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Clinical Outcomes after Septoplasty Using Cartilaginous Batten Graft in the Management of the Caudal Septal Deviation

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ORIGINAL STUDY

Clinical Outcomes After Septoplasty Using Cartilaginous Batten Graft in the Management of Caudal Septal Deviation

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Abstract

Background: **Caudal septal deviation is a major cause of nasal obstruction. This problem greatly inhibits normal nasal breathing by narrowing the nostril and external nasal valve area. It also represents a clear aesthetic problem due to the asymmetry of the nostrils.**

Objectives: **To evaluate the clinical outcomes of septoplasty using cartilaginous batten graft in cases with caudal septal deviation regarding the relief of nasal obstruction and aesthetic results.**

Materials and methods: **This prospective single-armed study was conducted on 20 patients suffering from nasal septal caudal deviation. Septoplasty was performed using a caudal septal batten graft with different techniques for each type of caudal septal deviation. We used the validated nasal obstruction septoplasty effectiveness score and visual analog scale (VAS) for self-reported nasal obstruction symptoms.**

Results: **The procedure resulted in significant improvements in nasal obstruction. Total nasal obstruction septoplasty effectiveness (NOSE) score was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively and at 6 months compared with 3 months postoperatively. Congestion, obstruction, breathing, sleep, and exercise all were significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively. Regarding basal photography, 11 (55 %) patients showed grade I basal photography, and nine (45 %) patients showed grade II basal photography.**

Conclusion: **Septoplasty using a cartilaginous batten graft is an effective surgical technique for the management of caudal septal deviation. The technique showed significant improvements in nasal obstruction. The majority of patients achieved satisfactory aesthetic outcomes based on basal view photography with minimal reported complications.**

Trial registration: **ClinicalTrials.gov ID: NCT04579042.**

Keywords: Batten graft, Caudal septal deviation, Septoplasty

1. Introduction

Nasal obstruction is frequently caused by caudal septal deviation. Due to the nasal valve angle and exterior valve area being restricted, this confusing issue significantly hinders regular nasal breathing [1].

Even though they are not the most frequent, caudal or anterior nasal septum deviations result in a lot of nasal tip complaints as they are both obstructive and aesthetic. Only 5%−10 % of patients with a deviated nasal septum also exhibited caudal deviations [2].

Caudal septal deviation is challenging to treat because intrinsic cartilage memory is challenging to get rid of. The surgical procedures such as

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morselization, crosshatching incision, partial thickness incision, swing-door flap, and anchoring suture are used to treat caudal septum deviations [3].

Swing-door technique is described by Wright and the caudal septal attachments are released, allowing the septum to swing to the midline, and the excess vertical cartilage along the maxillary crest is wedged out. An absorbable suture that is fastened to the periosteum next to the nasal spine's opposite side may be used to hold the midline position in place [4].

Pastorek, who developed the 'doorstop' technique, altered this method. Without additional cartilage removal, the deviated caudal septum is transposed over the anterior nasal spine to the opposite nasal cavity [5].

The caudal septal deviation can be corrected with the batten graft and cutting and suture procedures, which have also been linked to outstanding functional results in rhinoplasty [6].

Recently, it has become common practice to support the caudal septum during rhinoseptoplasty using caudal septal batten grafts. Patients who have a caudal septal deviation without an external nasal deformity should avoid having an open rhinoseptoplasty [3].

While Kim and colleagues evaluated the effectiveness of using endonasal caudal septal cartilaginous batten graft in the management of C-shaped deviation of caudal septum without angulation or dislocation, Jang and colleagues. Used the cutting and suture technique endoscopically in cases of caudal septal deviation or angulation but without dislocation from the anterior nasal spine [7,8].

In addition, to correct caudal septal deviation, Chung et al., used a bone batten graft endoscopically [9]. A more recent study by Kim and colleagues in 2017 assessed the surgical outcomes of the bony batten graft to correct the caudal C-shaped septal deviation without angulation or dislocation [3].

This study aimed to evaluate the clinical outcomes of septoplasty using cartilaginous batten graft in cases with caudal septal deviation as regards the relief of nasal obstruction and aesthetic results.

2. Patients and methods

2.1. Study design and patients

This prospective study was carried out at Benha Teaching and Benha University Hospitals, Benha, Egypt, from June 2020 to June 2023. This prospective single-armed study was conducted on 20 adult patients with caudal septal deviation, who were selected among those attending the ORL outpatient clinic of Benha Teaching and Benha University Hospitals and indicated for septoplasty.

We excluded patients with previous septal surgery, deformed nose that necessitate an external rhinoplasty approach, and other endonasal causes of nasal obstruction other than deviated nasal septum. Patients with bleeding disorders or systemic diseases were excluded. The patients who did not complete the follow-up periods were also excluded.

Informed written consents were obtained from all patients to participate in this study. Also, approval was obtained from the Research Ethics Committee at the Faculty of Medicine, Benha University (MS 40-1-2020).

2.2. Initial assessment and evaluation

All studied cases were subjected to the following: detailed history taking, preoperative assessment, full clinical examination: General examination (pulse, blood pressure, capillary filling time, respiratory rate, and temperature); local: anterior rhinoscopy (caudal septal deviation), endoscopic nasal examination: to exclude HIT, polyp, mass, and discharge; basal view photograph and computed tomography (CT) nose and paranasal sinuses to exclude other pathologies and routine laboratory investigations: complete blood count, random blood sugar, kidney function tests, and liver function tests.

The NOSE (nasal obstruction septoplasty effectiveness) score was applied preoperatively and at follow-up visits. Higher NOSE scores indicated worse nasal obstruction (range: 0–100). We used the validated NOSE scores for self-reported symptoms of nasal obstruction according to Stewart et al. [10]. Visual analog scale (VAS) (0–10) of nasal obstruction: For nasal obstruction, patients were asked to quantify subjective nasal obstruction using VAS from 0 (no obstruction) to 10 (complete obstruction).

2.3. Operative procedures

The procedures started with the hemitransfixion incision at the caudal end's concave side. Using the Freer elevator, the mucoperichondrial flap of the septum was raised, and the subperichondrial dissection was carried out in cephalic and dorsal directions. Without creating a cut on the opposite side, a contralateral flap was elevated from the caudal part of the cartilage. Bilateral flap elevation was followed by a subperichondrial dissection into the nasal floor, where a graft was placed. Excision was used to remove the curved section of the septal

cartilage, leaving behind an L-strut of the dorsal and caudal cartilaginous septum that was at least 1 cm long.

A caudal septal batten graft created from the harvested septal cartilage was sutured using three or four stitches (5–0 polydioxanone sutures). The cartilaginous batten graft is fastened on the concave side using counter-curvature with an appropriate, suited length from the nasal tip to the anterior nasal spine if there is a C-shaped caudal deviation without angulation or dislocation. If the caudal septal end was angled, the caudal strut was cut with scissors at the spot that was most convex in the caudocephalic direction. Batten graft was used to join excessive lower and upper caudal struts, and No. 5–0 polydioxanone sutures were used to do so (often on the concave side). If the caudal end is dislocated, the maxillary crest and anterior nasal spine (ANS) were removed from the septal cartilage so that it could be repositioned. If there was too much cartilage, it was cut out, and then the transplant was stitched together with three or four 5–0 polydioxanone stitches (Fig. 1).

Next, for repositioning and fixation between ANS and septal cartilage, a figure eight suture was done through the cartilaginous batten graft and ANS twice using 5–0 Prolene. The hemitransfixion incision was closed using 5–0 Vicryl, and two or three through-and-through transmucosal sutures (4–0 Vicryl sutures) were used to fix both mucosae tightly to the newly created caudal septum. An internal nasal splint and an anterior nasal pack were placed on both sides of the nasal septum.

2.4. Postoperative assessment and follow-up

Follow-up was scheduled at the first and second weeks for healing and complications such as wound infection or dehiscence, septal hematoma, septal abscess, adhesions, and/or infections (Fig. 2). Early postoperative assessment was at the third month using the NOSE score and VAS. The late postoperative assessment was in the sixth month using the NOSE score and basal view photography.

The results of the surgery concerning aesthetic improvement of the caudal deviation were evaluated using the base photographic view. Two independent observers reviewed the photographs, and a 4-point grading system was used to evaluate results, according to Gu et al. [11]. Grade I: The patient has little or no photographic evidence of residual caudal septal deviation. Grade II: The caudal septal deviation showed marked improvement but was still detectable by careful observation. Grade III: The caudal deviation was only mildly improved or not improved from the preoperative assessment. Grade IV: The caudal deviation was worse after surgical intervention.

2.5. Statistical analysis

Version 21 of the Statistical Package for the Social Sciences (SPSS) was used for data management and statistical analysis. Using means and standard deviations, numerical data were summarized. Numbers and percentages were used to represent a categorical set of data. The t-test was used to compare numerical data between the two groups. Differences across groups were analyzed using χ^2 (chi-square) testing for categorical variables. P values are always two-sided. P values of 0.05 or less were considered as significant.

3. Results

Table 1 shows age, sex, NOSE score, VAS (obstruction), and the type of caudal end preoperatively in the study group.

Fig. 1. Intraoperative caudal septal deviation (dislocation) was corrected using the cartilaginous batten graft: A, initial basal view; B, batten graft fixation; and C, basal view after wound closure.

Fig. 2. The basal view of one patient on the second week follow-up visit showing improvement of the caudal septal deviation: A, preoperative and B, postoperative.

Postoperative VAS (after 3 months) regarding nasal obstruction was significantly lower than preoperative VAS, improved from 6.70 ± 1.26 to 1.85 ± 0.75 (mean ± SD) ($P < 0.001$) (Table 2). Congestion was significantly different among the three measurements. Congestion was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively with no significant difference between 3 months postoperatively and 6 months postoperatively. Obstruction was significantly improved (decreased) at 3 months postoperatively and 6 months postoperatively compared with preoperatively with no significant difference between 3 months and 6 months postoperatively ($P < 0.001$) (Table 3).

Breathing was significantly different among the three measurements. Breathing was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively with no significant difference between 3 months postoperatively and 6 months postoperatively. Sleep was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively and at 6 months compared with 3 months postoperatively. Exercise was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively with no significant difference between 3 months postoperatively and 6 months postoperatively (Table 3).

Total NOSE score was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively and at 6 months compared with 3 months postoperatively (Table 4).

Congestion, obstruction, breathing, sleep, exercise, and total score were significantly different among the three measurements (Table 5).

Regarding complications (assessment at 2 weeks postoperatively), hematoma occurred in one (5 %), infection occurred in two (10 %) of patients, while dehiscence, abscess, or adhesions have not been observed in any patient.

As regards the aesthetic improvement of caudal deviation, patients' basal photographic views were evaluated and compared with initial views. Two independent observers reviewed the photographs, and according to the 4-point grading system that was used, 11 (55 %) patients gave grade I basal photography (indicating that the patient has little or no photographic evidence of residual caudal septal deviation). Nine (45 %) patients gave grade II basal photography (indicating that the caudal septal deviation showed marked improvement but was still detectable by careful observation). No patients gave grade III or IV basal photography.

Table 1. Age, sex, type of caudal end, and preoperative nasal obstruction septoplasty effectiveness and visual analog scale (obstruction) scores in the study group.

Age mean (SD)	26.1 (5.6)
Female/male no. (%)	11 (55)/9 (45)
VAS (obstruction)	6.7 (1.3)
NOSE score (preoperative) mean (SD)	
Congestion	2.2 (0.8)
Obstruction	2.7 (0.9)
Breathing	2.3 (0.7)
Sleep	2.1 (0.8)
Exercise	1.95 (0.8)
Total	55.5 (13.2)
Type of caudal end	
Dislocation	11 (55)
Angulation	6 (30)
C shaped	3 (15)

Data are represented as frequency and %.

Table 2. Preoperative and postoperative visual analog scale (nasal obstruction).

	Preoperative	Postoperative	*P*-value
	Mean ± SD	Mean ± SD	
VAS	6.70 ± 1.26	1.85 ± 0.75	<0.001*

VAS, visual analog scale.

Table 3. Preoperative and postoperative congestion, obstruction, breathing, sleep, and exercise scores.

	Study group ($n = 20$)	*P*1 (preoperative)	*P*2 (3 months' postoperative)
	Mean ± SD		
Congestion			
Preoperative	2.15 ± 0.81		
3 months' postoperative	0.55 ± 0.51	<0.001*	
6 months' postoperative	0.55 ± 0.51	<0.001*	0
Obstruction			
Preoperative	2.65 ± 0.93		
3 months' postoperative	0.70 ± 0.73	<0.001**	
6 months' postoperative	0.45 ± 0.51	<0.001**	0.06
Breathing			
Preoperative	2.30 ± 0.66		
3 months' postoperative	0.60 ± 0.59	<0.001**	
6 months' postoperative	0.45 ± 0.51	<0.001**	0.3
Sleep			
Preoperative	2.05 ± 0.76		
3 months' postoperative	0.60 ± 0.50	<0.001**	
6 months' postoperative	0.35 ± 0.49	<0.001**	0.02*
Exercise			
Preoperative	1.95 ± 0.76		
3 months' postoperative	0.60 ± 0.50	<0.001**	
6 months' postoperative	0.65 ± 0.49	<0.001**	0.7

Table 4. Preoperative and postoperative total nasal obstruction septoplasty effectiveness score.

	Study group ($n = 20$)	*P*1 (preoperative)	*P*2 (3 months postoperative)
	Mean ± SD		
Total NOSE score			
Preoperative	55.50 ± 13.17		
3 months' postoperative	15.50 ± 8.41	<0.001**	
6 months' postoperative	1 ± 5.71	<0.001**	0.003*

4. Discussion

Deviated nasal septum is a major cause of nasal obstruction, and septoplasty is one of the most common surgeries used to manage this condition. Various surgical methods, such as crosshatching incision, morselization, partial-thickness incision, swing-door flap, and anchoring suture, have been described to correct caudal nasal septal deviation [12].

One of the first articles that described the use of bone grafts in septoplasty for correction of caudal deviations was Foda [13] in 2005. His technique relied on fully mobilizing the deviated cartilage to the corrected position and then straightening it by applying bony splinting grafts, but it was performed through an external rhinoplasty approach.

In our study, the mean ± SD of age was 26.1 ± 5.6, 55 % of our patients were females and the rest of them were males (45 %). This matches with the Shukla et al. study, which was conducted on 80 patients with deviated nasal septum undergoing septoplasty. It was reported that the average age of the participants was 29.96 years, the youngest being 18 years of age and the oldest being 60 years of age. Male-to-female ratio was 2.33 : 1 [14].

Table 5. Preoperative and postoperative congestion, obstruction, breathing, sleep, exercise, and the total nasal obstruction septoplasty effectiveness score.

	Preoperative	3 months postoperative	6 months postoperative	*P*-value
	Mean ± SD	Mean ± SD	Mean ± SD	
Congestion	2.15 ± 0.81	0.55[a]±0.51	0.55[a]±0.51	<0.001*
Obstruction	2.65 ± 0.93	0.70[a]±0.73	0.45[a]±0.51	<0.001*
Breathing	2.30 ± 0.66	0.60[a]±0.59	0.45[a]±0.51	<0.001*
Sleep	2.05 ± 0.76	0.60[a]±0.50	0.35[a,b]±0.49	<0.001*
Exercise	1.95 ± 0.76	0.60[a]±0.50	0.65[a]±0.49	<0.001*
Total	55.50 ± 13.17	15.50[a]±8.41	12.00[a,b]±5.71	<0.001*

The total NOSE score preoperatively was 55.5 ± 13.2 (mean ± SD). Regarding NOSE score components, the mean ± SD for congestion was 2.2 ± 0.8, the mean ± SD for obstruction was 2.7 ± 0.9, the mean ± SD for breathing was 2.3 ± 0.7, the mean ± SD for sleep was 2.1 ± 0.8, and the mean ± SD of exercise was 1.95 ± 0.8. Our patients' symptoms nearly go with that of the study by Shukla and colleagues, where the average preoperative NOSE score was 73.33 and the most bothersome symptom was trouble breathing through the nose and the second was nasal obstruction or blockage [14].

Chi and colleagues tested 26 participants with caudal septal deviation who received endonasal septoplasty using a septal cartilaginous batten graft. It was observed that among the 26 patients (23 males, 3 females), the average age was 36.15 ± 11.02 years. The preoperative NOSE scale values were 75.38 ± 15.62 [15].

Regarding complications (assessment at 2 weeks postoperatively), in the present study, hematoma occurred in 1 (5 %), and infection occurred in 2 (10 %) of patients, slightly better than Kim and colleagues who studied 29 patients with caudal septal deviation who underwent septoplasty using caudal L-strut division and interposition batten graft technique. They noted that four patients had postoperative complications, two had septal abscesses, one had wound dehiscence, and one had synechia [16].

In this study, preoperatively the (mean ± SD) of VAS of nasal obstruction was 6.70 ± 1.26, while postoperatively the (mean ± SD) of VAS improved significantly to 1.85 ± 0.75. Our findings agreed with Chung and colleagues who included 39 patients who completed questionnaires by interviews postoperatively for assessment of nasal obstruction. They found patients reported a significant decrease in VAS severity of all nasal symptoms [9].

According to our study, congestion was significantly different among the three measurements. Congestion was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively with no significant difference between 3 months postoperatively and 6 months postoperatively. It was improved from 2.15 ± 0.81 (mean ± SD) preoperatively to 0.55 ± 0.51 (mean ± SD) at both 3 months and 6 months postoperatively.

Consistent with our study, Aksakal et al. retrospectively studied 27 patients with C-shaped caudal septal deviation, who underwent endonasal septoplasty using caudal septal division, strip excision, and unilateral bony batten grafting. It was demonstrated that significant decreases were observed in postoperative NOSE scores (nasal congestion, trouble breathing, nasal obstruction, or blockage) in all parameters [17].

In this study, the preoperative mean ± SD of breathing was 2.30 ± 0.66, and significantly improved to 0.60 ± 0.59 the mean ± SD at 3 months postoperatively and 0.45 ± 0.51 at 6 months postoperatively. Our results agree with those documented by Chung and colleagues who observed that the preoperative, mouth breathing was 5.53 ± 3.34, and was significantly improved after surgery to 1.93 ± 1.39 ($P < 0.002$) [9].

In our study, the preoperative trouble sleeping was significantly different among the three measurements. Sleep was significantly improved (decreased) at 3 months and 6 months postoperatively compared with preoperatively and at 6 months compared with 3 months postoperatively, 2.05 ± 0.76, 0.60 ± 0.50, and 0.35 ± 0.49 (mean ± SD), respectively.

Total NOSE score was significantly improved (decreased) at 3 months and 6 months postoperatively compared with the preoperative score and at 6 months compared with the 3 months' score postoperatively. The preoperative mean ± SD of the total NOSE score was 55.50 ± 13.17 and significantly improved to 15.50 ± 8.41 (mean ± SD) at 3 months' postoperatively and to 12.00 ± 5.71 (mean ± SD) at 6 months' postoperatively. The total score was significantly different among the three measurements. Comparable to our study, Kim and colleagues performed septoplasty using the caudal L-strut division and interposition batten graft technique. They found that the mean postoperative NOSE scores (nasal congestion, trouble breathing, nasal obstruction or blockage, trouble sleeping) were significantly lower than the preoperative scores, indicating a significant improvement in nasal obstruction [3].

In agreement with our study, Chi and colleagues showed that preoperative status showed significant improvements in NOSE scale after endonasal functional rhinoplasty using an autologous septal cartilaginous batten graft. They operated endonasal septoplasty using a septal cartilaginous batten graft [15].

For assessment of the aesthetic improvement of caudal deviation, in this study, we used patients' basal photographic views. Eleven (55 %) patients gave grade I basal photography (indicating that the patient has little or no photographic evidence of residual caudal septal deviation). Nine (45 %) patients gave grade II basal photography (indicating that the caudal septal deviation showed marked improvement but was still detectable by careful observation). No patients gave grade III or IV basal

photography. Our aesthetic results were to some extent better than those of Sedwick and colleagues, who evaluated the aesthetic surgical results using a 4-point scale [1, little or no photographic evidence of residual caudal septal deviation (total improvement); 2, marked improvement; 3, only mild or no improvement; and 4, condition made worse]. Their results showed that 23 out of 62 patients gave grade I (37.1 %), 33 patients gave grade II (35.2 %), and only three patients gave grade III [2]. This difference may be due to the different number of patients included in both studies.

4.1. Conclusion

The study concluded that septoplasty using a cartilaginous batten graft is an effective surgical technique for the management of caudal septal deviation. The procedure resulted in significant improvements in nasal obstruction, as indicated by reduced NOSE scores and VAS scores. Patients experienced improved congestion, obstruction, breathing, sleep, and exercise at both 3-month and 6-month follow-up visits. The majority of patients achieved satisfactory aesthetic outcomes based on basal view photography, with minimal complications reported.

5. Key message

Septoplasty using a cartilaginous batten graft is an effective surgical technique for the management of caudal septal deviation. The procedure resulted in significant improvements in nasal obstruction, as indicated by reduced NOSE scores and VAS scores.

Financial support and sponsorship

The authors declare no financial support or interest in this study.

Ethics and consent

The research was conducted in compliance with the 1975 Helsinki Declaration and its amendments. Informed written consents were obtained from all patients to participate in this study. Also, approval was obtained from the Research Ethics Committee at the Faculty of Medicine, Benha (MS 40-1-2020).

Availability of data and material

The data that support the conclusions of this research are accessible on reasonable request from the corresponding author.

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Ethics and consent

The study was performed in accordance with the Helsinki Declaration of 1975 and its amendments; the study protocol was approved by the Research Ethics Committee at the Faculty of Medicine, Benha University (REC-FOMBU), Egypt, under approval number MS 40-1-2020. All patients signed their written informed consent to participate in the study.

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Nil.

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Nil.

Conflicts of interest

The authors declare no conflict of interest.

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