10.5005/jp-journals-10013-1285

ORIGINAL ARTICLE

Posttraumatic Nasal Valve Collapse: Is Alar Batten Graft the Answer?

[1]Nidhi V Maggon, [2]Ashwani Sethi, [3]Avinash Das

ABSTRACT

Introduction: Posttraumatic nasal valve collapse (NVC) is an underdiagnosed cause of nasal obstruction causing significant symptoms and has been treated by various techniques, the results of which have been variable. In our study, alar batten graft (ABG) has been used to strengthen the nasal wall.

Techniques: A prospective interventional study was done on 13 patients of posttraumatic NVC using an ABG to reinforce the ala, and results were measured on the basis of standardized nasal obstruction symptom evaluation (NOSE) and nasal obstruction visual analog scale (NO-VAS) scores at 6 months.

Results: There was a statistically significant improvement in 12 out of 13 patients, with mean improvement of 25.62 on NOSE and 2.4 on NO-VAS scores. There was a visible improvement in the extent of collapse also.

Conclusion: Posttraumatic NVC can be treated effectively using ABG, with significant improvement in standard scores as well as the symptomatology.

Keywords: Alar batten graft, Nasal valve collapse, Posttraumatic.

How to cite this article: Maggon NV, Sethi A, Das A. Posttraumatic Nasal Valve Collapse: Is Alar Batten Graft the Answer? Clin Rhinol An Int J 2016;9(3):125-129.

Source of support: Nil

Conflict of interest: None

INTRODUCTION

Nasal airway obstruction (NAO) is a common presentation in otorhinolaryngology practice and can be caused due to various pathologies that include mucosal inflammation due to infectious process/allergy or a physical obstruction.[1,2] Nasal valve collapse (NVC) is a relatively uncommon cause of nasal obstruction and therefore is frequently underdiagnosed. Nasal valve collapse can be dynamic, or it could result from a static stenosis in nasal valve region as in the case of a deviated nasal septum (DNS). Most cases of NVC occur following rhinoplasty.[3] Constantian[4] in his series of 100 consecutive secondary rhinoplasties found that nearly 50% complained of obstruction at the external nasal valve, and over 60% patients complained of an internal valve obstruction. Other causes of NVC are an inherent weakness of the nasal cartilage or following nasal trauma, which may have caused excessive scar tissue or a weakness of the cartilage.[5] Such posttraumatic NVC causes a collapse of the nasal sidewall on forceful inspiration resulting in dynamic obstruction.

Many surgical techniques have been described for the treatment of NVC like a spreader graft, butterfly graft, alar batten graft (ABG), flair sutures, and suspension sutures, majority of which involve an open rhinoplasty.[6] We used an ABG for the treatment of posttraumatic NVC since it reinforced the weakened lateral wall and achieved good functional results.

This study aims to share our experience of managing patients with posttraumatic NVC with an ABG. We have also reviewed the relevant medical literature and have not found any study that exclusively addresses the management of a posttraumatic NVC with the help of an ABG.

TECHNIQUE

This study was carried out at a tertiary care military hospital for 2 years starting in June 2013. All patients who presented with NAO following blunt nasal trauma were evaluated in detail. Such patients report frequently to our institution because of rigorous physical training and contact sports that are common during military service.

A total of 13 patients presenting with NAO attributable only to NVC following blunt facial trauma were included in the study. Patients with other possible obstructive pathologies like DNS, chronic rhinosinusitis, nasal bone fracture, septal hematoma, inferior turbinate hypertrophy, or a prior nasal surgery were excluded. The principal complaint in all 13 patients was a nasal obstruction during strenuous physical exertion while they were asymptomatic during quiet breathing. After excluding other causes of NAO, a diagnosis of NVC was made by visualizing the collapse of lateral nasal wall during forced inspiration (Fig. 1), and the same was confirmed by Modified Cottle test and Bachmann maneuver. Patients

[1]Assistant Professor, [2]Associate Professor, [3]Professor

[1-3]Department of Otorhinolaryngology, Army College of Medical Sciences, New Delhi, India

Corresponding Author: Nidhi V Maggon, Assistant Professor Department of Otorhinolaryngology, Army College of Medical Sciences, New Delhi, India, Phone: +918826455452, e-mail: magnidhi@rediffmail.com

Fig. 1: Lateral nasal wall collapse on deep inspiration

who improved with these maneuvers were included in the study. The objective measurement of the symptoms before and after surgical intervention was done by using the standard nasal obstruction visual analog score (NO-VAS) (from 0 to 10 where 0 corresponds to no obstruction and 10 to complete obstruction) and nasal obstruction symptom evaluation (NOSE) score (The NOSE scale, copyright 2003, the American Academy of Otolaryngology–Head and Neck Surgery foundation).

All patients were operated under local anesthesia. Septal cartilage was used in all cases, and approximate size of the graft was measured by making the patient inspire deeply and marking the area of maximum collapse of the lateral wall. The dimensions of the area of collapse were recorded precisely and ranged from 10 to 12 mm in length and 6 to 8 mm in width. The area on the skin where the underlying pocket would be fashioned to place the septal graft was marked (Fig. 2). After local infiltration with 2% lignocaine with 1:80,000 adrenaline, the septal cartilage was harvested and was sized to adequately reinforce the area of collapse. An incision was made along the inferior margin of lower lateral cartilage, and a subcutaneous pocket was created deep to superficial muscular aponeurotic system and superficial to the lateral crus of lower lateral cartilage (Fig. 3). This pocket was just sufficient in size to hold the graft and to prevent its displacement. After placing the graft, the incision was closed with 4-0 polyglactin absorbable suture, and nasal packs were placed for 24 hours. Patients were evaluated at 1, 3, and 6 months following surgery, and the outcomes were measured in terms of their subjective improvement on NO-VAS and NOSE scores and directly visualizing the extent of alar collapse during forced inspiration. However, final assessment and statistical analysis of the scores were done at 6 months.

A standardized objective measure for assessing NAO does not exist, and therefore, NO-VAS and NOSE scales were used to objectively evaluate the improvement/deterioration in symptoms of our patients. In a systematic review of patient-reported nasal obstruction scores in patients of chronic NAO, it was found that mean (standard deviation, SD) NOSE and NO-VAS scores in patients with NAO were 65 (22) and 6.9 (2.3) respectively. The mean postsurgical NOSE and NO-VAS scores were 23 (20) and 2.1 (2.2) respectively. The mean NOSE and NO-VAS scores for general population were 42 (27) and 4.6 (2.6) respectively.

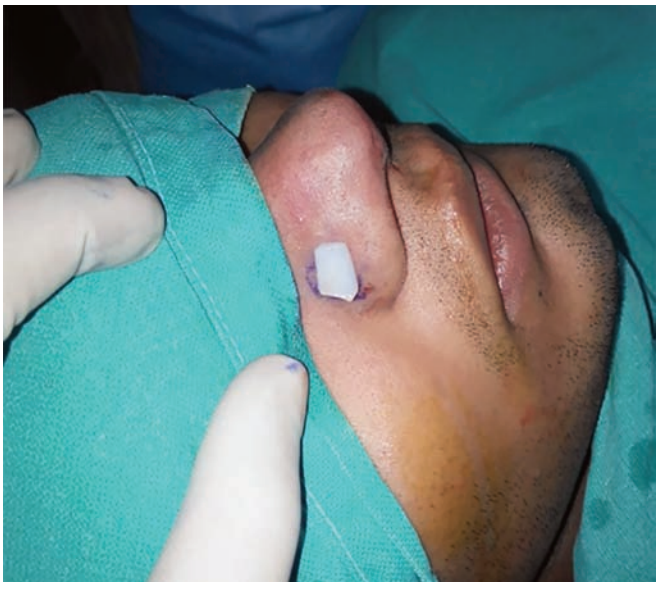

Fig. 2: Harvested septal cartilage graft overlying skin marking

Fig. 3: Rim incision to create a supraperichondrial pocket

Table 1: Nasal obstruction symptom evaluation scores in all patients; preoperative, postoperative, and improvement following surgery

	NOSE scores		
Sl. no.	*Preoperative score*	*Postoperative score*	*Improvement*
1	71.00	45.00	26.00
2	74.00	34.00	40.00
3	69.00	48.00	21.00
4	61.00	32.00	29.00
5	74.00	45.00	29.00
6	76.00	45.00	31.00
7	65.00	56.00	9.00
8	79.00	38.00	41.00
9	66.00	50.00	16.00
10	71.00	68.00	3.00
11	68.00	34.00	34.00
12	64.00	40.00	24.00
13	68.00	38.00	30.00
Avg	69.69	44.08	25.62
SD	4.94	9.64	10.70

Mean and SD are given at the bottom

Table 2: Nasal obstruction visual analog score scores in all patients; preoperative, postoperative, and improvement following surgery

	NO-VAS scores		
Sl. no.	*Preoperative score*	*Postopertive score*	*Improvement*
1	6.40	4.20	2.20
2	6.90	4.50	2.40
3	7.40	3.80	3.60
4	7.60	5.10	2.50
5	6.70	3.50	3.20
6	7.40	4.70	2.70
7	5.80	4.40	1.40
8	6.80	4.70	2.10
9	7.60	5.80	1.80
10	7.50	6.80	0.70
11	5.90	3.20	2.70
12	6.00	2.80	3.20
13	7.10	4.50	2.60
Avg	6.90	4.35	2.40
SD	0.49	0.21	0.28

Mean and SD are given at the bottom

RESULTS

A total of 13 male patients with their ages ranging from 22 to 34 years underwent ABG using septal cartilage graft. No additional surgical procedure was carried out. All of them had presented with nasal obstruction following blunt nasal trauma. The period of onset of symptoms following trauma ranged from 2 to 8 months, with a mean of 5 months.

Nasal valve collapse was bilateral in 10 and unilateral in remaining 3 of our patients, and a total of 23 grafts were placed. The NO-VAS and NOSE scores were used for assessment of symptoms of nasal obstruction, before and after surgery. Postoperative assessment was done at 1, 3, and 6 months. Visual assessment of extent and degree of alar collapse was recorded, and a subjective comparison of preoperative and postoperative alar collapse was done.

The preoperative NOSE score ranged from 61 to 79 with a mean of 69.69 (4.94) and reduced postoperatively to a range from 32 to 68 with a mean of 44.08 (9.64) (Table 1).

The preoperative NO-VAS scores ranged from 5.8 to 7.8 with a mean of 6.49 (0.49), while postoperatively it ranged from 2.8 to 6.8 with a mean of 4.35 (0.21) (Table 2).

Of the 13 patients, 10 reported excellent improvement in symptoms (NOSE score improvement of over 20, NO-VAS score improvement over 2), 2 patients were satisfied with the results of surgical intervention (NOSE score improvement 9 and 16 and NO-VAS improvement of 1.4 and 1.8), and 1 patient (Patient no. 10, NOSE score improvement 3 and NO-VAS improvement 0.7) did not report much symptomatic recovery.

Fig. 4: Good postoperative cosmetic and functional result with a reinforced lateral nasal wall

On subjective assessment of the extent and degree of alar collapse, 8 of the 13 patients had no postoperative, clinically evident collapse, while 4 patients had minimal clinically discernible collapse, though they were otherwise asymptomatic (Fig. 4). One patient (No. 10) had a persistent alar collapse and only marginal symptomatic relief. He underwent a spreader graft placement after 6 months.

None of the patients had any cosmetic complaint, although three patients were concerned about the fact that graft was palpable. No extrusion was noticed till the 6 months period of follow-up.

DISCUSSION

The nasal valve functions as the flow-limiting segment and an inflow regulator. Nose has an external valve situated at the vestibular rim and internal valve, which is near the nasal isthmus.[7] During inspiration, the dilator naris muscles contract, and this contraction is exacerbated during exercise leading to further dilatation and increased air flow. This dilatation can also be achieved voluntarily. About 50% of the total airway resistance in the respiratory tract is attributable to the nasal airways. The function of nasal valve is governed by Poiseuille's law according to which, if the velocity of air increases (as happens during strenuous activity), the pressure difference increases at the narrowest site and resultantly a structurally weak NVC medially.[8]

A posttraumatic NVC without a DNS, if not sought specifically, may go undiagnosed for a long time and will significantly impair patient's quality of life. These patients typically complain of difficulty in breathing due to nasal block during strenuous physical activities like running. In such activities, increased inspiratory airflow leads to reduced intranasal pressure and results in collapse of weakened lateral nasal wall medially. However, these patients are asymptomatic during quite breathing.

Nasal valve pathology is an infrequent cause of nasal obstruction and was found to be the cause in only 13% of cases of NAO in a study of 500 patients by Elwany and Thabet.[9] And, 72% of these cases were following a reduction rhinoplasty.

Trauma to the nose may lead to nasal obstruction by various mechanisms, such as a DNS, scarring of tissues in the nasal valve region, or a structural weakness of the lateral nasal cartilage. The diagnosis of NVC as the causative mechanism in such patients is made by visualizing the nasal collapse during forceful inspiration and confirmed by modified Cottle test and Bachmann maneuver. This NVC can be addressed by many different surgical techniques, which include placement of butterfly graft, a spreader graft, by suspension sutures, flair sutures, and ABG.[6]

We used ABG for correcting posttraumatic NVC as it strengthens the lateral nasal wall to improve its rigidity, thus preventing its medial collapse during forceful inspiration. Alar batten graft placement has been described by Millman[10] and Toriumi et al[11] using an intercartilaginous incision with good functional and acceptable cosmetic results. As against an intercartilaginous incision, in our study, the graft was placed via a rim incision as was also done by Reddy et al[12] in their study of 16 cases.

All the patients included in our study suffered from posttraumatic NVC unlike other studies where ABG was used in an NVC following rhinoplasty.[10] We have not been able to find any study that has addressed posttraumatic NVC exclusively in spite of an extensive search. All patients in our study were males aged between 22 and 34 years, as is expected from the patient profile in the Military. The age group of involvement varies in other studies since those studies dealt with all causes of postrhinoplasty or noniatrogenic NVC.

In this study, 10 of our 13 patients suffered bilateral NVC, while 3 had unilateral involvement. We could not find another study that dealt exclusively with posttraumatic NVC, and therefore, no comparative analysis of laterality could be done.

In a study of 107 patients of internal nasal valve incompetence treated with an ABG by Bewick et al, the NO-VAS scores improved from a preoperative score of 73.5 (0 mm = no blockage, 100 mm = full blockage) to a postoperative score of 15 at 6 months follow-up.

In our study, at 6 months follow-up, of the 13 patients, 10 reported excellent improvement in symptoms (NOSE score improvement of over 20, NO-VAS score improvement over 2), 2 patients were satisfied with the results of surgical intervention (NOSE score improvement 9 and 16 and NO-VAS improvement of 1.4 and 1.8), and 1 patient (Patient no. 10, NOSE score improvement 3 and NO-VAS improvement 0.7) did not report much symptomatic recovery (Tables 1 and 2).

Mean improvement in NOSE score for all 13 patients was 25.62 (SD 10.7, 95% confidence interval 48.29–91.09), and mean improvement in NO-VAS scores was 2.4 (SD 0.28, 95% confidence interval 1.84–2.96). On both scores, the improvement was statistically significant using paired t-test ($p < 0.05$).

On subjective assessment of the extent and degree of alar collapse, 8 of the 13 patients had no postoperative clinically evident collapse, while 4 patients had minimal clinically discernible collapse, though they were otherwise asymptomatic. One patient (No. 10) had a persistent alar collapse and only marginal symptomatic relief. He underwent a spreader graft placement after 6 months.

None of the patients had any cosmetic complaint, although three patients were concerned about the fact that the graft was palpable. No extrusion was noticed till the 6 months period of follow-up.

The main limitation of this study was that the only criterion used to evaluate symptoms and recovery was a visual examination of NVC and subjective NO-VAS and NOSE scores, before and after surgery. The only method of objectively assessing the nasal airway is a rhinomanometry that was not available to us.[2]

It is important to diagnose the exact causative factor leading to nasal obstruction following trauma as it could be multifactorial, and not addressing all pathologies

will leave the patient symptomatic with deep impact on quality of life. In a military setting, it may seriously interfere with training and restrict the ability to perform duty.

CONCLUSION

Nasal valve collapse caused by blunt facial trauma is a relatively common presentation in our setup. It is important to diagnose it early based on high clinical suspicion. Surgical treatment using ABG via rim incision is a fairly simple and effective method for treating this condition.

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