

Semi-wrapping lateral cartilage to a square edged strut perpendicularly to prevent collapse in external nasal valve dysfunction: pseudodome technique

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ABSTRACT

Objectives: During inhalation through the nose, the weakness of lateral cartilage may cause the collapse of nasal vestibule and sidewall, causing the complaint of difficult breathing through the nose. We aimed to support the lateral cartilage with a square edged strut to resolve this problem.

Methods: We described a technique in 8 cases (5 males, 3 females). In this technique the lateral cartilage is semi wrapped from the underside to a square edged strut, and arched to outside with an open approach rhinoplasty. As it was only a physical support and did not create a new canting up through the skin, we named this maneuver as *pseudodome* technique.

Results: All patients experienced relief of symptoms and no complications observed. The reinforcement effect of the strut was effective in preventing collapse of the nasal alar sidewall as well as did not cause contour irregularities.

Conclusions: *Pseudodome* technique can be performed for acquired or congenital nasal sidewall collapse caused by lower lateral cartilage structural weaknesses successfully.

Keywords: .nasal valve, lateral cartilage, *pseudodome* technique, open approach rhinoplasty

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Nasal septum, lateral nasal walls, and nasal mucosa interact as static and dynamic forces during the nasal breathing. The most important variable in nasal airflow for a patient with nasal obstruction is the diameter of the nasal passage.

The term nasal valve was introduced by Mink in 1903 [1]. It is divided into external and internal portions. Internal nasal valve is located in the area of transition between the skin and respiratory epithelium. It is the narrowest part of the nasal passage, and often referred to as the nasal valve. External nasal valve is

a dynamic structure that lies caudal to the internal valve. It is formed by columella, nasal floor, and caudal border of the lower lateral cartilage (nasal rim). The level of support for the external nasal valve is determined by the size, shape, flexibility, and orientation of the lower lateral cartilage and alar muscles [2].

Nasal valve collapse can be classified as congenital, traumatic, senile, mucosal, neurogenic, or idiopathic [3]. It is primarily diagnosed by clinical evaluation using the Cottle maneuver or Bachmann



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test [4], whereas rhinomanometry and acoustic rhinomanometry may assist in diagnosis [5-7]. Several surgical reconstruction techniques have been proposed to resolve this problem, with varied results [8-14].

Nasal valves may function as collapsible tubes attached to rigid tubes (Starling resistors) [15]. The transmural pressure increases as the airflow velocity increases, which leads to collapse of nasal passage and a decrease in airflow. In individuals with an external valve collapse caused by weakness of lateral cartilage, this mechanism functions at a low transmural pressure, which leads to premature collapse of alar sidewall and difficulty with nasal breathing. Beeson [16] also has outlined Ohm's law, Bernoulli's principle, Venturi effect, and Poiseuille's law as the key concepts relating to nasal physiology.

Herein we described a different technique to support the weakness of lateral cartilage to prevent alar sidewall collapse during forced inhalation. In this technique the lateral cartilage is semi wrapped from the underside to a square edged strut, and arched to outside.

METHODS

Patients

Between 2012 and 2013, a total of 8 patients (3 female and 5 male) were enrolled in the study. All patients had a complaint of difficulty breathing through the nose, and had the nasal valve collapse during forced inspiration through the nose.

A total of 8 patients (5 males, 3 females) with the complaint of difficulty breathing through the nose that had external nasal valve pathology in the ENT examination and underwent nasal valve surgery in our clinic between 2012-2013 years were included in the study. The study was approved by institutional review board of the study center. Patient's informed consent for photograph release obtained from the patient.

Of the 8 patients, only one male patient had a rhinoplasty operation five years ago and the others had congenital nasal sidewall collapse caused by lower lateral cartilage structural weaknesses. All patients had nasal valve collapse and difficulty in breathing during respiration. One patient had bilateral (rhinoplasty case) and 7 patients had unilateral lower lateral cartilage structural weaknesses. A Bachmann test [4] was used

to have positive predictive value, when there was an inspiratory collapse. Prior to topicalization of the internal nose, the back end of a Q-tip or some other small instrument was used to elevate the alar sidewall of the nose approximately 1-2 mm. When definite benefit was reported from this maneuver, the patient was evaluated for the surgery [17].

Surgical Technique

This technique is best suited for acquired or congenital nasal sidewall collapse caused by lower lateral cartilage structural weaknesses. This includes cartilage defects that cause the collapse of nasal sidewall during forced inhalation through the nose.

The local anesthetic solution (1% lidocaine with epinephrine, 1 mg/100 mL) was injected as defined for open approach rhinoplasty [18]. Nasal bridge and lower lateral cartilages were exposed with an open approach technique.

A vertical tunnel at the undersurface of weakest point of lateral cartilage from caudal to the cephalic margin, beneath the mucoperichondrium was dissected with a pair of short curved delicate Metzenbaum scissors and advanced with a Killian elevator. The mucosal integrity was preserved to prevent postoperative scar formation. A square edged strut graft which harvested from nasal septum was prepared and sized to the vertical length of lateral cartilage. The weak and collapsed part of lateral cartilage was semi-wrapped from the underside to that strut. The suture was initiated by inserting the needle from outside the lateral cartilage from one side, slightly farther from the strut graft. Then, passed under the strut graft and removed inside out on the opposite side, where it exits the cartilage. The needle was placed backwards in the needle driver, inserted into the cartilage about 2 mm beyond of that point the needle has just been passed through, and passed from the far side back to the first insertion side. The needle exited the cartilage about 2 mm near the first insertion site. Finally the suture was tied gently on the side of the wound where the suturing began, and completed as a horizontal mattress stitch. The square edged strut graft was fixed with 3 horizontal mattress stitches, and a support point between the medial and lateral portions of the lower lateral cartilage was created. Care was taken not to enter the mucoperichondrium lying undersurface of the lateral cartilage while suturing

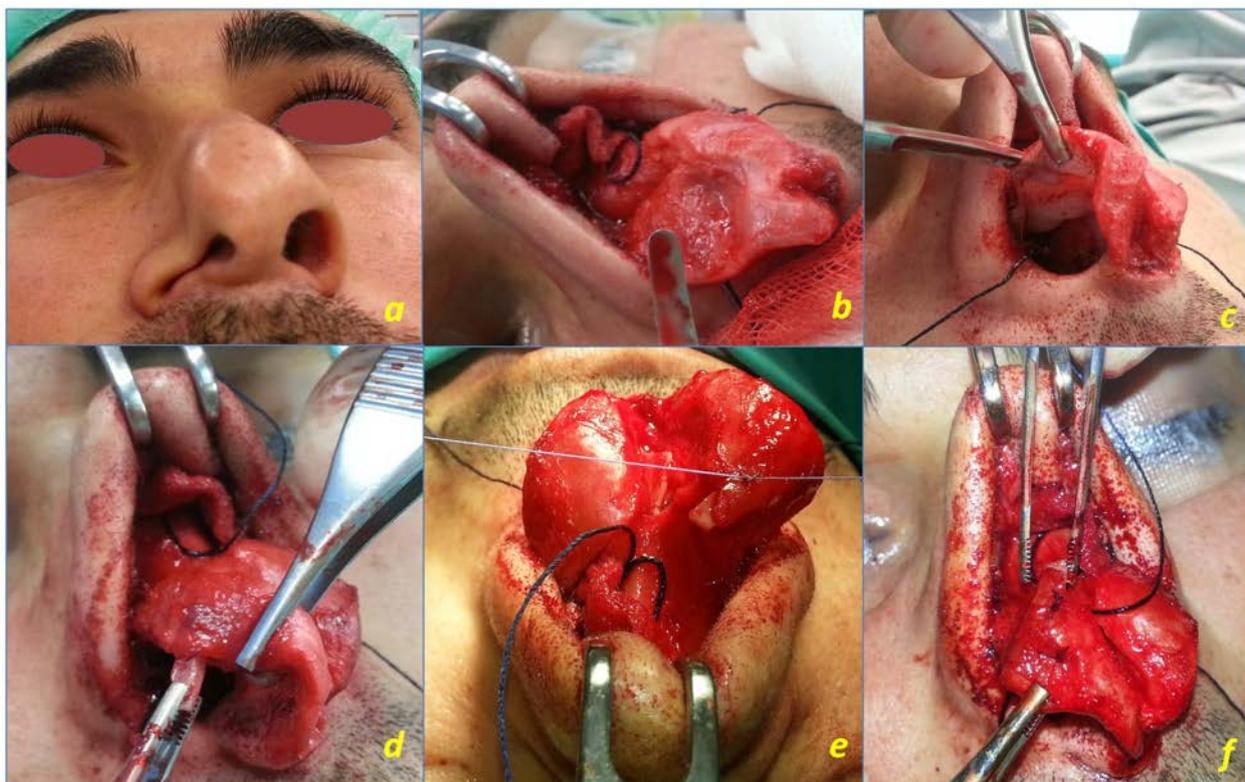


Figure 1. Preoperative nasal valve collapse during forced inspiration through the nose (a). Intraoperative implementation of pseudodome technique: Identifying the weakest point of lateral cartilage (b), creating a vertical tunnel at the undersurface of weakest point of lateral cartilage from caudal to the cephalic margin, beneath the mucoperichondrium (c), semi-wrapping the weakest and collapsed part of lateral cartilage from the underside to a square edged strut graft which was harvested from nasal septum (d), creating a support point between the medial and lateral portions of the lower lateral cartilage with 3 horizontal mattress stitches (e, f).

(Figure 1). After other required surgical manipulations, the skin incisions were closed with 5.0 prolene suture and the operation was completed. Bilateral intranasal packing were applied with a half of longitudinally divided and thinned Merocel® per nasal cavity for about 48 hours, and a silicone splined splint for about one week. If the procedure was performed in conjunction with a rhinoplasty operation, a thermoplastic or aluminum external nasal splint was used to immobilize the nose after the operation, otherwise only plaster strips were used.

The patients were followed-up for at least 12 months postoperatively. The result of the surgery was evaluated by a forced inspiration maneuver. A nasal sidewall collapse at rest or during physical exertion and forced inspiration accepted as the surgical failure.

RESULTS

We have utilized this technique on a case series of

eight patients successfully to repair alar sidewall insufficiency with optimal functional and cosmetic outcomes (Figure 2). The patients included in the study were both 5 males and 3 females ranging in age from 22 to 38 years.

No patients experienced nasal sidewall collapse at rest or during physical exertion and forced inspiration. All of the patients were followed for more than 12 months and did not note any delayed undesirable depression of the graft or compromise of the nasal vestibule. The reinforcement effect of the strut was effective in preventing collapse of the nasal alar sidewall as well as did not cause contour irregularities.

DISCUSSION

The lateral cartilage defects that cause the collapse of the nasal sidewall during forced inhalation through the nose may be due to a developmental defect which are somewhat more apparent or after rhinoplasty



Figure 2. Postoperative anterior (a), left (b), right (c), antero-inferior (d), inferior (e) and right-inferolateral (f) photographic views of a male patient.

operations. The most important variable in the nasal airflow is the diameter of nasal passage. The interaction of static and dynamic forces, including the nasal septum, turbinates, lateral nasal walls, and nasal mucosa interacts during normal nasal breathing [19]. Kern and Wang [20] classified the etiologies of nasal valve dysfunction as mucocutaneous and skeletal/structural disorders. Secondary to infectious, allergic or vasomotor rhinitis the cross-sectional area of the nasal valve may decrease due to mucosal swelling, and it may reduce nasal airway patency. The skeletal/structural components of nasal valve (septum, upper and lower lateral cartilages, fibroareolar lateral tissue, piriform aperture, head of the inferior turbinate, and nasal floor) may also contribute to lateral nasal valve collapse during inspiratory activity especially at sport activities.

The patient may experience a dynamic collapse of nasal valve during inspiration and it may lead to airway obstruction. The etiology of insufficiency is generally congenital structural defects or surgery or

trauma to the skeletal and soft tissue components. The upper lateral cartilages partially collapse at a ventilatory flow rate of 30 L/min in healthy individuals [19]. While a normal nasal valve may collapse with extreme inspiratory effort, a patient with dynamic nasal valve dysfunction often has a weakened lateral nasal wall and it may collapse even during normal nasal breathing.

External nasal valve collapse can be diagnosed based on the observation of nostril margin to determine if the alar collapse is present or a Bachmann test may be used. In this test alar sidewall of the nose is elevated approximately 1-2 mm with the use of back end of a Q-tip or some other small instrument prior to topicalization of the internal nose [4]. The patient with a flaccid or collapsible valve usually appreciates an immediate improvement in airflow with this maneuver.

Many different techniques has recently put forth to resolve nasal valve insufficiency. However, due to the variety of pathologies in the nasal valve area, any

technique does not provide the same benefits to every patient.

Alar batten graft was a simple choice for alar rim a decade ago. As the large grafts provide support, it often obscures the alar crease or causes altered symmetry. Lateral crural strut grafts have replaced alar batten grafts in the majority of primary rhinoplasty cases [21]. Lateral crural strut grafts were developed to reshape, reposition or reconstruct the lateral crura. Straight strong pieces of cartilage measuring 3-4 mm in width by 14-20 mm length are used in different ways. The medial portion of graft is sutured to the undersurface of the lateral crura (alar cartilage) while the distal end is placed in a lateral pocket in to one of three locations: pyriform, alar base, or nostril rim depending upon indication [21]. Transposition of lateral crura is a tip decision, whereas the position of a lateral crural strut graft is a functional decision. Controlled nasal tip rotation via the lateral crural overlay technique which was described by Kridel and Konior [22] also may be used to support lateral crural weakness or concavity.

As for severely concave or weak lateral crura we propose a different technique to straighten and support alar cartilage to prevent collapse of lateral nasal sidewall during inspiration especially at exercise. Although extreme forced inspiration may cause some collapse in most people, a part of lateral cartilage is thinner and weaker in some cases, and it may collapse into nasal cavity during inhalation for this reason. This technique helps to reinforce alar sidewalls of the nose by supporting only lower lateral cartilage from the underside to prevent the sidewalls from collapsing, resulting in maximized airflow. Weakest point of lateral cartilage is semi wrapped from the underside to a square edged strut and fixed with 2 or 3 mattress sutures defined in the surgical technique.

There was a weakness in the lateral cartilage in all patients in this study. We performed a minimum cephalic trimming to ensure the symmetry between two sides when necessary and reconstructed the defective part of lateral cartilage with this technique.

The weakened or concavity formatted part of lateral cartilage was semi wrapped from the underside to a square edged strut which was harvested from the nasal septum and sized to the vertical length of lateral cartilage. In fact, we created a new dome on the lower lateral cartilage with this technique. As it was only a

physical support and did not create a new canting up through the skin, we named this maneuver as *pseudodome* technique. For all that, the small number of cases presented in the study may be a lack of the study.

CONCLUSION

Pseudodome technique can be suggested for acquired or congenital nasal sidewall collapse caused by lower lateral cartilage structural weaknesses. However, this technique may not be sufficient for inferomedial displacement of the upper lateral cartilage after rhinoplasty operation.

Informed consent

Written informed consent was obtained from the patient for the publication of photographs in this article

Author Contributions:

MY: surgeon, data collection, writing manuscript; DA: editing, analyzing data, writing manuscript.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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