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Original Article

Modified alar batten grafts for treatment in nasal valve dysfunction: Our experience.

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ABSTRACT

Objective: Alar batten grafts are used to treat in nasal valve dysfunction (NVD). They can be placed by open or closed rhinoplasty using rib, septal, or auricular concha cartilage. Our surgical team used a modified placement of the classic alar batten.We aim to describe these changes and to the technique and demonstrate that modified alar batten grafts can improve the effects of spreader grafts and classic alar batten grafts.

Methods: A retrospective study of 91 functional rhinoplasties was performed from March 2011 to November 2019 at a public university hospital in Murcia. The patients were divided into three groups. Group A included patients operated on using spreader grafts, group B included patients operated on using spreader grafts associated with alar batten grafts fixed to the caudal edge of the lateral crura of the lower lateral cartilage (LLC), and group C included patients operated on using modified alar batten grafts.

Results: A total of 91 functional rhinoplasties were performed, 31 patients were operated on in group A, 27 patients were operated on in group B, and 33 patients were operated on in group C. The success rate was 67.7% in group A, 70.4% in group B and 93.9% in group C.

Conclusion: Modified alar batten grafts achieved better results than spreader grafts and spreader grafts associated with classic alar batten grafts. The size, position and placement of the sutures of modified alar batten grafts were the key factors in improving our results.

1. Introduction

Nasal valve incompetence can cause an impaired nasal breathing [1]. An internal nasal valve (INVs) and external nasal valves (ENVs) are both present in the nose. The INV is defined by the upper lateral cartilage (ULC), the head of the inferior turbinate and the septum. The ENV is defined by the cross-sectional location of the nasal ala and the vestibule. These structures plus the nasalis and dilator muscles prevent nasal valve dysfunction (NVD) during deep inspiration [2].

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INV obstruction could be correlated with a static anomaly (high septal deviation, turbinate hypertrophy) or dynamic collapse (ULC dysfunction) on inspiration [3]. Some nasal traumas or aggressive rhinoplasties, such as overresection of the lateral crura of the lower lateral cartilage (LLC), could cause obstruction of the ENV on inspiration [2].

Approximately, 13% of chronic nasal obstruction is due to NVD. The etiology can be congenital, age-related, rhinoplasties or trauma. [2,4,5].

The functional rhinoplasty approach can be closed or open. Closed rhinoplasty avoids scarring, although it limits the surgical field, whereas open rhinoplasty allows easier reconstruction of the LLC [6].

Septal cartilage is frequently used in functional rhinoplasties because it is more stable and easier to harvest than other types of autografts. Conchal cartilage could be the graft of choice when septal cartilage resources are scarce. Tragal cartilage is easy to harvest, but it is smaller than septal cartilage. Rib cartilage can be used when other resources are depleted [7].

Most NVDs can be corrected by surgical techniques such as alar batter grafts, spreader grafts, alar rim grafts, lateral crura J-flaps or sutures [1,8]. Alar rim grafts may improve ENV support and define the ridge between the tip and the alar cartilage [7]. Lateral crura J-flaps can be used by closed rhinoplasty and might improve ENV [8]. Suturing the suspension towards the orbital rim and the flaring sutures can improve INV function [7,9].

The use of spreader grafts to reconstruct the INV was described by Sheen in 1984. Many authors consider spreader grafts the "gold standard" for reconstructing the INV [4]. Septal cartilage is the first choice, but auricular cartilage or rib cartilage could be used in spreader grafts in cases of inadequate septal cartilage. [10].

Toriumi et al were the first to report alar batten grafts in 1997 as an effective technique to improve valve collapse. They used curved septal or concha cartilage where the convex surface was lateral. Alar batten grafts can be placed in two different positions depending on the nasal valve affected. To improve ENV function, the graft needed to be fixed caudal to the lateral crura of the LLC and placed into the pocket attached to the piriform sinus. Otherwise, to improve INV function, the graft needed to be fixed near the caudal edge of the ULC and placed into the pocket attached to the piriform sinus. Therefore, alar batten grafts are useful for addressing NVD caused by a weak lateral nasal wall (ENV) and an impairment of the INV [1,11,12].

2. Methods

A retrospective study of a case series of patients undergoing functional rhinoplasty was performed from March 2011 to November 2019 at a public university hospital in Murcia.

We included all patients who had nasal obstruction symptoms and a positive Modified Cottle maneuver [13]. Patient with surgical relapses, deviated septum, turbinate hypertrophy, functional rhinoplasties associated with septoplasties or turbinoplasties, polyposis and any other pathology in the upper airway were excluded.

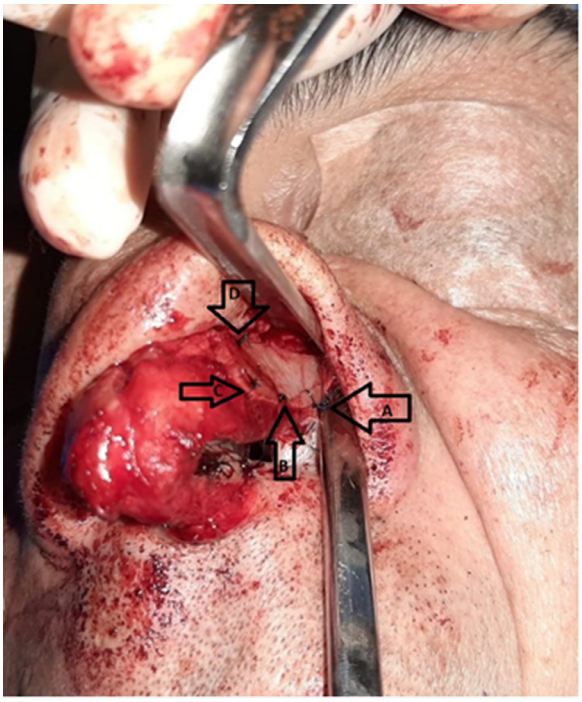

Fig. 1. Modified alar batten graft. The four suture places positions are shown. The first suture (arrow A) was fixed at the caudal edge of the lateral crura of the LLC to a point located between the middle third and the lateral third of the caudal edge of the graft. The second suture (arrow B) was fixed at the caudal edge of the lateral crura of the LLC to a point located between the middle third and inner third of the caudal edge of the graft. The third suture (arrow C) was used to fix the middle crura of the LLC to the top of the caudal edge of the graft. The fourth suture was fixed (arrow D), and the overlapping area between the ULC and the LLC was fixed to the top of the cranial edge of the graft.

The patients answered a questionnaire before and after the surgery, rating their ability to breathe through their nose. Impaired nasal breathing was scores as 0, partial nasal breathing was scores as 1, and unobstructed nasal breathing was scores as 2.

The patients were divided into 3 groups: The first group (group A) included all patients who underwent surgery from 2011 to 2014 by spreader grafts. The second group (group B) included all patients who underwent surgery from 2014 to 2016 by spreader grafts associated with alar batten grafts fixed caudal to the lateral crura of the LLC. The third group (group C) included patients operated on from 2016 to the present by modified alar batten grafts (Fig. 1). Then, we compared the success rates of the 3 groups.

Group C was operated on by the Toriumi technique, although some modifications were made. First, the graft was cautiously harvested from the septum cartilage. Then, the area between the pyriform sinus and the middle crura of the LLC was measured using a surgical ruler (Fig. 2). The graft was cut to a length of 27mm and width of 7mm (Fig. 3).

The caudal edge of the graft was placed over the caudal edge of the lateral crura of the LLC. The cranial edge of the inner third of the graft was placed on the overlapping area

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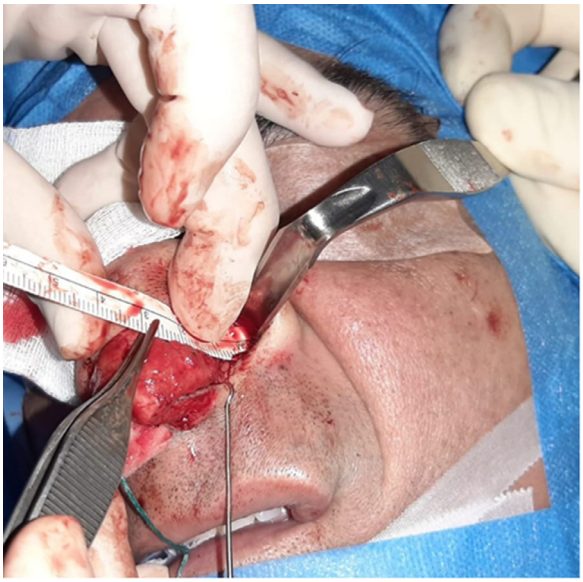

Fig. 2. Measurement of the required graft size.

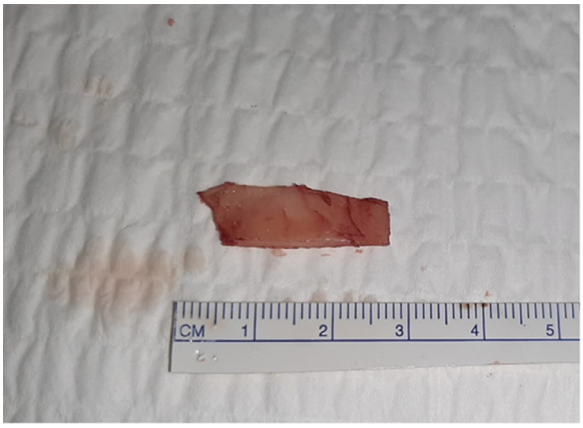

Fig. 3. The graft was 27 mm long and 7mm wide.

between the ULC and the LLC. The lateral third of the graft was placed in a pocket close to the pyriform sinus. Then, 4 simple sutures were place. The first suture (arrow A, Fig. 1) was fixed at the caudal edge of the lateral crura of the LLC to a point located between the middle third and the lateral third of the caudal edge of the graft. The second suture (arrow B, Fig. 1) was fixed at the caudal edge of the lateral crura of the LLC to a point located between the middle third and inner third of the caudal edge of the graft. The third suture (arrow C, Fig. 1) was used to fix the middle crura of the LLC to the top of the caudal edge of the graft. The fourth suture was fixed (arrow D, Fig. 1), and the overlapping area between the ULC and the LLC was fixed to the top of the cranial edge of the graft.

There was no need to suture the lateral edge of the graft because it was placed in a pocket close to the pyriform sinus

The inner part of the graft needed to be as wide as possible so that the fourth suture could fix the graft to the overlapping area between the ULC and the LLC. The lateral part of the graft could be less than 7 mm wide. (Fig. 3).

The grafts were fixed with 5/0 nonabsorbable sutures 5/0 (Prolene®) in the 3 groups.

All rhinoplasties were performed under general anesthesia using an open approach.

All procedures were performed by the same surgeon (AR). All patients provided informed consent for the surgery and were also informed that they were participating in a clinical trial.

The study was approved by the Ethics Committee of the Catholic University of Murcia (CE- 012112) in accordance with the Declaration of Helsinki.

All patients were discharged at 6 hours postoperatively. Postsurgical follow -up visits were performed at 3, 7, 30, 90 days and 12 months after the rhinoplasty. The surgery was considered a "success" if the patient indicated a score of "2" in the nasal breathing questionnaire and the Cottle modified maneuver had become negative at 12 months postoperative.

The chi-square test and Yates correction were performed to determine the relationships among the success rates in the three groups.

3. Results

Between 2011 and 2019, a total of 91 functional rhinoplasties were performed due to NVD, 31 patients underwent spreader grafts, 27 underwent classic alar batten grafts, and 33 underwent modified alar batten grafts.

We excluded 17 functional rhinoplasties associated with septoplasties, 14 associated with columellar struts and 12 associated with turbinoplasties.

Of the 134 functional rhinoplasties performed due to NVD, 105 were operated on by open rhinoplasties, and the others were operated on by closed rhinoplasties.

The 91 functional rhinoplasties in this study were performed using an open approach.

Fifty-seven of the 91 patients were males, and 34 were females.

No patient under 18 years of age was included in this study. The youngest patient operated on in the study was 20 years of age, and the oldest patient was 83 years of age. The mean age of the patients in the study was 42.2 yeas, and the median age was 42 years.

Twenty-one patients underwent in group A, 19 patients in group B, and 31 patients in group C underwent successful surgeries.

The success rate was 67.7% in group A, 70.4% in group B and 93.9% in group C (Table 1). We found statistically significant differences between the outcomes of groups A and C (p=0.018) and those of the groups B and C (p=0.037), but we did not find any statistically significant difference between the outcomes of the groups A and B (p=0.999). (Table 2).

4. Discussion

The success rate achieved in the 3 groups was similar to that found in the literature [4, 6,10,14].

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Table 1. Success rate in the three groups.

		Success	Failure	Total	p Value
	Spreader grafts	21(67.7%)	10(32.3%)	31	0.021
	Spreader grafts + Alar batten grafts	19(70.4%)	8(29.6%)	27	
	Modified alar batten grafts	31(93.9%)	2(6.1%)	33	
Total	71(78%)	20(22%)	91		

Table 2. Relationship between the success rates groups A and B, groups A and C, or groups B and C.

		Success	Failure	Total	p Value
	Spreader grafts	21(67.7%)	10(32.3%)	31	0.999
	Spreader grafts + Alar batten grafts	19(70.4%)	8(29.6%)	27	
Total	40(69%)	18(31%)	58		
	Spreader grafts	21(67.7%)	10(32.3%)	31	0.018
	Modified alar batten grafts	31(93.9%)	2(6.1%)	33	
Total	52(81.3%)	12(18.8%)	64		
	Spreader grafts + Alar batten grafts	19(70.4%)	8(29.6%)	27	0.037
	Alar batten grafts modified	31(93.9%)	2(6.1%)	33	
Total	50(83.3%)	10 (16.7%)	60		

The study was initiated in 2011 using spreader grafts because some authors considered spreader grafts as the gold standard technique to improve the NVD [15,16].

Later, we noticed some failures in the group A. According to some authors, spreader grafts were not generally considered to improve the external valve. We believe that concomitant internal and external valve compromise could appear in some cases [10,17].

Hence, we started using spreader grafts associated with classic alar batten grafts [1,11]. Thus, we stabilized the INV and the ENV [5,9].

In 2014, we started using spreader and alar batten grafts simultaneously, using septal cartilage for the spreader grafts and concha cartilage for the alar batten grafts.

We harvested the grafts from the auricular cartilage for use in alar batten grafts due to their curved shape, as reported by Toriumi et al [6,10,11].

We noticed that alar batten grafts placed at the ULC were extruded in some cases [7], therefore, we began using modified alar batten grafts as described in the "Methods" section.

From 2016 to the present, we have used septal cartilage for alar batten grafts because we believe that it is stronger than the auricular cartilage, but care needs to be taken when harvesting the maximum size of septal cartilage [4,7].

Failure occurred in only two cases. In these cases, a score of "1" was entered on the questionnaire at 12 months, but their Modified Cottle maneuver was negative in these patients.

We suggest that placement of 3 sutures 2 mm from the edge of the LLC instead of suturing the center of the graft, with the fourth suture placed in the overlapping area between the ULC and LLC. The placement of the graft in a deep pocket as close to the maxillary bone as possible are crucial in order to avoid extrusion of the graft and NVD. The graft needs to be 7 mm wide and 27 mm long to simultaneously improve the ENV and INV function.

Some authors have reported that the alar batten grafts technique alone could improve both types of nasal collapse (ENV and INV dysfunction) [10].

A disadvantage of fixing alar batten grafts to the caudal edge of the lateral crura of LLC is fullness of the lateral wall of the nose, but the patients were not bothered by this effect [5].

5. Conclusion

Modified alar batten grafts achieved better results than spreader grafts and spreader grafts associated with classic alar batten grafts. We found significant differences between the success rates of group C and the other two groups, but we found no significant differences between groups A and B. We suggest that using a graft that is 7 mm wide at the top, 27 mm long and including 4 sutures are critical for the success of the technique.

6. Authorship

The author, confirms that each co-author meets the requirements for authorship and has signed the Authorship Criteria Statement.

Declaration of Competing Interest

The authors have no conflicts of interest. This manuscript has not been submitted previously.

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The authors have no financial disclosures.

Ethics approval

The study was approved by the Ethics Committee of the Catholic University of Murcia (CE- 012112) in accordance with the Declaration of Helsinki.

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