

# Caudal Septal Division and Batten Graft Application: A Technique to Correct Caudal Septal Deviations

Original Investigation

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## Abstract

**Objective:** The aim of the study was to evaluate the surgical outcomes in patients who underwent in one session caudal septal division, strip excision and unilateral bony batten graft procedures, a method described for the correction of caudal septal deviations.

**Methods:** In this retrospective study, 27 patients with C-shaped caudal septal deviation who underwent endonasal septoplasty using caudal septal division, strip excision and unilateral bony batten grafting in our hospital in the period from August 2014 through October 2018 were reviewed. Patients were included in the study if their pre-operative and post-operative questionnaires and post-operative follow-up data (average follow-up period was 13.9 months) were available in full.

**Results:** The average age of the 27 patients (6 women and 21 men) was  $29.6 \pm 12.4$  years. Postoperative observations revealed that a straight septum was achieved in 23 patients (85.1%). Average pre- and post-operative Nasal Obstruction Symptom Evaluation (NOSE) scores were  $85.1 \pm 20.4$  and  $22.4 \pm 4.2$ , respectively ( $p < 0.0001$ ). Septal hematoma developed in one patient in the postoperative period.

**Conclusion:** The surgical outcomes of patients in whom we used caudal septal division, strip excision and unilateral bony batten graft to correct caudal septal deviations demonstrated the potential of this technique as an alternative to be used by surgeons.

**Keywords:** Nasal septum, deviated nasal septum, nasal surgical procedures, septoplasty, nasal obstruction, nasal cartilages

## Introduction

Correcting a deviated caudal septum is one of the most difficult procedures in septum surgery. The tendency of the caudal septum to return, particularly because of cartilage memory, to its preoperative condition could impair long term outcomes. Various methods have been described for correcting the caudal septum, such as scoring incisions, cutting and suturing techniques, and the swing-door method (1, 2). Cartilage batten grafting and bony batten grafting methods were recommended to support the caudal septum as these (scoring, cutting and swing-door method) could potentially weaken or shorten the nasal tip (3-7).

The swing-door method requires separating the caudal septum from the anterior nasal spine; however, this method may not ensure a straight cau-

dal septum in cases with extreme septal deviation. Unilateral bony batten grafting, on the other hand, is a treatment modality with proven efficiency in caudal septal deviation (3, 5). In cases which the caudal septum is extremely deformed, and especially when it forms a broken line, a straight caudal septum may not be achieved with the swing-door method.

Scoring is one of the most widely used surgical modalities and could produce a more elastic and ductile cartilage through weakening. This method, however, could also weaken the caudal septum support mechanisms and may subsequently lead to saddle nose deformities (8). The cutting and suturing method, on the other hand, refers to cutting the caudal septum at its most convex place and suturing the overlapping pieces (1). Although it may

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provide a straight caudal septum, it also may shorten the caudal septum and lead to saddle nose deformity in the long term as a result of weakened nasal tip support mechanisms.

In our clinic we usually treat caudal septal deviations by placing a bony or cartilage batten graft on the concave side of the caudal septum. We also use the cutting and suturing technique, albeit less frequently. The aim in caudal septum surgery is to establish a straight, sufficiently long septum with good nasal tip support. The cutting method, however, may not provide this support in the caudal septum, depending on the extent of the deformity and the thinness of the cartilage. Therefore, support is provided by a unilateral batten graft in these cases. The aim of our study was to evaluate the surgical outcomes and postoperative complications in caudal septal division combined with strip excision and unilateral batten graft application.

## Methods

### Patients and Subjective Outcome Evaluation

The study was approved by the Clinical Research Ethics Committee of Gaziosmanpaşa University School of Medicine (Approval Date: November 15, 2019; Approval Number: KAEK 19-177).

This retrospective study included 27 patients with C-shaped caudal septal deviation who underwent primary or revision endonasal septoplasty using caudal septal division combined with strip excision and placement of unilateral bony batten graft at the Tokat State Hospital in August 2014 through October 2018. Patients whose data were insufficient, and those who had septorhinoplasty and endoscopic sinus surgeries concomitantly were excluded. Patients older than 16 years of age with nose stuffiness for at least three months were included in the study. The patients were divided into two groups: those who had turbinoplasty (WT) and those who did not have turbinoplasty (WOT). Nasal Obstruction Symptom Evaluation (NOSE) was employed to evaluate the patients' satisfaction and improvement in symptoms. Preoperative NOSE scores of all patients were recorded. Postoperative third month NOSE scores were obtained by interviews over the telephone. Patients' self-evaluations of their surgical outcomes in relation to their nasal obstruction complaints were based on telephone interviews carried out in the 5<sup>th</sup> to 37<sup>th</sup> postoperative months (av-

erage 13.9 months). Patients were asked to rate the outcome using one of the "much improved", "improved" or "no change" options. Surgical procedures, preoperative and postoperative anterior rhinoscopic and endoscopic evaluations were performed by the same surgeon (CA). The postoperative statuses of nasal septa were evaluated endoscopically and categorized into three groups: straight, improved with some residual deviation, and no change or severe deviation compared to preoperative status. Demographic data and other information related to concurrent procedures and postoperative complications were obtained from the medical records of the patients. Informed consent was obtained from all individual participants included in the study.

### Surgical Procedures

All surgeries were performed under general anesthesia with an endonasal approach. Incision was made on the concave side of the caudal septum extending from the anterior septal angle to the anterior nasal spine. The perichondrium was elevated towards the columella to create a space where the prepared caudal septum component could be fitted. An L-strut was created. The ethmoid perpendicular lamina was the donor site for the bony batten graft. In cases where a thick graft was obtained, the graft was drilled in several places.

Figure 1a shows one of the cases with deviated septum. After bilateral mucoperichondrial flap elevation (Figure 1b) the caudal septum was cut at its most concave point (Figures 1c and 2a), and then the cut pieces were overlapped. After transplanting the bony graft, the excess part of the overlapped cartilage septum was excised to eliminate the narrowing which could arise on one side of the nasal cavity (Figures 1d, 1e, 1f and 2b). Then, the prepared bony graft was placed on the concave side of the caudal septum (Figures 1g and 2c), and the bony graft and the cartilage septum components were sutured to each other at two or three points, to form one straight and strong component, using 5-0 PDS (polydioxanone sutures; Ethicon, Somerville, NJ) (Figures 1h and 2d). Hemitransfixion incision was closed with 5-0 Vicryl (Ethicon). Both mucosae were tightly fixed to the newly formed caudal septum using two or three through-and-through transmucosal sutures (4-0 Vicryl, Ethicon). Some form of volume reduction in the inferior turbinate, such as radiofrequency volume reduction, electrocauterization, outfracture or submucosal resection, were applied in patients who had compensatory inferior turbinate hypertrophy of grades II (moderate enlargement with clear obstruction) and III (complete obstruction in nasal cavity). Then, a 1-mm thick silicone splint was placed bilaterally in the nasal cavity and sutured to the septum. Nasal splints were removed on the second postoperative day.

### Statistical Analysis

Statistical analyses were performed using IBM Statistical Package for the Social Sciences for Windows version 22.0 (IBM SPSS Corp.; Armonk, NY, USA). Data from quantitative variables were represented as mean standard deviation (SD). Wilcoxon signed-rank test was used to compare preoperative and postoperative NOSE scores. P values less than 0.05 were considered statistically significant.

### Main Points

- Caudal septal division together with batten grafting is a safe and effective surgical technique for straightening caudal septal deviations of the septum in carefully selected patients and with the proper application planning.
- The caudal septal division and batten grafting technique significantly improved the subjective symptoms measured by the NOSE score.
- The relationship between the caudal septum and anterior nasal spine remains intact in this technique. This prevents losses in the tip support mechanism with the contribution of the bony batten graft after the caudal septum cartilage division maneuver.

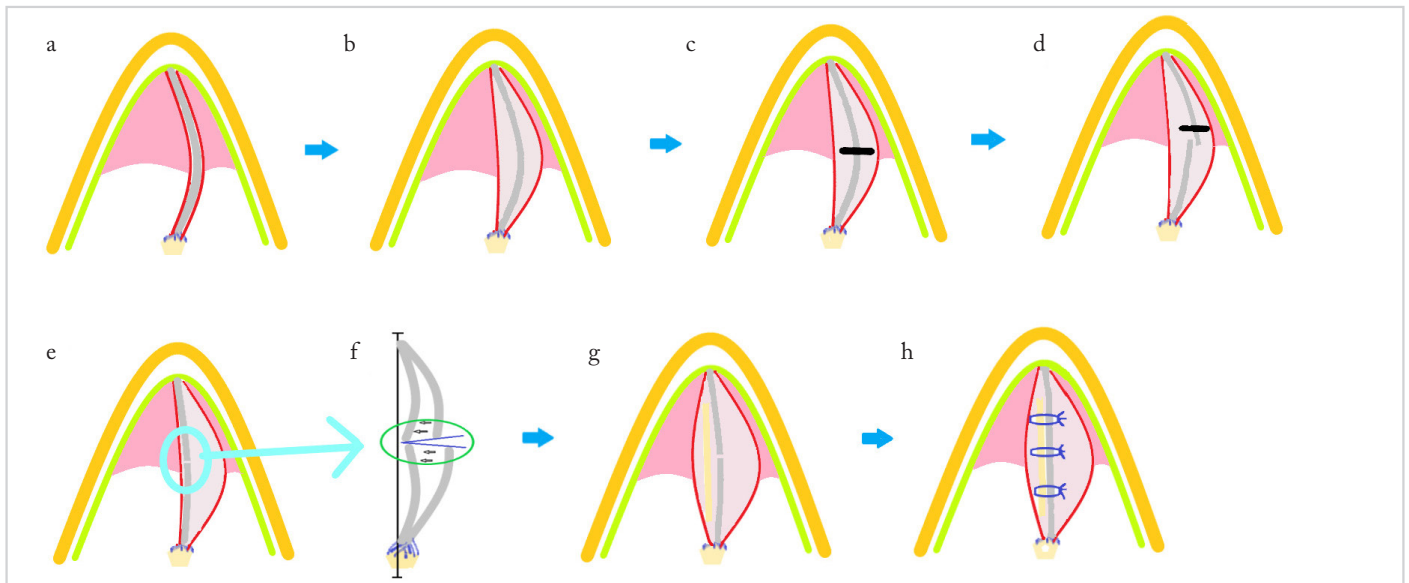


Figure 1. a-h. Schematic illustration of caudal septal division, strip excision and unilateral bony batten application. (a) Deviated caudal septum (b) Bilateral submucoperichondrial flap elevation (c) Incision into the caudal septum (d) Excision of excessive septal cartilage (e) Obtaining a flat caudal septum (f) Overlapping both parts and reducing the distance (g) Placement of the bony batten graft on the concave side (h) Suturing upper and lower cartilage parts to the bony batten graft

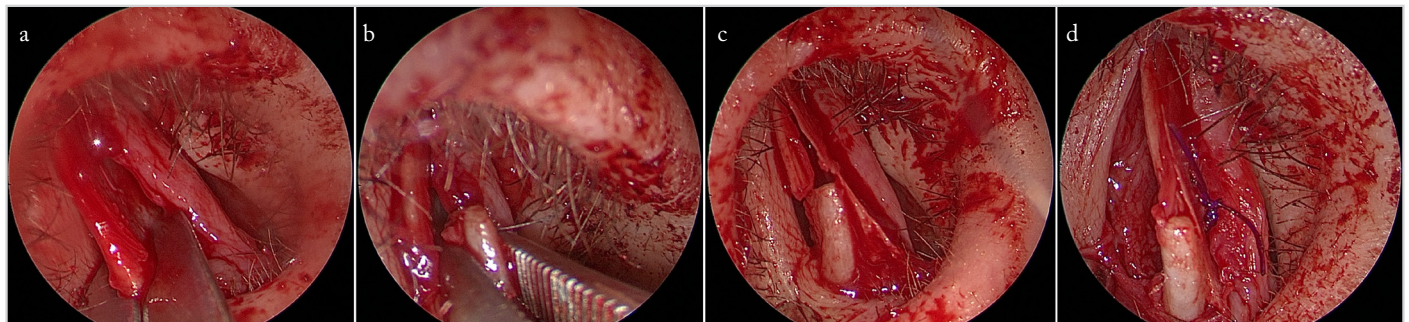


Figure 2. a-d. Surgical illustration of caudal septal division, strip excision and unilateral bony batten application. (a) Cutting of caudal septum (b) Excision of protruded part (c) Placement of bony batten graft (d) Fixation of caudal septum cartilages and bony batten graft with PDS sutures

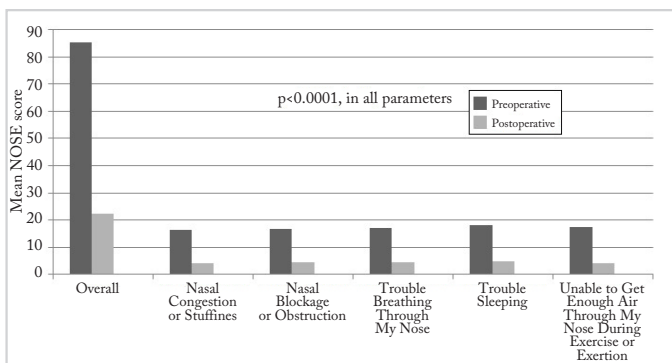


Figure 3. Preoperative and postoperative Nasal Obstruction Symptoms Evaluation (NOSE) scores

## Results

This case series consisted of 27 patients (six women and 21 men). The mean age of the patients was 29.6±12.4 years. Twenty-four patients (88.8%) had primary septoplasty while three (11.1%) underwent secondary (revision) septoplasty (Table 1).

According to the data provided in the postoperative questionnaire forms, nasal obstruction was “much improved” in 16 pa-

tients (59.2%) and “improved” in nine (33.3%), and two patients (7.4%) reported “no change.”

Significant decreases were observed in postoperative NOSE scores in all parameters. Average NOSE score was 85.1±20.4 preoperatively, whereas 22.4±4.2 postoperatively (p<0.0001) (Figure 3). There were no significant differences among the postoperative NOSE scores of the septoplasty-only patients (n=9; 33.3%) and the septoplasty plus turbinate surgery patients (n=18; 66.6%) (23.4±4.3 vs 20.4±5.0; p=0.07).

Postoperative anterior rhinoscopic and endoscopic examinations confirmed a straight septum in 23 patients (85.1%). Residual deviation was observed in four patients (14.9%) despite the improvement in septal deviation compared to the preoperative period. None of the patients had deterioration in septal deviation compared to the preoperative period.

Septal hematoma developed in one patient on the third day of the postoperative period. Septal hematoma was discharged by an incision made in the septum mucosa. Then, nasal splint was placed in both cavities and removed three days later. Oral cefu-

**Table 1.** Patient characteristics

Variables	Findings (n=27)
Age, Mean (SD), yr	29.6±12.4
Gender, No. %	
Male	21 (77.7)
Female	6 (22.2)
Type of surgery	
Primary	24
Secondary	3
Follow-Up (mean) (months)	
Turbinate surgery	
Yes	18
No	9
Postoperative complications	
Septal hematoma	1

yr: years; SD: standard deviation

roxime axetil (500 mg tablets) was administered for one week. None of the patients needed revision septoplasty.

## Discussion

Various types of caudal septum deviations have been described in previous studies. These include, C- or S-shaped deviations, anterior subluxation, and combination of deviations and angulations including horizontal and/or vertical deviations (2-5). The correction of a deviated caudal septum is one of the most difficult pathological conditions in septum surgery. Although methods such as scoring, excising and swing-door were described for the correction of caudal septal deviations, these methods may not be sufficient in advanced level caudal septal deviations (7, 9). Presented method involves incision in the caudal septum, excision of the excess part and application of unilateral batten graft in advanced level caudal septal deviations.

The results of our study showed that using caudal septal division, strip excision and unilateral batten graft placement is an efficient method for correcting nasal obstructive symptoms—as revealed by significantly lower postoperative NOSE scores (22.4) compared to preoperative scores (85.1). About 59.2% of the patients reported “much improvement” and 33% mentioned “improvement” in nasal obstruction. Moreover, postoperative nasal septum examination showed that a straight septum was achieved in 85.1% of the patients. In a study that used division and unilateral batten graft for the correction of caudal septal deviation, the authors observed that nasal obstruction symptoms improved in 83% of the patients (1). Surowitz et al. (10), on the other hand, found that preoperative NOSE scores decreased from 68.2 to 21.1 in the postoperative period after anterior septal reconstruction in caudal septal deviation cases.

The caudal septal division and unilateral bony batten graft technique we used showed some differences from the cutting and suturing method. In cutting and suturing, the caudal septum is cut, and the upper and lower parts are overlapped and sutured (2).

The elastic nature of the cartilage and the two overlapping parts in the cutting and suturing method could result in shortening of the caudal septum. However, unilateral batten graft application allows to adjust the caudal septum height and provides better support for the caudal septum.

Jang et al. (1) suggested using caudal septal division and unilateral cartilage batten graft in correcting caudal septal deviations. After cutting the caudal septum, they overlapped the cartilage pieces and sutured the batten graft to the concave side. Overlapping of cut pieces could lead to protrusion of the upper piece to one side, and thereby prevent the formation of a perfectly straight septum. With the method we used, however, excision of the protruded part of the upper or the lower piece, and placement of the bony batten graft in the concave side allowed for a straighter septum. Besides, height loss in the caudal septum and the subsequent formation of saddle nose deformity were not observed in any of our cases. This finding could be associated with a lower bending risk as a result of bony graft use and strip excision in our cases.

Placement of the batten graft on the concave side of the caudal septum by excising a part of the septum associated with anterior nasal spine after applying scoring to the caudal septum was employed in some previous studies (3-5). Although it was described as a frequently used method, the pulling forces of the cartilage towards the concave side could make it difficult to achieve a straight septum even when a batten graft is placed. In the presented method, on the other hand, no part is excised from the septum cartilage in conjunction with the anterior nasal spine. Indeed, the incision made over the deformed side breaks the pulling forces of the septum towards one side and the released upper and lower pieces could easily be sutured to the batten graft. This fact makes this method especially useful in situations where the caudal septum does not protrude from the anterior nasal spine and is in advanced level C-deviation of caudal septum.

The first major advantage of our technique was that unlike the previous methods (3, 5) the caudal septum did not separate early from the anterior nasal spine and the major tip supports were protected. A second advantage was that a straighter cartilage component was obtained by excising the excess part of the overlapped upper and lower cartilage pieces after cutting the caudal septum. Moreover, excision of the protruded part in this method could prevent the cartilage septum component from curving to one side. A third advantage was that the unilateral bony batten graft application increased the support of the caudal septum in all cases, which further improved the outcome in cases where the caudal septum cartilage was weaker. In addition, placing the bony batten graft on the concave side prevented the narrowing of the nasal cavity. This was revealed by the achievement of a straight septum in 85.1% of our cases. A fourth advantage of the presented method was that the height of the caudal septum was maintained. Preoperative C-shape of caudal septum resulted in shorter than necessary caudal septum. However, cutting the caudal septum, overlapping of the two pieces and placing the bony

batten graft on the concave side helped us to adjust the height of the caudal septum. In a similar study in which the caudal septum was cut and interpositional graft was applied, the authors indicated that they had ensured the desired height of the caudal septum by placing the cartilage septum between the area cut and the caudal septum (11). Similarly, in our study, cutting the caudal septum, overlapping the upper and lower parts, excising strip and using unilateral bony batten graft allowed to increase the caudal septum height.

The method might have some possible drawbacks. First of all, unilateral placement of the bony batten graft may lead to a unilateral narrowing in the nasal cavity. Nevertheless, unilateral nasal cavity narrowing and associated nasal obstruction were not observed in any of the patients in our study. The reason could be that we placed the bony batten graft in the more concave side and used the thin perpendicular plate of the ethmoid bone. Likewise, some previous studies also reported that narrowing in the nasal cavity was only minimal in unilateral bony batten graft applications and did not reach an extent as to cause considerable nasal obstruction (3, 5). A second disadvantage could be the possibility of recurrence due to bony graft resorption. Previous studies, however, showed that resorption was minimal when the ethmoid bone was used given its membranous structure (9). A third possible disadvantage of the method could be the shortening of the caudal septum and saddle nose deformity secondary to it. However, none of our cases had saddle nose deformity. Because of C-deformity, caudal septum support was not sufficient in most of our cases. Unilateral bony batten graft application along with an incision over the caudal septum, bringing together the upper and the lower cartilage pieces, and using strip excision surely did increase the length of caudal septum in some cases. Nevertheless, a shortening in the caudal septum complex and a decrease in its support secondary to it was not observed in any of the cases.

The presented study had some limitations. The study included a limited number of patients with relatively shorter follow-up periods. Future studies with larger cohorts could inform better on the advantages, as well as the disadvantages, of this method. Another limitation was that we used endoscopic evaluations and NOSE scores to evaluate the postoperative outcomes in patients. More objective airway measurements using acoustic rhinometry and rhinomanometry could better indicate the efficiency of the method through numeric data. Besides, we evaluated the postoperative status of the septum through endoscopy. Although such a practice carried a risk for bias, endoscopic examination findings were recorded impartial.

## Conclusion

Caudal septal division, strip excision and unilateral bony batten graft method using the endonasal approach is an efficient and useful method for correcting caudal septal deviations. A straight

caudal septum component with a good support was achieved in most cases by breaking the unilateral pulling forces of the caudal septum via an incision into the caudal septum and supporting it with a bony graft. Therefore, this method is an alternative for surgeons in correcting the caudal septal deviations.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of Gaziosmanpaşa University School of Medicine (Approval Date: November 15, 2019; Approval Number: KAEEK 19-177).

**Informed Consent:** Written informed consent was obtained from the patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** The author has no conflicts of interest to declare.

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