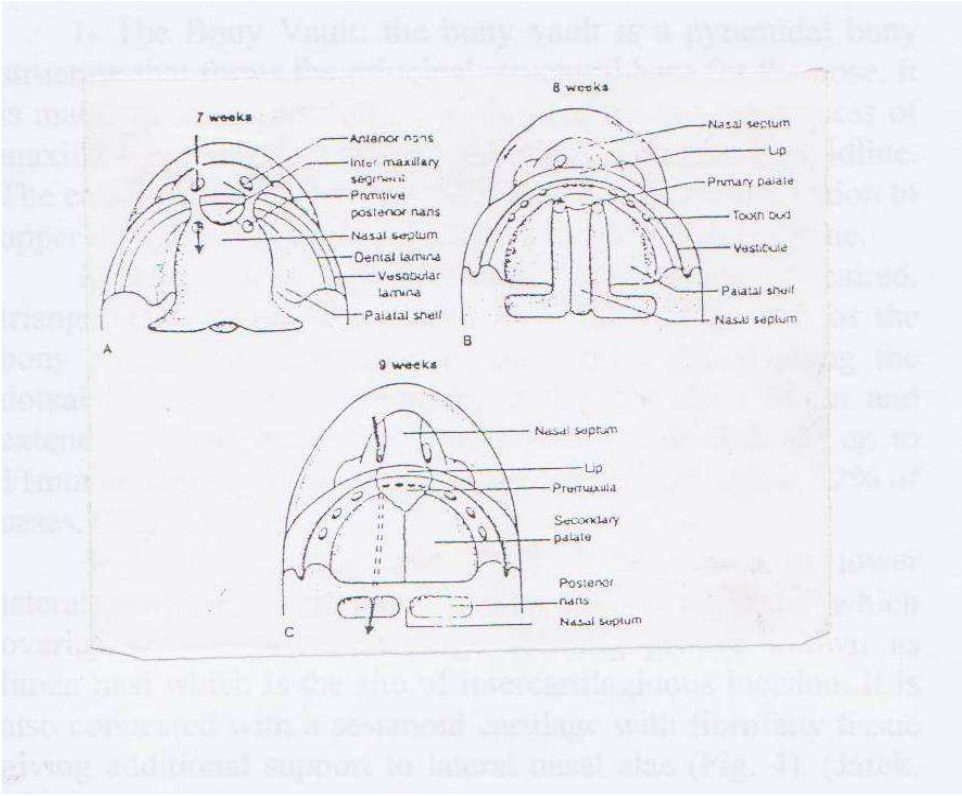


Fig. 3: - *Nasal embryology. Head region. Viewed from below, showing development of the palate. In (A) and (B), an arrow is passing along the nasal passage on one side. (From Fitzgerald MJT. Fitzgerald M: Human Embryology. London. Balliere Tindall, 1994, 99 169-170).*

ANATOMY OF THE NOSE

The nose as a functional organ can be divided into three compartements (from above downward):

1. the bony vault
2. the upper cartilaginous vault
3. the lower cartilaginous vault.

These have in common a supporting partition, the bony and cartilaginous septum, which in essence creats two separate and complete two functioning noses in one. (Sheen, 1978)

1- The Bony Vault: the bony vault is a pyramidal bony structure that forms the principal structural base for the nose. It is made up of the upward projections of the frontal process of maxilla which articulates with the nasal bones in the midline. The caudal arch is a free edge that lies in intimate apposition to upper cartilaginous vault, joined by a single C.T membrane.

2- Upper Cartilaginous Vault: It is made of paired, triangular cartilages that extend from the caudal arch of the bony pyramid as a cantilever. They are attached along the dorsal border of the septum by a dense fibrous union and extend cephalad under the bony arch for a distance of up to 11mm and also overlapped by lower lateral cartilage in 72% of cases. (Lang, 1989)

3- Lower Cartilaginous Vault: It is formed of lower lateral cartilages with their medial and lateral crura which overlaps upper lateral cartilage forming groove known as limen nasi which is the site of intercartilaginous incision. It is also connected with a sesamoid cartilage with fibrofatty tissue giving additional support to lateral nasal alae (Fig. 4). (Jafek, 2000)

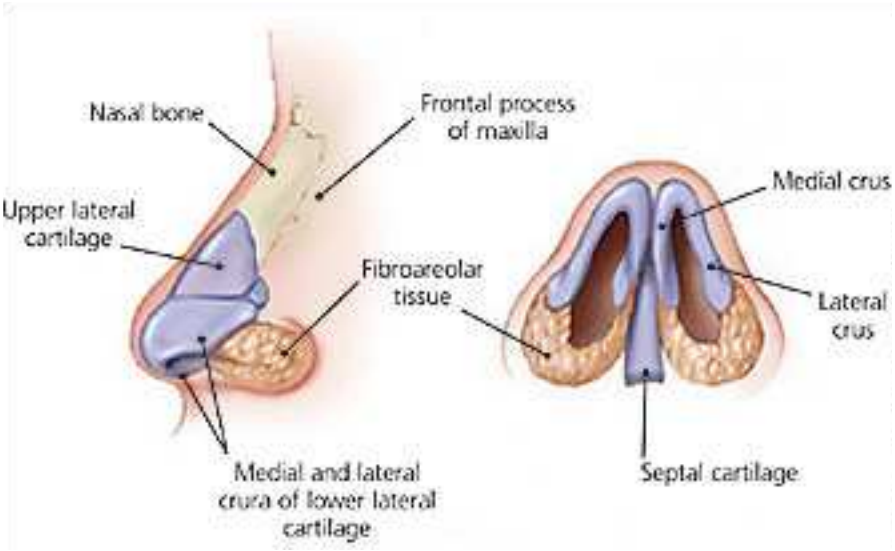


Fig. 4: - *Nasal cartilages. (From Cummings CW. Et al (eds): Otolaryngology – Head and Neck Surgery, 3rd ed. St. Louis, Mosby, 1998).*

The mobile lower portion of the nose caudal to lower lateral cartilage called lobule which is further subdivided into: tip, alae, columella (including the membranous septum) and nostril sills. The soft triangle spans the junction of the ala with the columella.(burget and menick,1994)

Skin quality (colour, texture and thickness) differs from one region of the nose to the other. The skin of the nasal dorsum and side walls is thin, smooth and pliable. The skin of the tip and alae is thick, stiff, and densely adherent to underlying cartilaginous structure and pitted with sebaceous glands. So the limiting factor in soft tissue closure is the prominence of nasal skeleton in the upper part and skin immobility in lower part (Langford, 2005).

Blood Supply of the Nose

The nose receives blood supply from both E.C.A (via facial and maxillary arteries) and I.C.A (via ophthalmic artery).

Facial artery arises from E.C.A and passes upwards forwards across the mandible and buccinator almost to the angle of the mouth where it ends by giving superior labial

artery and becoming the angular artery. The superior labial branch supplies the nostril sill and base of columella and gives columellar artery to supply alae and lower septum. The angular artery ascends at the side of the nose at the groove between the nose and cheek of a mean distance of 19.2 mm lateral to alar crease deep to levator labii superioris alaeque nasi ending at medial palpebral comissure to supply lacrimal sac and anastomose with dorsal nasal branch of ophthalmic artery and with infraorbital branch of maxillary artery. The angular artery gives off many branches which perforate muscle to supply skin of the cheek and nostril (the basis of nasolabial axial flap) and gives also lateral nasal artery which supplies lateral surface of the lower half of the nose. (Morrison et al, 1995)

1- Maxillary artery supplies the nose via infraorbital artery which supplies lateral wall and dorsum of the nose.
2- Ophthalmic artery supplies the nose via three branches:

a) Dorsal nasal artery which perforates orbital septum above medial canthal ligamentof a mean distance of 7,4mm(timothy and hybarger,2005) and runs downwards on the side of the nose to anastomose with lateral nasal artery and with branches of supratrochlear and infratrochlear arteries to form axial arterial network for the dorsal nasal skin.
b) External nasal artery, a branch of anterior ethmoidal artery and contributes to the vascular anastomosis at nasal tip.
c) Supraorbital artery supplies skin at the root of the nose (Fig. 5). (El Sahy, 2000)

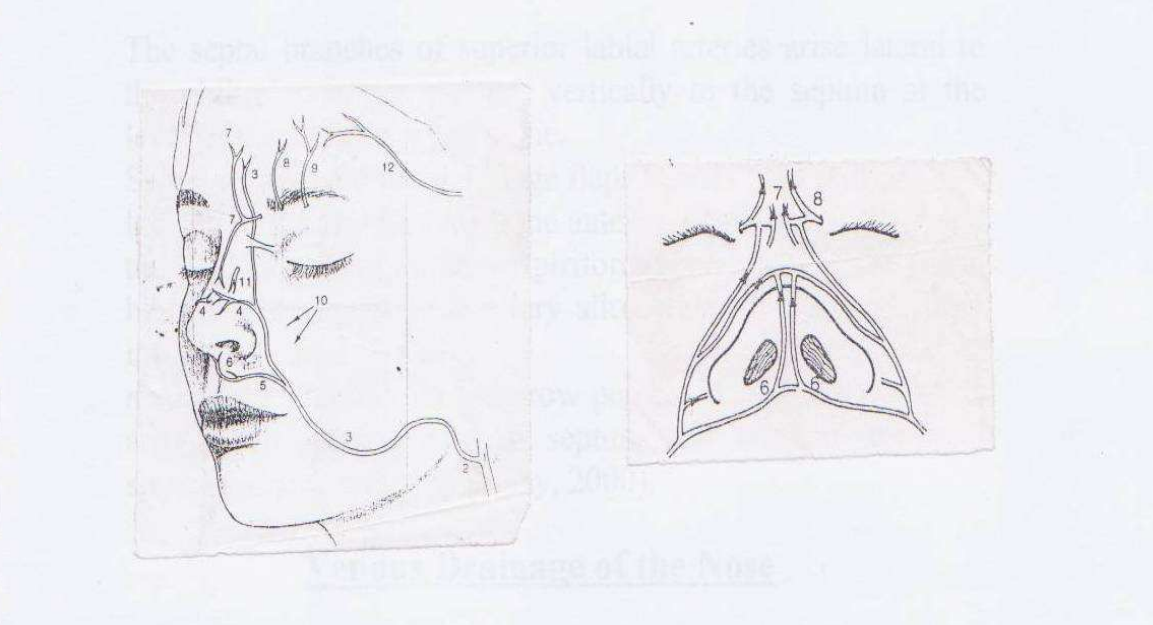


Fig. 5: - *Arterial supply of the nose. 1, external carotid a. 2, facial a. 3, angular a. (passes underneath the labii superioris nasi m.) 4, lateral nasal a. 5, superior labial a. 6, columellar a. 7, dorsal nasal a. 8, supratrochlear a. 9, supraorbital a. 10, infraorbital a. 11, external nasal a. 12, superficial temporal a. ..(El-sahy, Plastic and reconstructive surgery of the nose. 1st (Ed), Philadelphia, W.B. Saunders Co, 2000)*

Arterial supply to the Nasal Septum:

Posteriorly: septum is supplied by:

* Septal branches of sphenopalatine artery from maxillary artery.

Antero superiorly: septum is supplied by:

* Anterior and posterior ethmoidal arteries from ophthalmic artery.

Antero inferiorly: septum is supplied by:

* Bilateral septal branches of superior labial arteries.