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Septoplasty and Rhinoplasty

Clinical Policy Bulletins | Medical Clinical Policy Bulletins

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10/24/2025
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Review History

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Scope of Policy

This Clinical Policy Bulletin addresses septoplasty and rhinoplasty.

I. Medical Necessity

A. *Septoplasty*

1. Aetna considers septoplasty medically necessary when *any* of the following clinical criteria is met:

a. Asymptomatic septal deformity that prevents access to other intranasal areas when such access is required to perform medical necessary surgical procedures (e.g., ethmoidectomy); *or*
b. Documented recurrent sinusitis felt to be due to a deviated septum not relieved by appropriate medical and antibiotic therapy; *or*
c. Recurrent epistaxis (nose-bleeds) related to a septal deformity; *or*
d. Septal deviation causing continuous nasal airway obstruction resulting in nasal breathing difficulty not responding to 4 or more weeks of appropriate medical therapy; *or*
e. When done in association with cleft palate repair.

2. Aetna considers extracorporeal septoplasty medically necessary for initial correction of an extremely deviated nasal septum that can not adequately be corrected with an intranasal approach, for members who meet criteria for septoplasty listed above.

Aetna considers septoplasty experimental, investigational, or unproven for all other indications (e.g., allergic rhinitis) because its effectiveness other than the ones listed above has not been established.

B. *Rhinoplasty*

1. Aetna considers rhinoplasty medically necessary *only* in the following limited circumstances:

a. When it is being performed to correct a nasal deformity secondary to congenital cleft lip and/or palate or for removal of a nasal dermoid; *or*
b. Upon individual case review, to correct chronic non-septal nasal airway obstruction from vestibular stenosis (collapsed internal valves) due to trauma, disease, or congenital defect*, when all of the following criteria are met:

i. Prolonged, persistent obstructed nasal breathing; *and*
ii. Physical examination confirming moderate to severe vestibular obstruction; *and*
iii. Airway obstruction will not respond to septoplasty and turbinectomy alone; *and*
iv. Nasal airway obstruction is causing significant symptoms (e.g., chronic rhinosinusitis, difficulty breathing); *and*
v. Obstructive symptoms persist despite conservative management for 4 weeks or greater, which includes, where appropriate, nasal steroids or immunotherapy; *and*
vi. Photographs demonstrate an external nasal deformity; *and*
vii. There is significant obstruction of one or both nares), documented by nasal endoscopy, computed tomography (CT) scan or other appropriate imaging modality; *or*

c. When rhinoplasty for nasal airway obstruction is performed as an integral part of a medically necessary septoplasty and there is documentation of gross nasal obstruction on the same side as the septal deviation*.

*Documentation of criterion b or c should include:

a. The duration and degree of symptoms related to nasal obstruction, such as chronic rhinosinusitis, mouth breathing, etc.; *and*
b. The results of conservative management of symptoms; *and*
c. If there is an external nasal deformity, pre-operative photographs showing the standard 4-way view: anterior-posterior, right and left lateral views, and base of nose (also known as worm's eye view confirming vestibular stenosis; this view is from the bottom of nasal septum pointing upwards); *and*
d. Relevant history of accidental or surgical trauma, congenital defect, or disease (e.g., Wegener's

granulomatosis, choanal atresia, nasal malignancy, abscess, septal infection with saddle deformity, or congenital deformity); *and*

e. Results of nasal endoscopy, CT or other appropriate imaging modality documenting degree of nasal obstruction.

C. *Nasal Septal Button for Non-Surgical Closure of Septal Perforations*

Aetna considers nasal septal button for non-surgical closure of septal perforations medically necessary.

D. *Repair of Nasal Septal Perforations*

Aetna considers repair of nasal septal perforations medically necessary.

E. *Intranasal Excision or Destruction*

Aetna considers excision or destruction of intranasal lesions using an internal approach medically necessary for the following indications:

1. Cautery or arterial ligation for recurrent epistaxis refractory to initial local measures;
2. Necrotizing lesions (from infection, vasculitis, or drug abuse);
3. Removal of benign masses (e.g., inverted papilloma, juvenile angiofibroma, nasal glial heterotopias, dermoids, pyogenic granuloma, polyps) causing obstructionl;
4. Removal of isolated intra-nasal malignancies (e.g., intranasal basal cell carcinoma);
5. Removal of locally aggressive or destructive lesions such as schwannomas, fibro-osseous lesions, pleomorphic adenomas, and hereditary hemorrhagic telangiectasia;
6. Removal of other masses (excluding septal swell bodies) causing obstruction, airway compromise or pain interfering with quality of life; or

7. Removal of retained foreign bodies not amenable to external removal.

II. Experimental, Investigational, or Unproven

The following procedures are considered experimental, investigational, or unproven because the effectiveness of these approaches has not been established:

A. Ablation, excision or destruction of septal swell bodies for the treatment of chronic rhinitis, chronic sinusitis, or nasal obstruction;
B. Balloon septoplasty for the treatment for nasal fracture and septal deviation;
C. Extracorporeal septoplasty for revision of deviated septum;
D. Nasal valve suspension for the repair of nasal valve collapse;
E. Pyriform aperture reduction (pyriform turbinoplasty) for the treatment of nasal obstruction;
F. Use of absorbable nasal implant (e.g., the Spirox Latera Absorbable Nasal Implant) for nasal valve reconstruction, treatment of nasal valve weakness, and for all other indications;
G. Use of blood products (e.g., concentrated growth factor or platelet-rich fibrin) with diced cartilage in rhinoplasty;
H. Use of concentrated growth factor extracted from blood plasma for repair of nasal septal mucosal defect following rhinoplasty.

III. Cosmetic

Aetna considers rhinoplasty cosmetic for all other indications.

Note: See CPB 0031 - Cosmetic Surgery (0031.html) for details on exceptions to the cosmetic surgery exclusion. In addition, please check benefit plan descriptions for details.

IV. Related Policies

- CPB 0031 - Cosmetic Surgery (0031.html)

Applicable CPT / HCPCS / ICD-10 Codes

Septoplasty:

Code	Code Description
CPT codes covered if selection criteria are met:	
30520	Septoplasty or submucous resection, with or without cartilage scoring, contouring or replacement with graft
30620	Septal or other intranasal dermatoplasty (does not include obtaining graft)
CPT codes not covered for indications listed in the CPB:	
30801	Ablation, soft tissue of inferior turbinates, unilateral or bilateral, any method (eg, electrocautery, radiofrequency ablation, or tissue volume reduction); superficial
30802	Ablation, soft tissue of inferior turbinates, unilateral or bilateral, any method (eg, electrocautery, radiofrequency ablation, or tissue volume reduction); intramural (ie, submucosal)
ICD-10 codes covered if selection criteria are met:	
J32.0 - J32.9	Chronic sinusitis [due to deviated septum not relieved by appropriate medical and antibiotic therapy]
J34.2	Deviated nasal septum [causing continuous nasal airway obstruction resulting in nasal breathing difficulty not responding to appropriate medical therapy]
J34.0 - J34.9	Other and unspecified disorders of nose and nasal sinuses [significant nasal obstruction][after four or more weeks of conservative management when criteria are met]
M95.0	Acquired deformity of nose [that prevents access to other intranasal areas when such access is required to perform medically necessary surgical procedures] [not covered for nasal valve collapse]
Q30.1 - Q30.8	Other congenital anomalies of nose [deformity of septum]
Q35.1 - Q35.9	Cleft palate

Code	Code Description
Q37.0 - Q37.9	Cleft palate with cleft lip
Q67.0 - Q67.4	Congenital musculoskeletal deformities of skull, face, and jaw [congenital deviated septum]
R04.0	Epistaxis [related to septal deformity]
ICD-10 codes not covered for indications listed in the CPB:	
J30.1 - J30.9	Allergic rhinitis
J31.0	Chronic rhinitis
Rhinoplasty:	
CPT codes covered if selection criteria are met [limited circumstances only]:	
30124	Excision dermoid cyst, nose; simple, skin, subcutaneous
30125	Excision dermoid cyst, nose; complex, under bone or cartilage
30420	Rhinoplasty, primary; including major septal repair
30435	Rhinoplasty, secondary; intermediate revision (bony work with osteotomies)
30450	major revision (bony work with osteotomies)
30460	Rhinoplasty for nasal deformity secondary to congenital cleft lip and/or palate, including columellar lengthening; tip only
30462	tip, septum, osteotomies
CPT codes not covered for indications listed in the CPB:	
0232T	Injection(s), platelet rich plasma, any site, including image guidance, harvesting and preparation when performed
30400	Rhinoplasty, primary; lateral and alar cartilages and/or elevation of nasal tip
30410	complete, external parts including bony pyramid, lateral and alar cartilages, and/or elevation of nasal tip
30430	Rhinoplasty, secondary; minor revision (small amount of nasal tip work)
30468	Repair of nasal valve collapse with subcutaneous/submucosal lateral wall implant(s)
Other CPT codes related to the CPB:	
30130	Excision inferior turbinate, partial or complete, any method
30140	Submucous resection inferior turbinate, partial or complete, any method

Code	Code Description
30465	Repair of nasal vestibular stenosis (eg, spreader grafting, lateral nasal wall reconstruction)
31231 - 31235	Nasal/sinus endoscopy, diagnostic
31237 - 31294	Nasal/sinus endoscopy, surgical
70450	Computed tomography, head or brain; without contrast material
70460	with contrast material(s)
70470	without contrast material, followed by contrast material(s) and further sections
70486	Computer tomography, maxillofacial area: without contrast material
70487	with contrast material(s)
70488	without contrast material, followed by contrast material(s) and further sections
HCPCS codes not covered for indications listed in the CPB:	
Spirox Latera Absorbable Nasal Implant - no specific code:	
G0460	Autologous platelet rich plasma for chronic wounds/ulcer s, including phlebotomy, centrifugation, and all other preparatory procedures, administration and dressings, per treatment
S9055	Procuren or other growth factor preparation to promote wound healing
ICD-10 codes covered if selection criteria are met:	
D14.0	Benign neoplasm of middle ear, nasal cavity and accessory sinuses [nasal dermoid]
M95.0	Acquired deformity of nose [individual case review see criteria, nasal wall weakness]
Q30.0	Choanal atresia [individual case review see criteria]
Q30.1 - Q30.9	Other congenital anomalies of nose [individual case review see criteria]
Q35.1 - Q35.9	Cleft palate
Q37.0 - Q37.9	Cleft palate with cleft lip

Code	Code Description
Intra-nasal excision or destruction:	
CPT codes not covered for indications listed in the CPB:	
30117	Excision or destruction (eg, laser), intranasal lesion; internal approach
ICD-10 codes covered if selection criteria are met:	
B07.8	Other viral warts
B07.9	Viral wart, unspecified
C11.0 – C11.9	Malignant neoplasm of nasopharynx
C30.0	Malignant neoplasm of nasal cavity
C31.8	Malignant neoplasm of overlapping sites of accessory sinuses
C41.0	Malignant neoplasm of bones of skull and face [fibro-osseous lesions nose]
C43.31	Malignant melanoma of nose
C43.4	Malignant melanoma of scalp and neck
C44.301	Unspecified malignant neoplasm of skin of nose
C44.311	Basal cell carcinoma of skin of nose
C44.321	Squamous cell carcinoma of skin of nose
C44.391	Other specified malignant neoplasm of skin of nose
C4A.31	Merkel cell carcinoma of nose
C47.0	Malignant neoplasm of peripheral nerves of head, face and neck [nose schwannoma]
C76.0	Malignant neoplasm of head, face and neck
D03.39	Melanoma in situ of other parts of face
D04.39	Carcinoma in situ of skin of other parts of face
D09.8	Carcinoma in situ of other specified site
D10.6	Benign neoplasm of nasopharynx [juvenile angiofibroma]
D11.0	Benign neoplasm of parotid gland [pleomorphic adenomas]
D14.0	Benign neoplasm of middle ear, nasal cavity and accessory sinuses [nasal inverted papilloma]
D18.00	Hemangioma unspecified site
D18.01	Hemangioma of skin and subcutaneous tissue

Code	Code Description
D18.09	Hemangioma of other sites
D23.30	Other benign neoplasm of skin of unspecified part of face
D23.39	Other benign neoplasm of skin of other parts of face
D36.7	Benign neoplasm of other specified sites
D36.9	Benign neoplasm, unspecified site
D48.5	Neoplasm of uncertain behavior of skin
D48.7	Neoplasm of uncertain behavior of other specified sites
D49.1	Neoplasm of unspecified behavior of respiratory system
D49.2	Neoplasm of unspecified behavior of bone, soft tissue, and skin
D49.89	Neoplasm of unspecified behavior of other specified sites
I78.0	Hereditary hemorrhagic telangiectasia
J33.0 – J33.9	Nasal polyp [nasal polyps]
J34.0	Abscess, furuncle and carbuncle of nose
J34.81	Nasal mucositis (ulcerative)
J35.2	Hypertrophy of adenoids
K11.6	Mucocele of salivary gland
L57.0	Actinic keratosis
L82.1	Other seborrheic keratosis
L90.5	Scar conditions and fibrosis of skin
L98.0	Pyogenic granuloma [pyogenic granuloma nose]
L98.9	Disorder of the skin and subcutaneous tissue, unspecified
M31.30	Wegener's granulomatosis without renal involvement
M31.8	Other specified necrotizing vasculopathies
M31.9	Necrotizing vasculopathy, unspecified
M72.6	Necrotizing fasciitis
Q30.8	Other congenital malformations of nose [dermoids] [nasal glial heterotopias]
Q82.8	Other specified congenital malformations of skin
R04.0	Epistaxis [recurrent, refractory]

Code	Code Description
T17.0XXA - T17.298S	Foreign body in nasal sinus, nostril, pharynx [nasopharynx]
ICD-10 codes not covered for indications listed in the CPB:	
J31.0	Chronic rhinitis
J32.0 – J32.9	Chronic sinusitis
J34.1	Cyst and mucocele of nose and nasal sinus
J34.2	Deviated nasal septum
J34.3	Hypertrophy of nasal turbinates
J34.8200 – J34.8202	Internal nasal valve collapse
J34.8210 – J34.8212	External nasal valve collapse
J34.89	Other specified disorders of nose and nasal sinuses [septal swell bodies]
J34.9	Unspecified disorder of nose and nasal sinuses
Pyriform aperture reduction (pyriform turbinoplasty):	
CPT codes not covered for indications listed in the CPB:	
Pyriform aperture reduction (pyriform turbinoplasty) - no specific code:	
Other CPT codes related to the CPB:	
21209	Osteoplasty, facial bones; reduction [Pyriform aperture reduction (pyriform turbinoplasty)]
Balloon septoplasty:	
CPT codes not covered for indications listed in the CPB:	
Balloon septoplasty - no specific code	
ICD-10 codes not covered for indications listed in the CPB:	
J34.2	Deviated nasal septum
S02.2XXA – S02.2XXS	Fracture of nasal bones
Nasal septal button for non-surgical closure:	
CPT codes covered if selection criteria are met:	
30220	Insertion, nasal septal prosthesis (button)
ICD-10 codes covered if selection criteria are met:	
J34.89	Other specified disorders of nose and nasal sinuses [Nasal septal perforation]

Code	Code Description
Q30.3	Congenital perforated nasal septum
Repair of nasal septal perforation:	
CPT codes covered if selection criteria are met:	
30630	Repair nasal septal perforations
ICD-10 codes covered if selection criteria are met:	
J34.89	Other specified disorders of nose and nasal sinuses [Nasal septal perforation]
Q30.3	Congenital perforated nasal septum

Background

Reconstructive rhinoplasty is surgery of the nose to correct an external nasal deformity, damaged nasal structures or to replace lost tissue, while maintaining or improving the physiological function of the nose.

Reconstructive septoplasty is the surgical correction of defects and deformities of the nasal septum (partition between the nostrils) by altering, splinting or removing obstructive tissue while maintaining or improving the physiological function of the nose.

Cosmetic rhinoplasty and/or septoplasty are performed solely to enhance appearance.

Nasal septoplasty is a procedure to correct anatomic deformity or deviation of the nasal septum. Its purpose is to restore the structure facilitating proper nasal function. Cosmetic enhancement, if any, is incidental. Because the septum is deviated in most adults, the potential exists for over-utilization of septoplasty in asymptomatic individuals. The primary indication for surgical treatment of a deviated septum is nasal airway obstruction. Corrective surgery also is done to treat recurrent epistaxis associated with the septal deviation or sinusitis in which the deviation has a contributory role, and, occasionally, is necessary to gain access to another region such as the sphenoid, sella turcica or pituitary

gland. In addition, septoplasty may be performed in response to an injury (nasal trauma) or in conjunction with cleft palate repair. **Note**: Under many Aetna plans, surgery to correct deformity due to an injury is covered when it is performed in the calendar year of the accident that causes the injury or in the next calendar year. After this time period has elapsed, covered surgery is contingent on the need for functional improvement, i.e., the other specific indications for surgery would apply. Please check benefit plan descriptions for details.

The nose is essentially a respiratory organ that provides a passageway for incoming and outgoing air. The internal nose is comprised of 2 nasal cavities (nostrils) through which air enters and passes posteriorly to the nasopharynx; it is separated in the middle by the septum which is composed of cartilage, anteriorly and bone, posteriorly. The nasal cavity is an irregularly shaped space extending from the bony palate that separates the nose and mouth cavities upward to the frontal ethmoid and sphenoid bones of the cranial cavity. Each nasal cavity is divided into 3 passageways (the superior, middle and inferior meati) by the projection of the 4 nasal turbinates (inferior, middle, superior and supreme) from the lateral walls of the internal nose. The inferior turbinate is a separate bone, while the other 3 are part of the ethmoid bone. The turbinates greatly increase the surface area of the mucous membrane over which air travels as it passes through the nasal passages and into the nasopharynx, serving to improve humidification of inspired air.

The vestibule of the nostril is lined with skin containing nasal hairs and some sebaceous and sweat glands. The nose is lined with respiratory mucosa except for the skin in the vestibule and the olfactory epithelium. Mucus secreted by the mucosa is carried back to the nasopharynx by the cilia of the mucosa. The nasal mucosa is extremely vascular, which makes it appear redder than the oral mucosa.

The blood supply to the nose is from the external and internal carotid arteries. One of the terminal divisions of the external carotid artery, the internal maxillary artery and its terminal branch, the sphenopalatine artery, supply blood to most of the posterior nasal septum and lateral wall of the nose. Blood is supplied to the anterior superior part of the septum and lateral wall by the internal carotid system which includes the anterior ethmoid artery.

A number of techniques can be used to straighten and thin a displaced or deviated septum. In the most common procedure, an incision is made through the mucosa and perichondrium (on 1 side) just behind the mucocutaneous junction. The mucoperichondrium and the mucoperiosteum are elevated on that side. The cartilage is then cut through at the site of the original incision. Similar mucoperichondrial and periosteal flaps are elevated on the opposite side until the septal cartilage and bones are freed of all soft tissue attachments. The obstructing pieces of cartilage or bone or both are removed or placed in a better position by reshaping through marsupialization.

In one approach, submucous resection, almost all the framework of the septum, except a strut at the top and in the front (caudal and dorsal struts), is removed. In other techniques, an effort is made to excise as little cartilage and bone as possible. The obstruction is corrected by shaving off the thickened cartilage and braking its spring, leaving the septum thinned and straightened. When the inferior edge of the cartilage is dislocated and appears in one vestibule rather than in the midline, an incision through the entire membranous collumella just in front of the cartilage affords an end-on view of the free edge of the cartilage.

The potential complications of septoplasty include septal perforation; failure to completely improve breathing due to swollen membranes as is seen in allergic patients; post-operative bleeding; nasal crusting; and re-obstruction due to improper healing and scarring, creating intranasal synechiae.

There are 4 pairs of paranasal sinuses, frontal, maxillary, ethmoidal and sphenoidal. Sinuses are mucous membrane-lined cavities in the facial bones that drain into the nasal cavities through openings in grooves (the meati) between the turbinates. Although it has been purported that sinuses serve to lighten the weight of the skull and give the voice its resonance and timbre, much of their function is unknown.

The American Academy of Otolaryngology Head and Neck Surgery (AAOHNS, 1998) has noted that the following findings are useful in assessing the need for septoplasty:

I. History - *one or more* required:

A. Asymptomatic deformity that prevents surgical access to other intranasal areas, i.e., ethmoidectomy;
B. Atypical facial pain of nasal origin; positive response to topical anesthetic, where deformed septum contacts a turbinate, supports but may not prove septal cause;
C. Frequent nosebleeds;
D. Nasal airway obstruction or difficult nasal breathing causing any of the following: mouth breathing, snoring, sleep apnea or recurrent sinus infections;

II. Physical Examination - *all* appropriate findings required:

A. Description of complete anterior and posterior nasal examination;
B. Description of nasopharynx, oropharynx, hypopharynx and larynx if purpose of surgery is to prevent sleep apnea or snoring;
C. Document absence of nasal polyps, tumors, turbinate hypertrophy or other causes of obstruction unless their removal is part of the proposed surgery;
D. Identification of known or suspected bleeding site if the purpose of surgery is to control epistaxis;
E. Identification of sinus that is recurrently infected if the purpose of surgery is to control disease.

The AAOHNS states that objective testing (e.g., CT scan) is optional in assessing the need for septoplasty.

Septal Deviation

A deviated nasal septum is an abnormal shift in location of the nasal septum; it is a common condition causing obstruction of the nasal passages and difficulty in breathing and recurrent nose bleeds.

Septal deviation may occur during the birth process, but even when the septum is straight at birth, it is likely to become deformed or deviated from the midline as a person ages; often there is no history of injury to account for the change. Frequently there are no symptoms associated with a deviated septum. A significantly deviated septum can be seen, upon examination, to be inclined or bent to one side (sometimes an S-

shaped curve blocks both sides) and the airway is greatly reduced. The obstruction may be anterior (cartilaginous) or posterior (bony) or cartilaginous and bony. Sometimes the anterior end of the septal cartilage is dislocated into one nasal vestibule, causing moderate to severe degrees of nasal obstruction. In the presence of symptoms, the position and degree of any deviations, dislocations, and spurs should be noted on a diagram of the septum. Under such conditions, septal reconstruction or submucous resection is appropriate to relieve the nasal obstruction. Such surgery is not ordinarily intended to correct headache or reduce nasal mucous discharge.

Except for nasal obstruction, other symptoms resulting from septal malformations are not well defined. While headaches are found in some patients who have a septal spur impinging on the inferior turbinate, the possibility of coincidence in patients who have both head pain and septal deformity is great and careful evaluation is required before a causal relationship is suggested.

Symptoms of sinusitis may be influenced by a deviated septum that obstructs a sinus opening, and sometimes nosebleeds are produced as a result of air currents drying the mucosa that covers the deflected septum.

Nasal Obstruction

The nasal valves or vestibules are the areas just inside the nostrils comprised of cartilage and are structured to work together to keep the nasal airway open by facilitating airflow resistance during breathing. The internal valves are located in each side of the nose at the upper edge of the hair bearing area, while the outer (external) valves are at the edge of the nostril rim. Aging, congenital abnormality or prior nasal surgery may cause nasal valve impairment such as nasal valve collapse, also referred to as vestibular stenosis. Nasal valves may narrow, weaken or collapse resulting in symptoms of nasal obstruction.

Nasal obstruction can be caused by changes in the tissue of the nasal cavity, septum, or turbinates; disease of the nasal vestibule; or tumors of the nasal cavity; it can be temporary or fixed. Obstructive sensations can be associated with the physiologic process known as the nasal cycle, i.e., the physiologic alteration of congestion and decongestion of the nasal

turbinates. This phenomenon, present in about 80 % of the population, means that breathing at any time may be more difficult on one side, but the sides will switch after 2 to 4 hours. Because of the nasal cycle, total nasal resistance or breathing through both nares remains somewhat constant without producing symptoms of total nasal airway obstruction. Another normal physiologic occurrence is positional nasal airway obstruction, i.e., when a person lies on one side, that dependent side tends to feel obstructed.

A very common cause of nasal obstruction is allergic rhinitis; this usually can be determined by a patient's history and clearly requires medical, not surgical, management. Mechanical obstruction due to septal deformity or hypertrophic turbinates is one of several nonallergic causes.

In order to treat nasal obstruction appropriately, accurate diagnosis of its cause is essential. Evaluation should include quantification and qualification of the symptoms, determination of the site and cause of obstruction, and determination of any predisposing factors. The history should answer the questions of the duration of obstruction, any precipitating events such as trauma, are symptoms continuous or intermittent, unilateral or bilateral, or do they alternate from side to side. It is important to ascertain if symptoms are worse at certain times of the day or night, at certain times of the year, or in any position such as lying on one side, and also if they are provoked by environmental factors, allergens, irritants or dietary factors.

Along with a full ear, nose and throat examination, a systematic evaluation of the nasal cavity, the paranasal sinuses, and nasopharynx should be performed. In addition to rhinoscopy using a head mirror or fiberoptic headlight, flexible fiberoptic and rigid Hopkins rod endoscopy are important tools in diagnosing a variety of pathologies and anatomic abnormalities.

While obstructive symptoms associated with septal deviation usually occur on the affected side, paradoxically, a patient with a significant septal deviation may complain of obstruction on the apparently non-obstructed side. This can occur when a septal deviation has been present for years but the patient is unaware of the deformity since he can breathe comfortably from the other side. Under these circumstances

when a major septal deviation causes enlargement of one nasal passage at the expense of the other, the inferior and sometimes the middle turbinate in the enlarged passage undergo compensatory mucosal hypertrophy so that the total airflow resistance of the nose remains pretty normal. However, if the nasal cycle becomes more pronounced for any reason or even a mild degree of allergic or vasomotor rhinitis is acquired, then the symptoms will be noted primarily in the enlarged side rather than in the anatomically narrowed one since the hypertrophied turbinates on the enlarged side swell considerably more from any stimulus than do the relatively atrophic ones on the narrow side.

Permanent enlargement of the turbinates, particularly the inferior turbinate, may result from a long-standing allergic rhinitis and low-grade inflammation. The turbinate loses most of its normal ability to expand and to shrink, resulting in continuous nasal obstruction. Nose drops, antihistamines and allergic desensitization will not relieve such obstruction. Treatment options include steroid nasal sprays, injection of a sclerosing solution beneath the mucosa of the turbinate and submucosal electrocoagulation; however, in some cases, successful treatment is possible only by submucous resection of the turbinate itself.

At the extreme, nasal airway obstruction can lead to pulmonary pathology because the protective functions of the nose (humidification, heating and filtering) cannot occur. Asthma and bronchitis may worsen as a result of nasal obstruction. As noted previously, septal reconstruction or submucous resection is appropriate to relieve nasal obstruction that is definitively caused by a deviated septum.

Standard surgical methods for nasal valve repair depend upon the location and extent of the structural and functional impairment, but generally may include rhinoplasty, septoplasty, turbinoplasty, spreader grafts and batten grafts. Spreader grafts are formed from autologous cartilage and act as wedges between the septum and the upper lateral cartilage, thereby enlarging the internal valve. Batten grafts constructed from autologous cartilage (septum, ear or rib) are used to provide structure to the nasal side wall, supporting a weakened or pinched external valve.

Sinusitis

Sinusitis means an inflammatory change in the mucosa of a sinus. Definite signs and symptoms are produced by this pathology. Uncomplicated acute sinusitis is usually apparent clinically and imaging studies are unnecessary. However, plain films may be helpful in equivocal cases, and computed tomography (CT) now plays a role in the evaluation of patients with chronic sinusitis who are under consideration for endoscopic sinus surgery (ESS). CT, especially the coronal plane view, facilitates accurate definition of regional anatomy and extent of disease. It is currently the modality of choice in the evaluation of the paranasal sinuses because of this ability to optimally display bone, soft tissues and air. In selected patients with complications of sinusitis, magnetic resonance imaging (MRI) may be useful since its multiplanar imaging capability reveals any extension of sinus infection into the orbit and adjacent brain, especially in cases of aggressive fungal infection. However, authorities recommend that MRI should not precede CT because CT better displays the complex bony anatomy of the paranasal sinuses, orbits and skull base.

Although the paranasal sinuses often have been implicated as the underlying cause of nasal obstruction or other problems such as headaches, fever of unknown origin, cough, chronic dyspepsia and other upper respiratory or gastrointestinal symptoms, in actuality, probably only 10 % of patients who consult an otolaryngologist because of "sinus trouble" have sinusitis. Allergy evaluation is a useful part of the workup for chronic sinusitis.

Treatment of acute sinusitis is medical, directed at relief of pain, shrinkage of the nasal mucosa and control of infection; such conservative treatment is effective in 90 % of patients. When a subacute infection persists, antral irrigation and/or antral puncture may be indicated and short term corticosteroids may be helpful. Inadequate treatment of the acute or subacute phase or recurrent attacks can lead to irreversible tissue changes in the membranes lining one or more of the paranasal sinuses, i.e., chronic suppurative sinusitis. Frequently surgery is required for this condition with removal of all diseased soft tissue and bone, adequate postoperative drainage, and obliteration of the preexisting sinus

cavity where possible. Although a specific technique is used for each sinus, the aim of any procedure used is to eradicate the infection but to leave contiguous structures normal.

When sinusitis is influenced by a deviated septum that occludes a sinus ostium, septoplasty may be warranted.

Epistaxis (Nose-bleed)

The most common cause of nose-bleed is trauma such as picking a crust off the nasal septum or excessive drying of the nasal mucosa. Bleeding from the posterior half of the nose, however, is more likely to be caused by a splitting of a sclerotic blood vessel and is more common in hypertensive patients. Anterior nosebleeds are easy to treat by aspirating the blood clots, applying topical epinephrine and cauterizing the bleeding point. Prolonged packing of both sides of the nose may be necessary to allow healing in some patients. Because it is often impossible to see the exact bleeding site in posterior nosebleeds, treatment is more difficult. Bleeding must be controlled by compression of the bleeding vessel with a postnasal pack for 48 to 96 hours, arterial ligation or trans-palatal injection of saline solution into the greater palatine foramen. Usually operative procedures on the nasal septum are not required for the control of nosebleeds; however, sometimes when projecting parts of the septum are traumatized by the drying effect of inspired air and impede visualization of the area of the nose posterior to the deviation, then septoplasty may be indicated to visualize the area for purposes of cautery and control.

Nasal Packing

The practice of nasal packing following septoplasty was based on a desire to prevent post-operative complications such as bleeding, septal hematoma, and adhesion formation. However, it was since found that not only is nasal packing ineffective in this regard, it can actually cause these complications. In a prospective, randomized, comparison study, Awan and Iqbal (2008) compared nasal packing versus no packing after septoplasty (n = 88). These investigators examined the incidence of a variety of post-operative signs and symptoms in patients (15 years of age and older), who did (n = 44) and did not (n = 44) undergo nasal packing

following septoplasty. They found that patients who underwent packing experienced significantly more post-operative pain, headache, epiphora, dysphagia, and sleep disturbance on the night of surgery. Oral and nasal examinations 7 days post-operatively revealed no significant difference between the 2 groups in the incidence of bleeding, septal hematoma, adhesion formation, and local infection. Finally, subjects in the packing group reported a moderate-to-high level of pain during removal of the packing. These findings confirmed that nasal packing after septoplasty is not only unnecessary, it is actually a source of patient discomfort and other signs and symptoms.

Furthermore, Dubin and Pletcher (2009) stated that although it appears intuitive that packing may prevent or decrease the incidence of complications following septoplasty, evidence supporting this assertion is limited at best. In addition, certain types of nasal packing have been demonstrated to increase post-operative pain and have been implicated as a causative factor of catastrophic complications, such as toxic shock. With limited evidence to suggest a beneficial effect and a potential for deleterious side-effects, the routine use of post-operative packing following septoplasty should be questioned.

Banglawala et al (2013) stated that nasal packing is routinely used after septoplasty because it is believed to decrease risk of post-operative bleeding, hematomas, and adhesions. Multiple studies have shown, however, that there are numerous complications associated with nasal packing. These investigators performed a meta-analysis on the existing literature to evaluate the role of nasal packing after septoplasty. Two independent reviewers conducted a literature search using EMBASE, OVID, Medline, PubMed, Google scholar, Cochrane Library, and reference list review from 1966 to August 2010 to identify studies assessing nasal packing after septoplasty. All papers were reviewed for study design, results, and were assigned an Oxford level of evidence grade, Detsky score, and Methodological Index for Nonrandomized Studies (MINORS) score. A total of 16 papers were identified that met the inclusion criteria; 11 papers were randomized control trials, 3 were prospective, and 2 were retrospective studies. Nasal packing did not show benefit in reducing post-operative bleeding, hematomas, septal perforations, adhesions, or residual deviated nasal septum. There was, however, an increase in post-operative infections. Two studies using

fibrin products as nasal packing showed a decreased bleeding rate. The authors concluded that nasal packing after septoplasty does not show any post-operative benefits. Fibrin products showed a possibility of decreasing post-operative bleeding. They stated that routine use of nasal packing after septoplasty is not warranted.

Extracorporeal Septoplasty

Extracorporeal septoplasty (ECS) is a radical solution for extreme deviations of the septum. This approach entails resection, extracorporeal straightening, and re-implantation of the nasal septum (Baumann, 2010).

Often, the deviation of the nasal septum is one component of a larger nasal deformity. The deformity may involve the nasal tip, dorsum, and nasal bones. An intranasal approach to such deformities may not be adequate. In these situations, an open septorhinoplasty approach is best. Extracorporeal septoplasty is a technique that has been described to address these severe cases (Fettman et al, 2009). This technique involves removing the entire nasal septum and straightening the septum using various techniques, followed by reimplantation. Often, the external nose appears twisted in addition to symptomatic nasal obstruction, and extracorporeal septoplasty may help to correct this deformity as well.

Matulic and Skitarelic (2004) stated that rhinoplasty is often thought of as the most challenging of all esthetic procedures. Irregularities of nasal tip implicate decreasing of nasal function and are generally regarded as an unattractive facial feature. The combined operative techniques, which required ECS, incorporation of cartilage disc graft and onlay graft were performed in 19 patients. Among the 19 patients, 15 had procedure of primary rhinoplasty and in 4 of them secondary or revised rhinoplasty was made. Indications for this operative technique were in patients with boxy nasal tip, bifid nasal tip, lateral alar tethering with extremely fat or thin nose skin. The authors emphasized that this technique is very successful with an acceptable percentage of post-operative complications. The technique is method of choice for reconstruction of extreme nasal tip irregularities where the usual reconstruction technique does not give satisfactory results.

Gubisch (2005) described a technique of extracorporeal septal reconstruction to correct the markedly deviated nasal septum. Retrospective medical charts of 2,119 patients undergoing ECS from January 1, 1981, through July 31, 2004, by the author in a tertiary care facial plastic surgery center were reviewed. The primary outcome measures included surgical complications, revision rate, and the surgeon's subjective determination of functional and esthetic outcomes. Of the 2,119 patients, 2 cohorts were available for review. From January 1, 1981, to July 31, 1987, the author performed the operation on 459 patients. Fifty-seven complications (12 %) occurred, with irregular contour of the dorsum or saddling noted in 38 (8 %). Twenty patients (4 %) elected to have revision septoplasty. From January 1, 1996, to December 31, 1996, the author supervised residents performing ECS in 108 patients. Fourteen post-operative complications (13 %) occurred, with dorsal irregularity noted in 12 (11 %). Eight patients (7 %) elected to have revision septoplasty. The authors concluded that ECS is an important surgical option for the correction of the markedly deviated nasal septum. Fixation of the straightened and re-planted septum at the nasal spine and dorsal septum border with the upper lateral cartilages is essential. Spreader grafts for stabilization of the internal nasal valve and dorsal onlay grafts to prevent dorsal irregularity are strongly encouraged.

Most (2006) described a modified ECS technique and measured its effectiveness with a validated quality-of-life instrument. Pre-operative and post-operative evaluation was performed using photographs and the Nasal Obstruction Symptoms Evaluation scale. A total of 12 consecutive patients were enrolled. No complications occurred. All patients noted improved airway function post-operatively. There was a significant improvement in mean Nasal Obstruction Symptoms Evaluation score post-operatively (76.6 versus 12.9; $p < 0.01$). Examination of post-operative photographs revealed improved mid-vault and tip anatomy. The authors concluded that the anterior septal reconstruction technique is effective in improving both nasal airway function and esthetics in patients with severe septo-nasal deviation. The technique avoids the most common complication of standard ECS by preserving the dorsal strut of septal cartilage and its attachment to the nasal bones at the keystone area.

Kantas et al (2008) evaluated the effectiveness, indications, and contraindications of the ECS in treating a severely deviated nose. A total of 64 patients operated on for esthetic correction of a severely deviated nose were studied. Forty-six of them were first operations and 18 were revision cases. The surgical procedure of choice was the closed technique. Septal cartilage was prepared and then dislocated, followed by external alignment and re-implantation. Hump reduction with lateral osteotomies and, occasionally, medial dislocation of nasal bones was carried out. Cosmetic results were satisfactory in all first operation cases. In 11 of the 18 revision cases, septal preparation was impossible; in 2, septal sagging was observed; and in 1, perforation was noted. The authors concluded that ECS is an effective, safe, and reliable technique, especially for twisted noses undergoing surgery for the first time. The authors stated, however, that ECS is strongly contraindicated in a revised deviated nose.

Jang and Kwon (2010) noted that secure fixation of the re-implanted septum is critical for successful long-term esthetic and functional outcomes following ECS. These investigators described the results of their modified ECS technique. This retrospective study involved 27 patients with a deviated nose who underwent the authors' modified ECS method in rhinoplasty between June 2006 and January 2009. Anthropometric changes were assessed from pre-operative and post-operative facial photographs. Patient satisfaction was evaluated, and nasal obstruction improvement was assessed on a visual analog scale. Post-operative correction of the external nose deviation angle was statistically significant. Twenty-four patients (89 %) were satisfied with the cosmetic outcome, and all 23 patients with moderate-to-severe pre-operative nasal obstruction were satisfied with the post-operative improved nasal breathing. The authors concluded that their modified ECS fixation technique was easy to perform and effective in septorhinoplasty for severe septal deviation.

Nasal Valve Suspension

Nasal valve suspension surgery involves inserting a suture through the nasal mucosa, into the nasal valve and using a bone anchor to secure the suture to the orbital rim, purportedly maintaining valve patency. The procedure has been proposed as a treatment for nasal valve collapse.

Nasal valve collapse is a common cause of nasal airway obstruction. Nasal valve suspension (NVS) is a surgical approach for nasal valve repair, which entails suspension of the valve to the orbital rim. During NVS, an anchored suture is first attached to the orbital rim and then a suture is passed through the collapsed valve. The suspension suture is then returned to the anchor site at the orbital rim and tied, resulting in a repaired nasal valve that supposedly allows for less obstructed airflow. Modifications to this procedure or other types of suspensions, such as those using sutures tunneled within the facial soft tissue to an infra-orbital incision on each side of the nose, have also been reported.

In a non-randomized, pilot study, Paniello (1996) evaluated the safety and effectiveness of NVS for treating nasal valve collapse. Subjects (12 men aged 38 to 73 years; mean age of 59.3 years) were patients with complaints of nasal airway obstruction, a positive Cottle maneuver, and clinical findings of nasal valve collapse. Follow-up ranged from 1 to 20 months. Main outcome measures were subjective self-assessment scores for nasal airflow were collected on a 10-point scale. Anterior rhinomanometry, acoustic rhinometry, and photographic analysis provided objective data. The procedure involves accessing the orbital rim by a trans-conjunctival incision, then passing sutures from the nose to this incision where they may be affixed to the orbital rim. The collapsing tissue of the nasal valve is thus supported and collapse is prevented. All patients reported immediate subjective improvement in their symptoms of nasal obstruction; this was reflected in their self-assessment scores. The rhinomanometry showed reduced nasal resistance in 10 (83 %) of 12 patients. The acoustic rhinometry showed an increase in minimum cross-sectional area (CSA) in 2 (33 %) of 6 patients, with the others remaining stable. The photographic analysis revealed mild widening of the mid-third of the nose in 6 of 12 patients, although this was not of concern to the patients. There were no major complications. The authors concluded that NVS is a safe and effective procedure for treatment of nasal valve collapse. These preliminary findings need to be validated by well-designed studies with larger sample size and longer follow-up.

Nuara and Mobley (2007) reviewed their experience with NVS in a cohort of patients with nasal valve collapse, including a subset of patients with facial paralysis. The objectives were to determine patient satisfaction and complication rates after NVS. A retrospective review of patients 18 years

and older who had NVS from 2003 to 2006 with a follow-up of at least 1 month was performed. Data were collected on diagnosis, surgical outcomes, complications, and treatments required. Complications included adverse outcomes, infections, and the need for repeat surgery or treatments. In 17 charts reviewed, 9 patients (53 %) had nasal valve collapse as a result of facial paralysis, and 8 (47 %) had previous nasal surgery. Follow-up ranged from 1 to 30 months, with a mean of 16.5. Moderate-to-complete resolution of obstruction was reported by 82 % of patients, or for 88 % of procedures. Sustained relief was observed in 2 of 8 patients who had previous nasal surgery and 6 of 9 who had no previous nasal surgery ($p = 0.1$). Infection occurred in 4 (24 %) patients and 5 (21 %) total suspensions and ranged from 1.5 to 7 months. Six (35 %) patients experienced a loss of suspension at 6 to 22 months. The authors concluded that NVS is a technically straightforward, relatively reversible procedure particularly useful in the patient with facial paralysis. The efficacy is excellent in the short-term yet appears to diminish with time.

Andre and Vuyk (2008) described their experience with NVS for treating nasal valve insufficiency. A total of 20 patients with nasal valve insufficiency underwent NVS (a total of 33 sides). Patients were prospectively studied and their nasal patency was rated per side pre- and post-operatively, by subjective self-evaluation on a scale from 1 to 10. Post-operatively 7 sides (21 %) were rated as unchanged, on 17 sides (52 %) the improvement was from 1 to 3 out of 10, and on 9 sides (27 %) 4 or more out of 10. The average post-operative improvement for all sides was 2.3 out of 10. In 5 patients (25 %) complications occurred, such as pain, inflammation and suborbital swelling, and 3 eventually underwent a re-exploration of the surgical area, resulting in a permanent scar in 1 patient. The authors concluded that although NVS may be beneficial for some patients, based on their experience, they would not recommend this technique as first line treatment for nasal valve insufficiency. In this series, these researchers found relatively limited improvement in most patients and a far higher complication rate compared with other nasal valve procedures they had experienced with in the past.

Spielmann et al (2009) evaluated the surgical treatment strategies for nasal valve collapse. A systematic review of studies to treat nasal valve collapse, using surgical methods, from 1970 to 2008. A search of EBM reviews, MEDLINE, and EMBASE was performed using the following search terms: "nasal valve collapse" and "alar collapse," "nasal valve insufficiency," "alar insufficiency," and "functional rhinoplasty". The following outcome measures were sought: subjective symptom relief, cosmetic outcome, and objective measurements of nasal airway patency. The following were inclusion criteria: at least 10 patients in each study, stated aim to improve airway obstruction, and a minimum of 1 month follow-up for every patient. These investigators identified 98 papers, which were then retrieved and analyzed. Of these, 43 met the inclusion criteria. No randomized controlled trials exist; 1 trial presented level IIIb evidence, but all other studies were classed as level IV. Seven authors present objective measurements of nasal airflow or CSA, and 4 authors presented validated outcome measures. The authors concluded that a variety of focused surgical techniques were described to deal with nasal valve collapse. They could find no randomized controlled trials on nasal valve surgery. Research in nasal valve surgery is frequently driven by technical description of surgical technique rather than the establishment of evidence of long-term patient benefit. They stated that although their understanding of the role of the nasal valve in the pathophysiology of nasal obstruction has improved vastly, the myriad of surgical techniques described perhaps reflects the uncertainty in choice of technique and in degree of patient benefit.

In a prospective pilot study, Kim et al (2011) evaluated the effect of septoplasty on the clinical course of allergic rhinitis by comparing (i) symptom change using the visual analog scale (VAS), (ii) change of the medication score, and (iii) improvement of the quality of life using a questionnaire. A total of 62 patients who had undergone septoplasty and turbinoplasty for septal deviation and allergic rhinitis were enrolled in group A; 26 patients who had undergone only turbinoplasty for allergic rhinitis were enrolled in group B. The VAS score, the Average Rescue Medication Score (ARMS), and the Rhinasthma Questionnaire for the quality of life were all obtained from each patient. These parameters were compared before and after the surgery and between the groups. Both groups showed significant improvement of the VAS score ($p <$

0.001). When the change of VAS was compared between groups, there was a significant difference in group A only for nasal obstruction ($p = 0.047$). Comparison of the ARMS between groups showed significant improvement in both groups after the surgery ($p < 0.01$). However, there were no differences between the groups. The Rhinasthma score of group A was significantly lowered after the surgery (56.4 +/- 13.2 to 34.1 +/- 12.3, $p < 0.001$). The Rhinasthma score of group A was significantly lower than that of group B after the surgery ($p = 0.004$). The authors concluded that this is the first research about the potential effect of septoplasty on the clinical course of allergic rhinitis. They stated that further studies are needed to elucidate the mechanisms underlying these effects.

Antibiotic Prophylaxis in Septoplasty

Ricci and D'Ascanio (2012) stated that antibiotic prophylaxis for surgical procedures is a common practice among otorhinolaryngologists. Most American Rhinology Society members use antibiotics routinely in septoplasties, even though the need for this practice in rhinological surgery is controversial. These investigators evaluated the necessity of antibiotic prophylaxis in septoplasties in relation to surgical outcome and post-operative complications. In a prospective, randomized clinical trial these researchers evaluated 630 subjects who underwent septoplasty according to the technique already described by the authors. Patients were divided into 3 groups: group A, no antibiotic prophylaxis; group B, antibiotics (cefazolin at 1.0 g i.v.) only at anesthetic induction; and group C, antibiotics both at anesthetic induction (cefazolin at 1.0 g i.v.) and post-operatively (oral amoxicillin at 1 g every 12 hours) for 7 days. Pre- and post-operative patients' scores on the Nasal Obstruction Septoplasty Effectiveness (NOSE) questionnaire were compared to assess the improvement of nasal symptoms after surgery. Post-operative pain, nasal bleeding, septal hematoma/abscess, fever, and nausea/vomiting were recorded. Nasal endoscopy was performed 14 days post-operatively to quantify purulent rhinorrhea. An improvement of post-operative nasal symptoms on the NOSE questionnaire was recorded with respect to pre-operative score. No significant difference was found among the groups with regard to post-operative pain, fever, nausea/vomiting, and nasal bleeding. No case of hematoma or septal abscess was noticed. No significant difference in purulent nasal

discharge was found among the groups. The authors concluded that septal surgery with early removal of nasal packing is a clean-contaminated procedure and does not require routine antibiotic prophylaxis because of the low infection risk.

Karaman et al (2012) examined the effect of antibiotic prophylaxis and septoplasty on nasal flora. These researchers included 115 consecutive patients who underwent septoplasty because of symptomatic nasal septal deviation. Patients were divided into study and control groups. Study patients received prophylactic parenteral sodium cefazoline twice-daily beginning intra-operatively and while the nasal packing remained in the nose for 48 hours, and expandable polyvinyl acetate (Merocel) packing covered with antibiotic ointment containing 0.2 % nitrofurazone was inserted into each nostril at the end of the operation. Control patients received neither parenteral antibiotic prophylaxis nor antibiotic ointment around the Merocel packs. Both groups received oral prophylactic cefuroxime axetil for 5 days after nasal packing was removed. Nasal flora was determined pre-operatively, post-operatively when nasal packing was removed, and 3 months after surgery. Study patients were compared to control patients at pack removal and 1 month after surgery. The effect of antibiotic use in septoplasty on nasal flora was as follows: Increased isolation rate of gram-positive rods ($p = 0.007$), decreased methicillin-sensitive coagulase-negative staphylococci ($p = 0.002$). Pre-operative and post-operative culture results at 3 months were compared. The effect of septoplasty on nasal flora was as follows: Decreased coagulase-negative staphylococci ($p = 0.05$), decreased Klebsiella ($p < 0.001$), decreased gram-positive rods ($p < 0.001$), increased methicillin-sensitive Staphylococcus aureus ($p < 0.001$). The authors concluded that septoplasty increases S. aureus colonization and decreases normal flora. Antibiotics do not protect against S. aureus colonization and contribute to a decrease in normal flora. They stated that antibiotics do not seem to confer benefit in terms of flora changes; studies investigating flora changes with a longer follow-up should be conducted.

Gioacchini et al (2014) noted that both systemic antibiotic therapy and nasal packing are used frequently in septoplasty. Nevertheless, there is still great disagreement among authors around the real advantages with regard to the effectiveness of both of these procedures in septal surgery. The aim of the present review was to evaluate the more recent data

published on this topic. One appropriate string was run on PubMed to retrieve articles dealing with the topics mentioned above. A double cross-check was performed on citations and full-text articles found using the selected inclusion and exclusion criteria. Overall, the articles analyzed by these researchers indicated the poor utility of routine antibiotic therapy and nasal packing during septoplasty, the latter procedure producing more complications than advantages. The authors concluded that on the basis of the recent literature, the use of systemic antibiotic prophylaxis and nasal packing in septal surgery seems to be a non-rational procedure.

Submucosal Endoscopically Assisted Septoplasty and Closed Nasal Reduction for the Treatment of Naso-Septal Fractures

Andrades and colleagues (2016) stated that nasal bone fracture is the most common among facial bone fractures. The prevalence of concomitant septal and nasal bone fractures fluctuates between 34 % and 96.2 %. An adequate management of such fractures is essential to prevent complications such as post-traumatic nasal obstruction and naso-septal deformities. These researchers introduced the submucosal endoscopically assisted septoplasty (SEAS) as an alternative approach for acute septal lesions and reported their experience and outcomes. They performed a retrospective review including patients with nasal fracture in association with septal fracture (naso-septal fractures) who underwent SEAS and closed nasal reduction. A total of 90 patients were included; 23 % were female and 77 % were male, with a mean age of 40 years. All the cases were work-place accidents or commuting accidents. The mean time elapsed between the accident and surgery was 15 days. There were no technique-related intra-operative complications; 3 (3.3 %) patients suffered a subsequent nasal obstruction and/or deviation of the nasal axis, requiring subsequent secondary open rhino-septoplasty. The authors concluded that submucosal endoscopically assisted septoplasty and closed nasal reduction for the treatment of naso-septal fractures is a novel approach that reduces the rate of secondary rhino-septoplasty as compared to other authors' reports. They stated that the technique described is reproducible, cost-effective and has very encouraging outcomes (Level of Evidence: IV).

Trans-Septal Suturing Following Septoplasty

In a systematic review and meta-analysis, Wang and Dong (2017) evaluated the curative effect of trans-septal suturing versus nasal packing after septoplasty. These researchers carried out a computerized search of the published literature in PubMed, Embase, CENTRAL, Cochrane Database of Systematic Reviews, WANFANG, CNKI databases. Randomized trials investigating trans-septal suturing versus nasal packing following septoplasty in patients with deviated nasal septum were selected for analysis. Complications and outcome measures included adhesion, septal hematoma, bleeding, septal perforation, infection, pain, headache, or residual septal deviation per randomized patients. A total of 19 randomized controlled trials (RCTs) of 1,845 subjects were included. Meta-analysis showed that post-operative pain, headache, and adhesion were significantly lower in trans-septal suturing group. Nasal packing and trans-septal suturing technique appeared to be equivalent with regard to post-operative bleeding, hematoma, septal perforation, infection, and residual septal deviation. Trans-septal suturing technology is not only associated with less patient pain, headache, and lower occurrence rate of adhesion after septoplasty but it also related to higher patient satisfaction and an improved quality of life (QOL). The suturing technology can be used as a substitute for traditional nasal packing of the 1st-line treatment. The authors concluded that more well-designed studies are needed to confirm the effect of trans-septal suturing following septoplasty.

Dadgarnia and colleagues (2017) stated that it has been shown that nasal packing after septoplasty is associated with several complications. In a randomized clinical trial, these investigators compared post-septoplasty nasal packing and trans-septal suturing, in terms of complications and outcome of operation. This study was performed on patients with deviated nasal septum who were candidates for septoplasty. Patients were visited 3 times after operation (on the 1st 48 hours, 1st week, and 3rd post-operative month). Participants were checked for having common complications. Rhinomanometric evaluation was performed to measure nasal air flow and airway resistance, as indicators of operation efficacy, both prior to and after surgery. A total of 72 patients were allocated into the 2 trial arms. Patients in nasal pack group reported higher pain scores on the 1st 48 hours ($p < 0.001$) and 1 week after surgery ($p < 0.001$). Epiphora ($p = 0.028$), sleep disturbance

(p = 0.012), and dyspnea (p < 0.001) were also more commonly observed in patients using nasal pack. Objective evaluation of bleeding demonstrated that more severe bleeding occurred in patients with trans-septal sutures (p = 0.001). No differences were found comparing the indices of rhinomanometry between the 2 groups. The authors concluded that the use of trans-septal sutures after septoplasty compared to nasal packing might be associated with lower frequencies of several specific complications and a lower rate of patients' discomfort. Nevertheless, increased risk of bleeding and hematoma was noted in the trans-septal suture group. No differences were observed between the nasal air flow and resistance of patients in the 2 groups.

Rhinoplasty for Removal of a Nasal Dermoid

Zapata and Kearns (2006) stated that midline congenital nasal lesions are rare, occurring in 1 out of every 20,000 to 40,000 births. Of these midline lesions, nasal dermoids are the most common. This review centered on diagnosis of nasal dermoids, the role of imaging in diagnosis and surgical planning and the various approaches to surgical management of these lesions. Multi-planar, high-resolution thin section MRI allows for excellent soft tissue detail, particularly when intra-cranial extension is expected. Open rhinoplasty is favored by many head and neck surgeons for excision of dermoids. Trans-nasal endoscopic excision of nasal dermoids has been reported but is not recommended for dermoids extending into or beyond the falx cerebri. The authors concluded that imaging of the midface and brain is essential for accurate diagnosis, assessment for any intra-cranial extension and appropriate surgical planning. Any surgical approach for removal of nasal dermoid cysts should permit adequate access, allow repair of the skull base and cerebrospinal fluid (CSF) leak, facilitate nasal reconstruction and result in acceptable cosmesis. The surgeon should be able to consider various surgical approaches to manage these lesions.

Moses and colleagues (2015) stated that the incidence of midline frontonasal dermoid cysts is 1 in 20,000 to 1 in 40,000. These lesions may have intra-cranial extension. This is explained by the anatomy and embryology of naso-frontal development. Skin involvement may also be extensive . Incomplete excision frequently leads to recurrence. These investigators reported their experience and pathway for management of

midline dermoids. Databases were searched to identify patients who had undergone surgery for removal of a dermoid cyst. Pre-operative imaging and indications for surgery were reviewed. Cases were grouped according to surgical approach, and outcomes and complications were identified. A total of 55 patients were treated; MRI or CT was used to delineate the anatomy, and surgical excision was expedited if there was a history of infection, especially if imaging suggested intra-cranial extension; 12 patients were treated endoscopically (1 was converted to open); 11 patients needed trans-cranial approaches for intra-cranial extension (20 %). Of these, 1 lesion breached the dura. The remaining 32 patients had dermoids excised with an open approach (direct, bi-coronal, or rhinoplasty). There were no recurrences in the open group and there was 1 recurrence in the trans-cranial group that was treated by re-excision. The authors concluded that midline dermoid cysts are relatively uncommon. However, knowledge of the pathogenesis of these lesions together with the authors' experience over 15 years has allowed them to develop a protocol-driven approach, with a low incidence of complications.

Hartley and co-workers (2015) noted that nasal dermoids are rare developmental anomalies seen in children. These researchers reported the largest case series of 103 patients seen in a quaternary specialist unit over a 10-year period. They reported the surgical and radiological findings and proposed a new classification system, which described the extent of the lesions, thus allowing better surgical planning. These investigators performed a retrospective review of case notes. Data collection included demographics, initial presentation, site of lesion, pre-operative CT and MRI imaging, surgical procedure, intra-operative findings (including depth of lesion), complications and recurrence. Surgical findings were correlated with radiological findings. A total of 103 patients were included in the study. The mean age at presentation was 29 months; 89 % of children presented with a naso-glabellar or columellar lesion and 11 % had a medial canthal lesion. All the patients underwent pre-operative imaging and were treated with surgical excision; 58 children had superficial lesions, 45 had subcutaneous tracts extending to varying depths. Of these, 38 had intra-osseous extension into the frontonasal bones, 8 extended intra-cranially but remained extra-dural and 2 had intra-dural extension. There was good correlation between radiological and surgical findings. The superficial lesions were locally excised. The

lesions with intra-osseous tracts were removed via open rhinoplasty; and the frontonasal bones drilled for access. Intra-cranial extension was approached either via a bi-coronal flap and frontal craniotomy or the less invasive anterior small window craniotomy. The authors concluded that this report described the largest published cases series of nasal dermoids. The cases demonstrated the presenting features and the variable extent of the lesions. The new proposed classification; superficial, intra-osseous, intra-cranial extra-dural and intra-cranial intra-dural, allows precise surgical planning. In the presence of intra-cranial extension, the low morbidity technique of using a brow incision and small window anterior craniotomy avoided the more invasive and commonly used bi-coronal flap and frontal craniotomy.

El-Fattah and associates (2016) stated that nasal dermoids are congenital anomalies constituting 3.7 to 12.6 % of dermoids in the head and neck. Most of lesions are superficial but there is always a risk that it may end blindly within the deep structures of the nose or extend intra-cranially. Complete excision, regardless of extension, is essential and must be balanced against cosmoses. These investigators reviewed the clinical characteristics and imaging findings as well as the appropriate surgical approach adopted for 29 cases managed at Mansoura University Hospitals. They carried out a retrospective analysis in 29 patients admitted for management of nasal dermoid between January 2001 and January 2015 at the Otolaryngology department of our tertiary referral university hospital. Recorded data included patient's demographics, complaint, lesion's site, pre-operative radiological findings, surgical technique, intra-operative findings, and post-operative sequelae. This series included 12 (41 %) girls and 17 (59 %) boys, with a mean age of 2.5 years; 27 children presented with a naso-frontal swelling of which 20 had an apparent sinus. Other presentations included a swelling in the inner canthum (n = 1), nasal tip and columella (n = 1); 9 (31 %) patients had a history of infection and 2 patients gave a positive history of meningitis. Intra-cranial extra-dural extension was identified in 10 patients (34.5 %) during pre-operative imaging. Surgical modalities included local excision and direct closure (n = 12), open rhinoplasty (n = 7), bi-coronal excision and craniotomy (n = 10). In 9 cases, the tract was adherent to the dura, but was carefully dissected and in 1 case resection required excision of a segment of dura and reconstruction. In a follow-up period of 1 to 8 years, recurrence was detected in 1e case and the

cosmetic results were satisfactory. The authors concluded that these lesions were rare and required early precise surgical planning to achieve complete en bloc excision. This study reported a low morbidity associated with management of nasal dermoids with intra-cranial extension.

Absorbable Nasal Implant for Nasal Valve Reconstruction / Treatment of Nasal Valve Weakness

According to the manufacturer, the Latera nasal implant is used to support upper and lower lateral cartilage in the nose, reinforcing the nasal wall like traditional cartilage and polymer grafts. Supporting the cartilage in this manner is intended reduce nasal airway obstruction symptoms and help patients breathe better. The Latera implant is absorbed over a period of about 18 months.

Hernandez Martinez and colleagues (2016) stated that reparation of large nasal septum perforations continues to be challenging. Bipedicled mucoperichondrial and inter-positional grafts currently show the most promising results. New implants have emerged to be used as a support membrane to carry on the mucosal cells, taking advantage of the innate proliferative properties of the mucosal tissue. These researchers compared the effectiveness of 2 kinds of material: non-absorbable dimethylsiloxane (silicone elastomers) and absorbable porcine small intestinal submucosa (Surgisis), both used as an inter-positional graft without neighboring flaps to close nasal septal perforations in an experimental model. A total of 15 dogs were divided into 3 groups: One group received Surgisis, the other sheets of dimethylsiloxane and the last group a sham group. The dogs were followed for 6 weeks. The initial perforation of the nasal septum showed complete mucosal closure in the dimethylsiloxane group. The Surgisis group, on the other hand, had a smaller reduction than that at the beginning (final mean area = 23.0 ± 5.4 mm(2) ($p < 0.05$); however, complete closure was not achieved. Sham animals showed an inconstant and slight reduction in dimension from 100 mm(2) to 70 ± 16 mm(2) of mucosa and cartilage, but closure was not achieved. A significantly higher number of capillaries were observed in the Surgisis group compared to the dimethylsiloxane group ($p < 0.05$)

without differences in inflammation, fibrosis, or necrosis. The authors concluded that the non-absorbable implant; dimethylsiloxane facilitated a better closure of the nasal septum.

San Nicolo and associates (2017) evaluated the safety and effectiveness of an absorbable implant for lateral cartilage support in subjects with nasal valve collapse (NVC) with 12 months follow-up. A total of 30 subjects with Nasal Obstruction Symptom Evaluation (NOSE) score of greater than or equal to 55 and isolated NVC were treated; 14 cases were performed in an operating suite under general anesthesia, and 16 cases were performed in a clinic-based setting under local anesthesia. The implant, a polylactic acid copolymer, was placed with a delivery tool within the nasal wall to provide lateral cartilage support. Subjects were followed-up through 12 months post-procedure; 56 implants were placed in 30 subjects. The mean pre-operative NOSE score was 76.7 ± 14.8, with a range of 55 to 100. At 12 months, the mean score was 35.2 ± 29.2, reflecting an average within-patient reduction of -40.9 ± 31.2 points. The majority (76 %) of the subjects were responders defined as having at least 1 NOSE class improvement or a NOSE score reduction of at least 20 %. There were no adverse changes in cosmetic appearance at 12 months post-procedure; 3 implants in 3 subjects required retrieval within 30 days post-procedure and resulted in no clinical sequelae". The authors concluded that the findings of this study demonstrated safety and effectiveness of an absorbable implant for lateral cartilage support in subjects with NVC at 12 months post-procedure.

San Nicolo and colleagues (2018) noted that the safety and effectiveness of an absorbable implant for lateral cartilage support have been recently demonstrated in subjects with NVC at 12 months post-procedure (San Nicolo et al, 2017). This follow-up study examined if the safety and effectiveness of the implant persist in these patients for 24 months after the procedure. A total of 30 subjects with NOSE score of greater than or equal to 55 and isolated NVC were treated; 14 cases were performed in an operating suite under general anesthesia and 16 cases were performed in a clinic-based setting under local anesthesia. Subjects were followed-up through 24 months post-procedure; 56 implants were placed in 30 subjects. The mean pre-operative NOSE score was 76.7 ± 14.8, with a range of 55 to 100. At 24 months, the mean score was 32.0 ± 29.3, reflecting an average within-patient reduction of -44.0 ± 31.1 points.

There were no device-related adverse events (AEs) in the 12 to 24 months period. There were 5 subjects who exited the study prior to the 24-month follow-up; 4 of the 5 subjects who exited were elected for further intervention and 1 subject was lost to follow-up. The authors concluded that the findings of this study demonstrated safety of an absorbable implant for lateral nasal wall support and symptom improvement in some subjects with NVC at 24 months post-procedure. Moreover, these researchers stated that further studies with a larger sample size and additional concomitant procedures would be valuable. In addition, a trial beyond 24 months would be useful in understanding the longer term benefits of the implant.

In a prospective, multi-center, non-randomized, single-blinded study, Stolovitzky and co-workers (2018) examined 6-month outcomes for treatment of lateral nasal wall insufficiency with a bio-absorbable implant. A total of 101 patients with severe-to-extreme class of NOSE scores were enrolled at 14 U.S. clinics (September 2016 to March 2017). Patients were treated with a bio-absorbable implant designed to support lateral wall, with or without concurrent septoplasty and/or turbinate reduction procedure(s); NOSE scores VAS were measured at baseline and month 1, 3, and 6 post-operatively. The Lateral Wall Insufficiency (LWI) score was determined by independent physicians observing the lateral wall motion video. A total of 43 patients were treated with implant alone, whereas 58 had adjunctive procedures; 17 patients reported 19 AEs, all of which resolved with no clinical sequelae. Patients showed significant reduction in NOSE scores at 1, 3, and 6 months post-operatively (79.5 ± 13.5 pre-operatively, 34.6 ± 25.0 at 1 month, 32.0 ± 28.4 at 3 months, and 30.6 ± 25.8 at 6 months post-operatively; $p < 0.01$ for all). They also showed significant reduction in VAS scores post-operatively (71.9 ± 18.8 pre-operatively, 32.7 ± 27.1 at 1 month, 30.1 ± 28.3 at 3 months, and 30.7 ± 29.6 at 6 months post-operatively; $p < 0.01$ for all). These results were similar in patients treated with the implant alone compared to those treated with the implant and adjunctive procedures. Consistent with patient-reported outcomes, post-operative LWI scores were demonstrably lower (1.83 ± 0.10 and 1.30 ± 0.11 pre- and post-operatively; $p < 0.01$). The authors concluded that stabilization of the lateral nasal wall with a bio-absorbable implant improved patients' nasal obstructive symptoms over 6 months. Moreover, these investigators stated that the drawbacks

of this study included a single-arm study design with short-term follow-up (6 months); they stated that a randomized, placebo-controlled trial is needed.

An UpToDate review on "Clinical presentation, diagnosis, and treatment of nasal obstruction" (Bhattacharyya, 2018) does not mention Latera or nasal implant for rhinoplasty.

Furthermore, an UpToDate review on "Etiologies of nasal symptoms: An overview" (Wang, 2018) states that "External nasal valve weakness may be congenital or a result of traumatic injury. Correction of nasal valve weakness requires surgery using cartilage grafts to buttress and support the existing cartilage". However, there is no mention on the use of absorbable nasal implants.

Stolovitzky et al (2019) stated that dynamic NVC is a common factor contributing to nasal obstruction; however, it is often under-diagnosed and untreated. An in-office, minimally invasive procedure addressing dynamic NVC uses a bio-absorbable implant (Latera) to support the lateral nasal wall. In a prospective, multi-center, single-blinded, randomized controlled trial (RCT) with sham control, these researchers examined the safety and effectiveness of the treatment. This study included 137 patients from 10 clinics; subjects were randomized into 2 arms: treatment arm (70 patients) and sham control arm (67 patients). Outcome measures were followed through 3 months after the procedure. The primary end-point was the responder rate (percentage of patients with reduction in clinical severity by greater than or equal to 1 category or greater than or equal to 20 % reduction in NOSE score). Before the procedure, there were no statistically significant differences in patient demographics and nasal obstruction symptom measures between the 2 arms. Three months after the procedure, responder rate was significantly higher for the treatment arm compared to the control (82.5 % versus 54.7 %, $p = 0.001$). Patients in the treatment arm also had a significantly greater decrease in NOSE score (-42.4 ± 23.4 versus -22.7 ± 27.9, $p < 0.0001$) and significantly lower VAS scores (-39.0 ± 29.7 versus -13.3 ± 30.0, $p < 0.0001$) than the sham control arm; 17 patients reported 19 procedure/implant-related AEs, all of which resolved with no clinical sequelae. The authors concluded that this study showed the safety and effectiveness of the bio-absorbable implant in reducing patients' nasal

obstruction symptoms. These researchers stated that this study had several drawbacks. This study reported short-term follow-up data up to 3 months only. Furthermore, this was a single-blinded study in which all patients were blinded but physicians were aware of the assignment, which may have introduced risk of bias.

Furthermore, an UpToDate review on "Nasal obstruction: Diagnosis and management" (Bhattacharyya, 2020) does not mention absorbable nasal implant as a therapeutic option.

In a prospective, non-randomized, multi-center study, Sidle et al (2020) examined 12-month outcomes for in-office treatment of dynamic NVC with a bio-absorbable implant. A total of 166 patients with severe-to-extreme class of NOSE scores were enrolled at 16 U.S. clinics (November 2016 to July 2017). Patients were treated with a bio-absorbable implant (Latera) to support the lateral wall, with or without concurrent inferior turbinate reduction (ITR), in an office setting. NOSE scores and VAS were measured at baseline and 1, 3, 6, and 12 months post-operatively. The LWI score was determined by independent physicians observing the lateral wall motion video. A total of 105 patients were treated with implant alone, whereas 61 had implant + ITR; 31 patients reported 41 AEs, all of which resolved with no clinical sequelae. Patients showed significant reduction in NOSE scores throughout 12 months post-operatively (77.4 ± 13.4 baseline versus 36.2 ± 22.7 at 1 month post-operatively, 33.0 ± 23.4 at 3 months, 32.1 ± 24.6 at 6 months, and 30.3 ± 24.3 at 12 months; $p < 0.001$). They also showed significant reduction in VAS scores post-operatively (69.7 ± 18.1 baseline versus 31.3 ± 27.1 at 12 months post-operatively, $p < 0.001$). These findings were similar in patients treated with implant alone and those treated with the implant + ITR. Consistent with patient-reported outcomes, post-operative LWI scores were demonstrably lower (1.42 ± 0.09 and 0.93 ± 0.08 pre- and post-operatively, $p < 0.001$). The authors concluded that in-office treatment of dynamic NVC with a bio-absorbable implant improved clinical evidence of LWI at 6 months and improved nasal obstructive symptoms in a majority of patients up to 12 months. Moreover, these researchers stated that longer follow-up is needed to determine efficacy beyond 12 months. Level of Evidence = IIb.

The authors stated that this study had several drawbacks. This was a single-arm study comparing pre- and post-treatment measurements of symptoms. A future RCT should be considered to further examine the device efficacy. Follow-up for this study was limited to 12 months post-procedure. Previously, animal histology studies have shown that an implant of the same composition was absorbed over 18 to 24 months after implantation, and that, upon complete absorption, the implant was replaced with nodular bundles of mature collagenized fibrous tissue that may provide mechanical strength at the lateral wall. Thus, additional follow-up out to 24 months would be beneficial.

Brandon et al (2020) noted that internal nasal valve compromise is a major cause of nasal obstruction, with a growing number of ways to treat this condition. In a cadaveric study, these researchers compared the effects of butterfly graft, spreader graft, and the bio-absorbable nasal implant on nasal air-flow resistance. Computational fluid dynamics (CFD) simulations were completed from 9 pre-operative and post-operative cadaveric subjects. Each cadaveric head underwent placement of a bio-absorbable nasal implant (BNI) (Spirox Latera), butterfly graft, or spreader graft. Pre- and post-operative CT scans were used to generate three-dimensional (3D) models of the nasal airway used in steady-state CFD simulations of airflow and heat transfer during inspiration. Butterfly graft placement resulted in a mean improvement in nasal airway resistance of 24.9 % (± 7.3), whereas BNI placement resulted in a 6.7 % (± 1.2) improvement, and spreader graft placement also resulted in a consistent improvement of 2.6 % (± 13.5). Pressure within the main nasal cavity was consistently lower following butterfly graft placement versus a spreader graft or BNI. Butterfly and spreader graft placement also resulted in modest improvements in airflow allocation, whereas BNI demonstrated more variation (-1 % to 12 %). Heat flux was not significantly different; however, a small improvement in total heat flux was observed with all 3 interventions. The authors concluded that the findings of this study demonstrated reduction in nasal airway resistance in all 3 surgical interventions, with the butterfly graft demonstrating superiority to the other 2 techniques; however, these findings only reflected a static environment and not dynamic changes in airflow observed during respiration. Level of Evidence = NA.

Seyidova et al (2020) noted that persistent nasal airway obstruction (NAO) due to mid-vault soft tissue collapse in patients following rhinoplasty or nasal surgery is a clinical challenge for surgeons. An absorbable lateral nasal wall implant is one option available to help treat mid-vault soft tissue collapse and to improve NAO symptoms. Previous studies have not examined its use in complex revision functional rhinoplasty with respect to patient-reported outcomes. Data were collected on all patients with a history of previous nasal procedures who underwent Latera implant placement in conjunction with functional rhinoplasty from January to December 2018. The NOSE and VAS were used to evaluate functional outcomes. A total of 8 implants were placed in 6 revision functional rhinoplasty patients with mid-vault collapse. All patients responded to the survey. Mean follow-up was 16 ± 4 months. There were no implant-related AEs. Mean NOSE score was 33 ± 33, and mean VAS score was 20 ± 9. In total, 1 patient reported complete resolution of NAO, whereas 2 patients reported mild, 1 reported moderate, 1 reported severe, and 1 reported extreme symptoms; 4 of the 6 patients reported nasal obstruction improvement, with all reporting improvement in mid-vault soft tissue collapse. Apart from being used in nasal valve collapse treatment, a lateral nasal wall implant is a potentially useful solution that may help surgeons improve patients' NAO symptoms in complex functional rhinoplasty cases. However, in certain cases, a patient's nasal obstructive symptoms may continue to be multi-factorial.

Kim et al (2020) stated that nasal obstruction is a common cause of breathing problems with lateral wall insufficiency (LWI) a key anatomic contributor. Recently, a bio-absorbable nasal implant was introduced to correct LWI and treat nasal obstruction. In a systematic review with meta-analysis, these researchers examined the effectiveness of the bio-absorbable nasal implant for treating nasal obstruction caused by LWI. A total of 5 databases (PubMed, SCOPUS, Embase, Web of Science, and the Cochrane Database) were independently reviewed by 2 researchers, starting at the earliest time-point recorded in the database to September 2019. Studies that scored endoscopic lateral wall movement and nasal obstruction related to quality of life (QOL) post-operatively before and after bio-absorbable nasal implants and those that compared the outcomes of nasal implants (treatment group) with outcomes of sham surgery (control group) were included in the analysis. A total of 5 studies (396 patients) met the inclusion criteria. Bio-absorbable nasal implants

significantly reduced endoscopic lateral wall motion compared to pre-treatment values and also improved QOL at 12 months post-operatively. Most adverse effects following the nasal implant, such as skin or mucosal reaction, infection, or implant retrieval, were reported with a 5 % incidence rate. All adverse outcomes were resolved without significant sequelae. Compared with sham surgery, bio-absorbable nasal implants significantly improved disease-specific QOL. The authors concluded that bio-absorbable nasal implants may reduce nasal wall movement and subjective symptom scores compared to pre-operative status; however, these researchers stated that more randomized clinical trials must be conducted to further verify the effectiveness of bio-absorbable nasal implants.

Sidle et al (2021) reported outcomes after treatment of NVC with a bio-absorbable nasal implant. It involved 2 prospective, multi-center, post-market studies evaluating long-term effectiveness of the Latera implant for severe-to-extreme nasal obstruction. Subjects underwent implant alone or with concomitant ITR and/or septoplasty. Outcome measures included the change from baseline NOSE scores, NOSE responder rates, VAS scores, and AEs. A total cohort of 277 subjects (109 implants only, 67 implants + ITR, 101 implants + septoplasty + ITR) enrolled at 19 U.S. centers was available for analysis with 177 subjects (69 implants only, 39 implants + ITR, 69 implants + septoplasty + ITR) available at 2 years. The mean changes from baseline in NOSE scores and VAS scores were statistically significant ($p < 0.001$) at all follow-up periods . The baseline NOSE score of 77.8 ± 13.6 was improved to 24.2 ± 23.6 at 24 months. Greater than 90 % of subjects were NOSE responders across all follow-up periods, 6.1 % withdrew for lack of treatment effect. The baseline VAS score of 66.7 ± 18.8 was improved to 21.1 ± 23.9 at 24 months. There were no serious AEs related to the device or implant procedure. Implant retrieval rate was 4.0 % (22/543 implants). Non-serious AEs were mild-to-moderate in severity, typically occurred within 6 months of implant, and resolved or were stable. Significant reductions in NOSE and VAS scores and high responder rates from the large population of patients with nasal obstruction who had nasal valve implants confirmed sustained effectiveness at 24 months after treatment.

The authors stated that the lack of a control group was the principal limitation of this study. Although these were single-arm studies comparing pre-treatment with post-treatment outcomes within patient, a recent RCT (Stolovitzky et al, 2019) has demonstrated the superiority of the implant over a sham procedure for the treatment of NVC. 2nd limitation of this study was that the initial study design only included follow-up through 12 months. The long-term follow-up amendment required additional consent and resulted in some loss to follow-up at long-term visits. Furthermore, 2 patients withdrew due to implant retrieval before any follow-up data were obtained. To address this limitation, a worst-case sensitivity analysis was performed. The analysis showed that significant symptom improvement persisted under these extremely conservative imputation assumptions. Thus, despite the loss to follow-up, these investigators believed the 24-month results were reliable.

Furthermore, an UpToDate review on “Nasal obstruction: Diagnosis and management” (Bhattacharyya, 2021) does not mention Latera / bio-absorbable nasal implant as a management / therapeutic option.

Bikhazi et al (2022) reported the long-term safety and effectiveness of the treatment and cross-over arms of a randomized controlled trial (RCT) examining an absorbable nasal implant to address dynamic nasal valve collapse. Subjects were adults with severe/extreme nasal airway obstruction primarily due to nasal valve insufficiency who had implant placement. Follow-up visits were at 3-, 6-, 12-, 18-, and 24-month post-implant. Visits included collection of the following patient-reported outcome measures (PROMs): nasal obstructive symptom evaluation (NOSE), nasal obstruction visual analog scale (VAS), and the Epworth Sleepiness Scale (ESS). Adverse events (AEs) were evaluated at each visit. A total of 111 subjects with implants were followed. Of the 111, 90 completed the 12-month visit and 70 completed the 24-month visit.. NOSE responder rates were greater than 80 % at all follow-ups through 24 months. Mean reduction from baseline in NOSE scores was 30 points or more and statistically significant ($p < 0.001$) at all time-points through 24 months. Mean VAS score reduction was 29.7 points or higher and statistically significant ($p < 0.001$) at all time-points. The subgroup of subjects with baseline ESS values of greater than 10 experienced statistically significant ($p < 0.001$) and clinically meaningful reductions at all post-implant periods, suggesting that the reduction in nasal symptoms

may reduce daytime sleepiness for patients who have problems with sleep quality. No serious device-/procedure-related AEs were reported. Implant migration/retrieval rate was 4.5 % (10/222) of total implants or 9 % of subjects (10/111). The authors concluded that the implant was safe and effective for dynamic nasal valve collapse in patients with severe/extreme nasal obstruction and provided durable symptom improvement 24 months after placement.

The authors stated that study limitations included the lack of long-term follow-up of the control arm, significant loss of subjects to follow-up at 18 and 24 months, and a lack of objective assessment of nasal valve collapse. Subjects who had received the sham procedure and continued to meet all inclusion criteria could cross-over to the treatment arm at 3 months. As noted, 40 of the 66 sham subjects crossed-over to the treatment group. By study design, the 26 remaining sham subjects exited from the study after 3 months. Once the initial, 3-month randomized comparison established that the treatment arm was superior to the sham arm, the study designers/authors felt it would be unethical to continue long-term follow-up of the sham subjects without allowing the remaining subjects who still met inclusion criteria the opportunity to cross-over to the treatment arm. While this lack of long-term follow-up of the control arm may be seen as a limitation of the study, it was unlikely that any placebo effect that was not noted during the initial 3-month interval would have presented in later months. The loss of treatment subjects at 18 and 24 months, which was due in part to the coronavirus-19 pandemic (COVID-19) of 2020, also presented a limitation to the study. A last observation carried forward (LOCF) analysis was carried out to examine the impact of subject drop-out over time. To address concerns regarding the validity of the long-term analysis with LOCF, a worst-case scenario analysis was also carried out, that validated the findings of the LOCF analysis. This trial employed subjective patient assessments of nasal obstruction to examine treatment outcome effect. A more objective evaluation of nasal valve collapse, such as computed calculation of change in area of the nasal valve through endoscopic video or photo could be considered in future studies. While that type of objective analysis of nasal valve response would provide valuable data, validated patient symptom scores are useful, especially when counseling patients on potential treatment outcome/expectations. Lastly, a notable limitation of this study was an uneven distribution of subject of varying race or ethnicity. While the

enrolled population of non-White subjects was low at 14 %, significant attempts were made in the study design to find a diverse population, such as the inclusion of 10 clinical sites across multiple geographies. While all attempts to find a diverse population were made, inherent bias toward White subjects may exist. Previous studies have demonstrated racial differences in nasal anatomy that may contribute to under-representation of some ethnic groups. For example, Morgan et al (1995) demonstrated that Blacks have a larger minimum cross-sectional area (CSA) as well as less nasal resistance in comparison to Caucasians; therefore, may be less likely to need nasal surgery. Furthermore, to nasal anatomy variations, differences in cultural views toward surgery, or inequality in clinician attitude may influence the ethnic subsets enrolled in studies such as in this.

Kim et al (2020) stated that nasal obstruction is a common cause of breathing problems with lateral wall insufficiency (LWI) a key anatomic contributor. Recently, a bio-absorbable nasal implant was introduced to correct LWI and treat nasal obstruction. In a systematic review and meta-analysis, these researchers examined the effectiveness of the bio-absorbable nasal implant for treating nasal obstruction caused by LWI. A total of 5 databases (PubMed, SCOPUS, Embase, Web of Science, and the Cochrane Database) were independently reviewed by 2 researchers, starting at the earliest time-point recorded in the database to September 2019. Studies that scored endoscopic lateral wall movement and nasal obstruction related to QOL post-operatively before and after bio-absorbable nasal implants and those that compared the outcomes of nasal implants (treatment group) with outcomes of sham surgery (control group) were included in the analysis. A total of 5 studies (396 patients) met the inclusion criteria. Bio-absorbable nasal implants significantly reduced endoscopic lateral wall motion compared to pre-treatment values and also improved QOL at 12 months post-operatively. Most adverse effects following the nasal implant, such as skin or mucosal reaction, infection, or implant retrieval, were reported with a 5 % incidence rate. All adverse outcomes were resolved without significant sequelae. Compared with sham surgery, bio-absorbable nasal implants significantly improved disease-specific QOL. The authors concluded that bio-absorbable nasal implants may reduce nasal wall movement and

subjective symptom scores compared to pre-operative status. Moreover, these researchers stated that more RCTs must be carried out to further verify the effectiveness of bio-absorbable nasal implants.

The authors stated that although this study offered supporting evidence for the use of a bio-absorbable implant in patients with nasal valve collapse due to LWI, the number of enrolled studies (and patients) and short follow-up periods limited the generalizability of these findings. These investigators stated that larger, comparative studies or well-designed RCTs with outcomes based on validated PROMs are still needed to provide more definitive recommendations.

Furthermore, an UpToDate review on "Etiologies of nasal symptoms: An overview" (Wang, 2023) states that "The most common cause of internal nasal valve weakness is iatrogenic, resulting from overzealous cartilage resection during rhinoplasty. The internal nasal valve may also be weakened by nasal trauma. External nasal valve weakness may be congenital or a result of traumatic injury. Correction of nasal valve weakness requires surgery using cartilage grafts to buttress and support the existing cartilage. A synthetic, bio-absorbable spreader graft implant has also been found to be effective in correcting nasal valve weakness [Kim et al, 2020]".

Wilkins et al (2023) noted that bio-absorbable implants (e.g., Latera) have recently been approved for addressing NVC. These researchers summarized AEs and treatment sequelae associated with bio-absorbable nasal implants queried in the Manufacturer and User Facility Device Experience (MAUDE) database. Of the 26 device reports entered between March 2017 and April 2022, the most frequently reported complications included abscess (n = 13) and implant protrusion (n = 5). Other common symptoms reported greater than 1-year post-implantation included facial pain/discomfort (n = 3) and failure to absorb (n = 3). Management of AEs included treatment with antibiotics (n = 9), steroid injections (n = 4), and explantation (n = 20). In 3 reports, adverse reactions required a biopsy of adjacent tissue for pathologic analysis. The authors concluded that these findings suggested that further investigation is needed to evaluate the potential long-term complications

and optimize the management of bio-absorbable nasal implants. In addition, standardized reporting templates may improve the utility of the MAUDE database.

In a retrospective, cohort study, Vo et al (2024) compared all-cause claims associated with the Latera absorbable nasal implant and surgical repair of nasal vestibular stenosis in patients with NVC. These investigators used data from STATinMED RWD Insights. A defined set of HCPCS, ICD-10-CM and CPT codes were employed to identify patients with 1 or more claim for a Latera procedure, and patients with 1 or more claim for surgical repair between June 1, 2015 and March 31, 2023. Patients with continuous capture for at least 12 months before and at least 6 months after the index date were selected. The index date was defined as earliest date of encounter for a Latera or surgical repair procedure. Inverse probability of treatment weighting (IPTW) was used to ensure balance between cohorts. Descriptive analyses were provided for all claims data using standard summary statistics. All-cause claims were assessed during the baseline, index date, and follow-up period. Chi-squared tests and independent sample t-tests were used to examine differences in cohorts for categorical and continuous variables, respectively. The study population included 5,032 Latera patients and 26,553 surgical repair patients. During the baseline and follow-up periods, the matched cohorts exhibited similar all-cause claims. On the index date, Latera patients incurred lower claims versus surgical repair, likely due to Latera's ability to be implanted in the physician office setting. Latera patients and surgical repair patients mean (SD) total costs were $9,612 [$14,930] versus $11,846 [$17,037] ($p \leq 0.0001$), respectively. The authors concluded that treatment with the Latera absorbable nasal implant was a potentially cost-saving option for payers on the index date compared to traditional surgical repair in patients with NVC due to the ability to be carried out in the office setting. All-cause claims were similar in the baseline and follow-up periods. When performed with concomitant procedures, all-cause claims during follow-up were similar between groups. Moreover, these researchers stated that the overall economic impact of innovative therapeutic options such as Latera have yet to be analyzed. Various studies have examined the effect of absenteeism and socioeconomic benefit of less invasive care. For example, patients were able to recover faster and return to work earlier, increasing productivity and decreasing healthcare resource

utilization as compared to more complex and invasive procedures. In an era of healthcare consumerism and employer-based insurance environments, less or minimally invasive procedures may be preferred by both patients and employers. These investigators stated that recommendations for future research include using only data from 2021 on for a uniform Latera CPT code, analyzing NAO-specific related resource utilization and costs, and the greater economic impact of NAO treatment.

An UpToDate review on "Etiologies of nasal symptoms: An overview" (Wang, 2024) stated that "The most common cause of internal nasal valve weakness is iatrogenic, resulting from overzealous cartilage resection during rhinoplasty. The internal nasal valve may also be weakened by nasal trauma. External nasal valve weakness may be congenital or a result of traumatic injury. Correction of nasal valve weakness requires surgery using cartilage grafts to buttress and support the existing cartilage. A synthetic, bioabsorbable spreader graft implant has also been found to be effective in correcting nasal valve weakness [Wang et al, 2020]".

Concentrated Growth Factors Extracted from Blood Plasma for Repair of Nasal Septal Mucosal Defect Following Rhinoplasty

Zhao and colleagues (2020) examined the effect of concentrated growth factor (CGF) for repair of nasal septal mucosal defect following rhinoplasty. A total of 10 women with mucosal defects of the nasal septum were enrolled from May 2017 to May 2018. Liquid and gel CGF was prepared from each patient's blood sample using a Medifuge system, including benchtop centrifuge. After debridement of the defect, the prepared liquid CGF was injected around the wound, and a membranous CGF film was applied to the surface. Vaseline gauze was used to pack the nostrils. All patients were treated with CGF at intervals from 3 to 5 days. After 3 to 12 treatments, all the patients achieved successful repair of the nasal septal mucosal defect, with good appearance and function. During a follow-up of 3 to 6 months, no recurrence was observed. The authors concluded that CGF appeared to have great curative effect for patients with nasal septal mucosal defects following rhinoplasty. Level of Evidence = IV. These preliminary findings needed to be validated by well-designed studies.

Rhinoplasty and External Nasal Splinting

Challita and colleagues (2019) noted that rhinoplasty is a common and challenging procedure. Lateral osteotomy is routinely performed in most cases. Most of the surgeons have the habit of applying external nasal splints to stabilize the nasal tissues and bone in their new position post-rhinoplasty. These splints are widely used despite the absence of any evidence supporting this practice. Moreover, these splints have a lot of disadvantages, thus, these researchers examined the cosmetic result in their absence. A retrospective, cross-sectional study was carried out. Medical records of 211 patients operated on for rhinoplasty by the same surgeon from 2015 to 2017 were reviewed. All patients were operated using open technique. After surgery, a Steri-Strips dressing with an overlying layer of surgical tape was applied to the nose without the use of an external nasal splint. Most of the patients were followed-up for 18 months. Complication rates, revision rates, and nasal bone widths were recorded. Complication rates and revision rates were as follows: skin infection = 0.99 %, skin necrosis = 0.99 %, and secondary revision = 3.48 %. Finally 79.6 % of patients had a decrease in their nasal bone width post-surgery. The authors concluded that based on the present study, external nasal splinting post-rhinoplasty should not be routinely used. Satisfactory cosmetic results could be obtained while avoiding the complications, cost, and bulky dressings associated with external splints. These researchers stated that a causal relationship could not be assessed due to the absence of a control group. Therefore, RCTs comparing the outcome with and without splinting post-rhinoplasty are needed to determine if external nasal splints are really a must.

Ablation of Septal Swell Bodies for the Treatment of Nasal Obstruction, Chronic Rhinitis, or Chronic Sinusitis

Wotman and Kacker (2015) noted that the nasal septal swell body (NSB) is a distinct structure of the anterior nasal septum. Comprised of septal cartilage, bone, and a thick mucosal lining, the NSB is visible on endoscopic examination and radiographic study. However, it receives little attention in the clinical setting and can be confused with high septal deviation. Based on anatomical and histological evidence, investigators theorize that the NSB plays an important role in nasal airflow regulation and humidification. These investigators examined if otolaryngologists

should pay more attention to this structure, especially as it relates to nasal obstruction? The authors concluded that according to the current literature, the NSB possesses venous sinusoids and seromucinous glands, is located in or near the distal segment of the internal nasal valve, is common in patients with symptoms of chronic sinusitis, and is linked to septal deviation and allergic rhinitis; thus, otolaryngologists should pay more attention to this structure, especially as it may play a role in regulating nasal airflow and humidifying inspired air. The studies analyzed in this review were of level III evidence.

Catalano and colleagues (2015) stated that anatomic etiologies of nasal obstruction (NO) include septal deviation, turbinate hypertrophy, and nasal valve collapse. These investigators have also noted that NSB are very common and can produce a significant effect on nasal resistance. They examined changes in validated outcome metrics following surgical reduction of NSB. A total of 60 consecutive patients (38 men: 22 women) were enrolled after persistent NO following septoplasty, turbinate reduction and internal nasal valve repair. Clinical history and nasal endoscopy confirmed prominent NSB. Evaluation of treatment effect was determined by changes in the NOSE scale and a newly developed NSB grading scale before, and 6 months after swell body ablation in the office setting using Coblation. NSB grades were based on endoscopic visualization of the middle turbinate (MT): 1 = greater than 50 % MT visualized; 2 = less than 50 % MT visualized; 3 = no MT visualized. Patient data were scored and transferred for analysis using Prism6 Graph Pad software. Subjects in this study had a mean age of 48 years (range of 19 to 71) and were followed for 3 and 6 months. The mean pre-operative NOSE score was 41.6 and mean NSB grade was 2.5. At 3 months, the mean post-operative NOSE score was 17 with NSB grade of 1. At 6 months, the NOSE score was 21 and the NSB grade was 1.2 ($p < 0.05$); therefore, statistically significant improvement in NOSE scores and standardized NSB grading was noted at 3 and 6 months post-Coblation of NSB tissue. There was 1 asymptomatic small septal perforation noted, and 5 patients needed re-treatment at 6 months. The authors concluded that Coblation reduction of NSB was a new, safe and effective office-based therapeutic option for the correction of refractory NO.

The authors stated that radiofrequency ablation (RFA) has become an accepted method for tissue reduction in the inferior turbinate in the office setting under local anesthesia, thus this technique was slightly modified for treatment of the NSB. The long-term efficacy of this procedure (greater than 2 years) has not yet been studied, as the procedure is new and follow-up time reported was limited to 6 months. These researchers did see the need to retreat 5/60 patients after 6 months due to the presence of new NSB, either contralateral to the treated side, or anterior to the original NSB on the ipsilateral side. All 5 patients were previously diagnosed with vasomotor rhinitis, a well-known vasoactive disease process. In general, one might postulate that the durability of NSB RFA would mirror RFA of the inferior turbinate since the vasoactive tissues are similar, but this is yet unproven. These researchers stated that further studies to demonstrate the long-term effectiveness of this treatment are needed and underway, yet this simple procedure has yielded significant improvements in their patient population, and is an important adjunct to any nasal airway procedure in patients with obstructive sleep apnea, snoring, allergic rhinitis, and other types of NO.

In a retrospective study, Kim and associates (2016) presented the preliminary findings of Coblation NSB reduction for the treatment of NO in patients with abnormally thickened NSB. The trial was carried out at a single tertiary medical center; 8 patients underwent Coblation NSB reduction. Pre-operative and post-operative nasal functions were evaluated by acoustic rhinometry and subjective symptom scales. These investigators also analyzed pre-operative CT scan images and nasal endoscopic findings. The mean maximal NSB width was 16.4 ± 2.2 mm on pre-operative coronal CT scan images. The mean visual analog scale (VAS) score for NO was decreased from pre-operative 7.63 ± 0.99 points to 3.88 ± 0.92 points (post-operative 3 months), 4.16 ± 0.78 points (post-operative 6 months), and 4.63 ± 0.69 points (post-operative 1 year); 6 of the 8 patients were satisfied with the clinical outcome at 1 year after the procedure. The authors concluded that to the best of their knowledge, Coblation NSB reduction has not yet been reported in the medical literature; these preliminary findings showed that it could be an effective therapeutic option for nasal valve narrowing in patients with abnormally thickened NSB. These findings need to be validated by well-designed studies.

Pyriform Aperture Reduction (Pyriform Turbinoplasty) for the Treatment of Nasal Obstruction

Silva Merea and associates (2015) noted that congenital pyriform aperture stenosis (CPAS) is a form of nasal obstruction caused by congenital narrowing of the maxilla at the medial processes. Traditionally, surgical correction involves a sub-labial approach with sub-periosteal dissection, widening of the aperture by drilling, and the use of nasal stents post-operatively. Although this approach may lead to symptomatic improvement, it alone may fail to provide a patent airway secondary to unaddressed posterior narrowing. Additionally, the use of stents was problematic because they were prone to clogging and could cause internal nasal scarring and septal or alar necrosis. In a retrospective chart review, these researchers presented the surgical management of this condition in 6 patients using a novel approach that aimed to correct these limitations by including both the traditional sub-labial procedure and an endo-nasal reduction of the inferior turbinates, without the use of stents post-operatively. A review of the medical records of 6 consecutive patients aged 2 weeks to 7 months, who underwent repair of CPAS via a sub-labial ostectomy and endo-nasal inferior turbinate reduction from 2009 to 2012 was performed. All 6 patients were cleared of airway obstruction post-operatively and at follow-up. The authors concluded that this was an alternative approach that led to symptomatic improvement for CPAS patients without the morbidity associated with stent use. Level of evidence = IV.

Simmen and co-workers (2015) described a new procedure, pyriform turbinoplasty; and nasal airflow was measured before and after this procedure in a virtual model. Pyriform turbinoplasty is the submucosal reduction of the bone of the frontal process of the maxilla and the lacrimal bone. It opens part of the lateral margin of the nasal valve area with minimal damage to nasal mucosa. The resection of bone in this area could be extended by "nasal wall lateralization" when the lacrimal bone that joins the uncinate process behind the lacrimal duct as well as the base of the inferior turbinate and the edge of the maxilla at the rim of the pyriform aperture are removed. Nasal airflow was simulated using computational fluid dynamics and ANSYS Fluent solver. Analysis using fluid dynamics showed that these procedures help ventilation in the main airflow areas without substantially altering the normal pattern of airflow.

The authors concluded that changes after performing a pyriform turbinoplasty appeared to be an improvement when compared to the changes after inferior turbinate surgery that could misdirect the airflow largely through the inferior meatus.

Furthermore, an UpToDate review on "Nasal obstruction: Diagnosis and management" (Bhattacharyya, 2020) does not mention pyriform aperture reduction (pyriform turbinoplasty) as a therapeutic option.

Balloon Septoplasty is for the Treatment for Nasal Fracture and Septal Deviation

UpToDate reviews on “Initial evaluation and management of facial trauma in adults” (Mayersak, 2021), “Nasal trauma and fractures in children and adolescents” (Mendez and Lapointe, 2021), “Assessment and management of facial lacerations” (Hollander, 2021) “Patient education: Nose fracture (The Basics)” (Written by the doctors and editors at UpToDate, 2021), “Nasal obstruction: Diagnosis and management” (Bhattacharyya, 2021), and “Patient education: Deviated septum (The Basics)” (Written by the doctors and editors at UpToDate, 2021) do not mention balloon septoplasty as a management / therapeutic option.

Septoplasty with Turbinate Reduction for Nasal Obstruction Due to Deviated Nasal Septum

Bin Lajdam et al (2022) stated that compensatory inferior turbinate hypertrophy is a common accompanying manifestation in patients with nasal obstruction due to deviated nasal septum (DNS). The grounds for inferior turbinate reduction (ITR) in this population are still not well established. In a systematic review and meta-analysis, these investigators examined the safety and effectiveness of septoplasty with ITR versus septoplasty alone. They carried out computerized search in Medline, Embase, and CENTRAL. Eligible for inclusion were RCTs comparing septoplasty to septoplasty with unilateral, contralateral, ITR in adults with DNS. Primary outcomes were health-related QOL (HR-QOL) and nasal patency. The secondary outcome was the occurrence of AEs; standardized mean differences (SMD) and odds ratios (OR) with 95 % confidence intervals (CIs) were calculated. A total of 12 RCTs that enrolled 775 subjects were found eligible. Data were reported at follow-

up periods ranging from 1 month to 48 months. The pooled effect estimate showed a statistically significant improvement with unilateral, contralateral, ITR in NOSE scores. The rate of AEs was significantly higher with ITR. The authors concluded that unilateral reduction of the hypertrophied contralateral inferior turbinate during septoplasty resulted in better subjective relief of nasal obstruction in adults with DNS than septoplasty alone. However, caution is needed since only few well-designed RCTs were identified.

Furthermore, an UpToDate review on "Nasal obstruction: Diagnosis and management" (Bhattacharyya, 2022) states that "Nasal septal deviation -- Septoplasty is the definitive treatment in patients with nasal obstruction due to septal deviation. Reported rates of long-term efficacy vary, but one study reported that septoplasty was successful in reducing nasal symptoms in up to 89 % of patients". However, this UpToDate review does not mention the use of inferior turbinate reduction as an adjunctive treatment for nasal obstruction due to septal deviation.

Use of Autologous Cartilage / Diced Cartilage Wrapped with Blood Products in Rhinoplasty

Wu et al (2022) noted that rhinoplasty is one of the most common operations in plastic and aesthetic surgery. Both solid silicone material and autologous cartilage (AC) tissue have their individual advantages and disadvantages. In a meta-analysis, these investigators examined the effectiveness, complication rate of rhinoplasty with AC and silicone material. They searched Medline, Embase, PubMed, China National Knowledge Infrastructure (CNKI) and Wanfang by rapid matching of keywords to obtain RCTs related to AC rhinoplasty or silicone filled rhinoplasty, which were analyzed using the software Stata 16.0 after screening and quality assessment. A total of 1,233 patients undergoing rhinoplasty from 7 articles were included in the study. Meta-analysis showed that rhinoplasty with AC would gain more satisfaction (risk ratio [RR] = 1.11; 95 % CI: 1.02 to 1.21; Z = 2.413; p = 0.016); would reduce the complication rate [RR = 0.34; 95 % CI: 0.22 to 0.52; Z = -5.010; p < 0.0001); and resulting in less secondary surgery rate [RR = 0.34; 95 % CI: 0.18 to 0.64; Z = -3.363; p = 0.001] comparing to silicone prosthesis (SP) material. The authors concluded that in rhinoplasty, the use of AC material resulted in more satisfaction, had less total complication rate,

and led to less secondary surgery rate than SP material. However, these researchers stated that based on the heterogeneity and publication bias in the included studies, this topic still needs to be further examined by including more high-quality RCTs in clinical practice.

Dong et al (2022) stated that diced cartilage has been widely used in rhinoplasty, especially for segmental dorsal augmentation, with favorable outcomes over time. Various techniques were developed to increase both stability and viability of diced cartilage, including wrappings with non-blood material/blood products and changing the shapes of the diced cartilage, while the optimal technique is inconclusive. In a systematic review, these investigators examined the current strategies of diced cartilage technique for rhinoplasty, emphasizing the value of various wrapping materials. Free diced cartilage has a potential risk of gathering in certain regions and causing post-operative irregularities. Among non-blood wrapping materials, Surgicel is now rarely used due to severe foreign body reactions. The obvious drawbacks of fascia are donor site morbidity, inadequate quantity, and time-consuming. Although diced cartilage wrapped in tutoplast-processed fascia lata, AlloDerm, or esterified hyaluronic acid (HA) has achieved primary encouraging results, the increased inflammation raised controversies regarding their clinical use. The authors stated that diced cartilage wrapped with blood products (e.g., concentrated growth factor, or platelet-rich fibrin) achieved long-term reliable aesthetic results, and shaved cartilage and ultra-diced cartilage have recently shown satisfactory clinical outcomes. However, further investigation is still needed. Level of Evidence = IV.

Nasal Septal Button for Non-Surgical Closure of Septal Perforations

Taylor and Sherris (2015) noted that prosthetics serve as an option for the treatment of naso-septal perforation in patients who have active systemic disease, are poor surgical candidates, or wish to avoid surgery. These investigators carried out a systematic review of the literature on prosthetics for naso-septal perforation treatment. They examined previous studies, assessed the success rate for naso-septal prosthetics, provided evidence-based guidelines for naso-septal prosthetic use, and identified areas for further investigation. Data sources included Cochrane Controlled Trials Register, Embase, PubMed, and Web of Science. Data sources were queried for relevant articles published from 1965 to 2013.

Studies were selected for inclusion if they presented primary data for human naso-septal perforation treatment employing prosthetic materials. Each included study's level of evidence and risk of bias were identified; and grades of recommendation were assigned. A quantitative meta-analysis was carried out on studies with low risk of bias. The search yielded 4,756 abstracts for review, with 23 included case series and 5 case reports; 706 total cases of prosthetic naso-septal perforation treatment were identified. All studies provided level 4 evidence, with an overall conclusion grade of C for improvement in naso-septal perforation symptoms, prosthetic in-situ rate, and complication rate. Meta-analysis of 6 low-risk-of-bias studies with 297 patients showed an overall success rate of 65 %. The authors concluded that the literature provided level 4 evidence for the safety and effectiveness of prosthetics for naso-septal perforation treatment with favorable success rates and few reports of complications (only 1 fungal infection and 9 unspecified infections) in 706 cases.

Zaoui et al (2016) stated that perforations of the nasal septum could be very disturbing for patients due to increased crust formation, nose bleeds, obstruction of nasal breathing and whistling sounds during nasal breathing. In a retrospective study, these researchers examined how the symptom burden could be alleviated by custom-made silicone buttons derived from an impression mold. This trial was performed to evaluate 45 patients with symptomatic septal perforations, who have been treated over a period of 8 years. The magnitude and localization of the perforations were measured on the impression molds as well as in-situ in 28 patients. The symptoms were rated on a VAS before and after treatment (response 64 %). No correlation was found between the size of the perforation and the distance from the nasal opening. Of the patients 31 (69 %) still had the septal button in-situ at the time of the last follow-up. The magnitude and localization of the perforation were not found to be predictors of treatment success. The following symptoms showed a highly significant improvement: crust formation (VAS median 75 versus 31), nose bleeds (VAS median 50 versus 0), obstruction of nasal breathing (VAS median 84 versus 14) and whistling breathing sounds (VAS median 69 versus 0). Unpleasant odor and symptoms of sinusitis did not show significant changes. The long-term septal button carriers

rated the improvement with a median of 91 % on the VAS. The authors concluded that the majority of patients were extremely satisfied because the symptom burden could be markedly reduced.

Non-Surgical Correction of Surgical Rhinoplasty Complications with Hyaluronic Acid Fillers

Harb and Abdul-Razzak (2024) noted that surgical rhinoplasty is a highly complex cosmetic procedure with significant revision rates. Unfortunately, surgical revision rhinoplasty is associated with many challenges. Non-surgical correction of surgical rhinoplasty complications with injectable hyaluronic acid (HA) fillers is an alternative with less cost and down-time. In a retrospective chart review, these investigators presented their experience with 2,088 cases of non-surgical revision rhinoplasty, including technical considerations, patient-reported outcomes (PROs), and AEs. This review was completed on patients 18 years of age or older who received non-surgical rhinoplasty treatment between March 2018 and August 2022. Patient demographic data, and data on indications for treatment, volume of filler used, patient-reported satisfaction, and AEs (including erythema, infection, vascular occlusion, and necrosis) were collected up to 1 year after the initial injection. A total of 2,088 patient cases were included in this study. The most common indications for treatment included bridge collapse or asymmetry (49.0 %), an under-projected tip (44.0 %), and surface irregularity/scarring (35.4 %). The mean volume of filler used at initial treatment was 0.49 ml (SD 0.19). Median patient satisfaction immediately after treatment was 9 (VAS ranging from 1 to 10). The most common AE reported at the 2-week follow-up was erythema (36.4 %). A total of 3 patients presented with skin necrosis (0.47 %); all 3 of these complications were transient and self-resolving. The authors concluded that non-surgical correction of rhinoplasty complications with HA fillers could be a safe, minimally invasive option with high patient satisfaction and immediate and predictable results. These investigators stated that this approach should be tried first before surgical revision.

Glossary of Terms

Term	Definition
Epistaxis	Nosebleed
Pyriform aperture	Anterior opening of the nasal cavity in the skull
Swell body	A widened region of the nasal septum located superior to the inferior turbinates and anterior to the middle turbinates

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