Reconstruction of Alar Defects

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• Nasal reconstruction • Nasal ala • Flap reconstruction

ANATOMY

Successful reconstruction of the nose depends on a thorough understanding of the anatomic and functional components of the ala. The crescentic alar groove serves as a topographic landmark that frames the ala and separates this convex structure from the surrounding cosmetic subunits. The ala abuts the nasal tip anteriorly and the nasal sidewall superiorly. The alar groove deepens as it extends posteriorly. This posterior portion of the alar groove is often called the alar-facial sulcus and separates the ala from the cheek and hairless apical triangle of the lip.

The ala is a critical cosmetic and functional landmark. The distal free margin of the alar lobule and the transition from the shadows of the alar groove to the reflection of the convex surface of the ala are important visual landmarks. The ala also frames the lateral aspect of the external nasal valve, a critical path for airflow during inspiration. Altered position of the ala during reconstructive surgery can compromise function of the external nasal valve. Relative to the nasal tip and sidewall, the alar tissue is more compliant, because it does not contain cartilage.[1] The alar lobule consists of skeletal muscle and fat enveloped by dermis and epithelium on both the vestibular and external aspects.[2] The lower lateral cartilage does not cross the alar groove and it is not part of the alar lobule.[2] The lack of an intrinsic osseous-cartilaginous skeleton and the complete absence of support at its distal free margin make this delicate structure particularly susceptible to distortion during reconstructive surgery.

Although the alar lobule does not contain cartilage, the ala gains dynamic and static support from the close relationship of its muscles with the osseous-cartilaginous framework of the nose.[1] A brief description of the osseous-cartilaginous framework is helpful. The nasal bone and maxilla frame the pyriform aperture. The paired upper lateral cartilages are firmly stabilized as they flare laterally from cartilaginous septum and fix to the deep aspect of the nasal bone. The intercartilaginous ligament stabilizes the cephalic margin of the lateral crura of the lower lateral cartilages to the caudal aspect of the upper lateral cartilages.[3] The lower lateral cartilages gain additional stability from loose connective tissue that links the domes of the lower lateral cartilages and possibly from direct connection of the medial crura with the caudal septum.[3] A fascial system, called the pyriform ligament, stabilizes the entire cartilaginous framework by connecting the lateral cartilages with the pyriform rim.[4]

The alar lobule essentially suspends from this osseous-cartilaginous framework as a network of skin and skeletal muscles. The actions of skeletal muscles on the position of the nasal ala remain poorly understood.[1,4,5] The dilatator naris muscle is the main muscular component of the alar lobule. The dilatator naris muscle originates from the lateral crus of the lower lateral cartilage and inserts

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directly onto the alar skin.[1] Contraction of this dilator naris muscle opens the nostril and may indirectly, via the intercartilaginous ligament, affect the caudal margin of the upper lateral cartilage and internal nasal valve.[1] The alar portion of the nasalis muscle originates from the fossa incisiva of the maxilla and inserts on the alar skin and accessory cartilages near the pyriform aperture. Contraction of this muscle may dilate the nasal valve area by drawing the accessory cartilages, and by extension, the lateral crura, laterally.[1] By contrast, the transverse portion of the nasalis muscle does not insert on the nasal cartilages and it mainly stabilizes the valve area by moving nasal skin. Additional dynamic support to the ala may come from the levator labii superioris alaeque nasi, which pulls the ala superiomedially,[5] and from the levator labii superioris muscle, which partially inserts on the vestibular skin of the nasal vestibule and widens the nostril by pulling it superolaterally.[4]

In addition to the structural and supporting tissue of the ala, the sensory and motor innervation, vascular supply, and lining all play intricate parts in the nasal alar anatomy. The dilator naris anterior, levator labii superioris alaeque nasi, and alar nasalis muscles are innervated by the buccal branch of the facial nerve (CN VII). The sensory innervation to the caudal and lateral portions of the nose are supplied by the external branch of the anterior ethmoidal nerve (branch of V1) and branches of the infraorbital nerve (V2).[6] The vascular supply to the nasal ala is derived from multiple branches of both the external and internal carotid artery systems. The facial artery gives off the superior labial and angular arteries, both of which contribute blood supply to the ala. Branches of the infraorbital artery, lateral nasal artery, and the external nasal branch of the anterior ethmoid artery also supply blood to the ala.[6,7]

In addition, because the nasal ala borders a free margin, the undersurface of the ala incorporates a combination of nasal vestibular skin and mucosal lining, going further into the nose. The importance of an intact nasal lining should not be underestimated, because if it is not replaced during a nasal reconstructive procedure, the nasal ala can become distorted from the contraction of this intranasal tissue void.

The structure and support of the nasal valves are linked to the anatomy and function of this area of the nose. The external nasal valve has been described as the area bounded by the caudal edge of the upper lateral cartilage superolaterally, the nasal ala and attachment of the lateral crus laterally, the caudal septum and columella medially, and the nasal sill inferiorly.[8] This area is variable and dependent on the shape, size, and strength of the lower lateral cartilage. Located just superior to the external nasal valve is the site of greatest resistance in the entire human airway, the internal nasal valve. Anatomically, the internal nasal valve is the cross-sectional area bounded superiorly by the upper lateral cartilage, cartilaginous nasal septum medially, anterior head of the inferior turbinate laterally, and nasal floor inferiorly. This valve angle is normally between 10 and 15 degrees in whites, but tends to be more obtuse in ethnic African Americans and Asians. The cross-sectional area of the internal nasal valve is about 0.73 cm.[2,9]

ANALYSIS OF THE ALAR DEFECT

The reconstructive surgeon must carefully analyze the defect to determine precisely what is missing. Originally described by Manson and colleagues,[10] nasal reconstruction should be viewed as a 3-part approach. The overlying skin, structural framework, and internal lining should be evaluated individually before developing an operative plan. Furthermore, the nostril free margin, contour, and relationship of the external nasal valve are vital to both a functional and aesthetic alar reconstruction. Preoperative recognition of whether reconstruction of the defect needs skin coverage, nonanatomic cartilage support, internal lining, or a combination of these allows for optimum results.

The skin of the nasal ala is thick and sebaceous. The skin in the region of the ala is also tightly adherent to the underlying muscles of facial expression. Consequently, the skin of the ala affords considerably less mobility or laxity compared with the skin of the nasal sidewalls and dorsum. To achieve aesthetic reconstructions of alar tissue, the surgeon strives to recruit skin with a similar thick texture and sebaceous character, such as the skin immediately adjacent to the defect or from the more distant melolabial fold and forehead.

Other factors that may influence reconstructive options of soft tissue defects include the quality of the wound bed and patient history. Patients who have prior nasal scars in the vicinity, current smokers, or those with a history of radiation to the area of the defect require an especially judicious choice of reconstruction. In such patients, the surgeon may limit the risk of necrosis by avoiding skin grafts, by delaying a flap before transfer, or by lengthening the amount of time between the flap transfer and pedicle division and insetting.[11]

In addition to the soft tissue defect, the surgeon must assess the status of theosseous-cartilagenous