European Archives of Oto-Rhino-Laryngology (2019) 276:1981–1986
https://doi.org/10.1007/s00405-019-05411-x

RHINOLOGY

Risk factors for intraoperative saddle nose deformity in septoplasty patients

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Received: 24 February 2019 / Accepted: 25 March 2019 / Published online: 2 April 2019

Abstract

Introduction Septoplasty is one of the most common otolaryngologic procedures. Previous studies have reported that the overall rate of significant change in cosmetic appearance of the nose after septoplasty ranged from 0.4 to 3.4%, and saddle nose was the most commonly cited deformity. In this study, we evaluated the risk factors for intraoperative saddle nose in a group of septoplasty patients.

Methods This case–control study (1:2 case:control) was conducted based on retrospective chart review. Intraoperative saddle nose was observed in 108 (5.1%) of 2106 patients who underwent septoplasty in our center between January 2008 and December 2017. The control group consisted of 216 randomly selected, hospital-matched septoplasty patients who had no intraoperative saddle nose deformity in the same period. The demographic data, preoperative endoscopic findings, and surgical procedures of the two groups were analyzed to identify possible risk factors of intraoperative saddle nose deformity.

Results The mean ages of the two groups were 34.8 years (saddle group) and 33.2 years (control group). In multivariate logistic regression analysis, clinical risk factors associated with intraoperative saddle nose were female gender (OR 3.39; 95% CI 1.76–6.54; $p < 0.01$), severe caudal septal deviation (OR 2.22; 95% CI 1.30–3.79; $p = 0.003$), and intraoperative finding of septal cartilage fracture (OR 3.96; 95% CI 1.92–8.19; $p < 0.01$).

Conclusions Severe caudal septal deviation, intraoperative fracture of septal cartilage, and female gender were risk factors for intraoperative saddle nose deformity in our study population.

Keywords Septoplasty · Saddle nose · Risk factor

Introduction

Septoplasty is one of the most common otolaryngologic procedures. A German study reported that surgery for a deviated septum was among the top ten hospital diagnoses in the male insured population [1]. In an American study, septoplasty was the third most commonly performed operation by otolaryngologists, after myringotomy with ventilation tube insertion and tonsillectomy with adenoidectomy [2]. Septoplasty is usually required to improve the nasal airway in patients with a continuous unilateral or bilateral nasal obstruction with deviated septum. Other reasons to perform septoplasty include treatment of facial pain caused by contact of the septum with the lateral nasal wall or improvement of intraoperative visualization during endoscopic sinus surgery [3].

Various adverse complications can occur after septoplasty, such as epistaxis, postoperative pain, septal perforation [4], and cerebrospinal fluid rhinorrhea [5]. Saddle nose is also a potential complication. Overall reported rates of significant change in cosmetic appearance of the nose after septoplasty range from 0.4 to 3.4% [4, 6]. These changes occur because the nasal septum plays an important role in maintaining the shape of the nose. The most commonly cited cosmetic defects arising from septoplasty are saddle nose deformity and supratip depression [7].

Reconstruction of saddle nose deformity is an arduous task [8]. Although intraoperative saddle nose deformity is a rare complication in septoplasty, it is a serious problem for both surgeon and patient. However, in many cases, surgeons do not know the cause of intraoperative saddle nose deformity. It is known only that, in cases of overzealous

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manipulation near the L-strut of the septal structure, there is a risk of septal instability, which is likely to induce a saddle nose deformity. However, cases of saddle nose deformity are possible even if the L-strut is preserved. On the other hand, saddle nose may not occur despite manipulating the part including the L-strut for active correction of septal deviation. Manipulation of the L-strut alone is not enough to explain the risk of a saddle nose deformity. Therefore, we aimed to evaluate the clinical risk factors for predicting intraoperative saddle nose from demographics, preoperative endoscopic findings, and surgical procedures in septoplasty patients.

Materials and methods

This retrospective case–control study was approved by the Samsung Medical Center Institutional Review Board. Adult patients (over 18 years old) with septal deviation who underwent septoplasty with or without inferior turbinoplasty between January 2008 and December 2017 at a single tertiary rhinology department were enrolled. The indication for septoplasty was persistent nasal obstruction with definite septal deviation, despite medical treatment including intranasal steroid spray for at least 1 month. Patients who underwent septoplasty to access the sinuses during endoscopic sinus surgery were excluded in this study. We conducted a retrospective chart review with a case–control study design. A total of 2106 patients underwent septoplasty with or without inferior turbinoplasty in our hospital during the study period. Of these, saddle nose deformity occurred in 129 patients and was treated with camouflage insertion. However, because this study aimed to evaluate the risk factors of intraoperative saddle nose, we excluded 21 patients who had a preoperative saddle nose deformity and were scheduled to receive camouflage insertion for cosmetic purposes. Ultimately, 108 (5.1%) patients were enrolled as the case group with intraoperative saddle nose deformity. The control group consisted of 216 randomly selected, hospital-matched septoplasty patients (1:2 case:control) who had no intraoperative saddle nose deformity in the same period.

The location of deformity in the nasal septum can be evaluated by nasal endoscopy and CT scan. In our study, the site of septal deviation was confirmed by CT scan. In a previous study, the locations of deformity were classified into five divisions [9]: caudal, dorsal, posterior ethmoid plate (posterior bony septum), maxillary crest with inferior septal cartilage, and mid-septum (Fig. 1). We noted severe caudal septal deviation when the inferior turbinate was not visible through endoscopic examination due to caudal septal deviation (Fig. 2). To confirm the intraoperative occurrence of saddle nose, we routinely assessed a lateral view of the patient before and after surgery. We noted intraoperative saddle nose when immediate correction was necessary due to change around the supratip area after surgery (Fig. 3). If saddle nose was detected, we performed camouflage insertion on the dorsum area using crushed remnant septal cartilage through marginal incision.

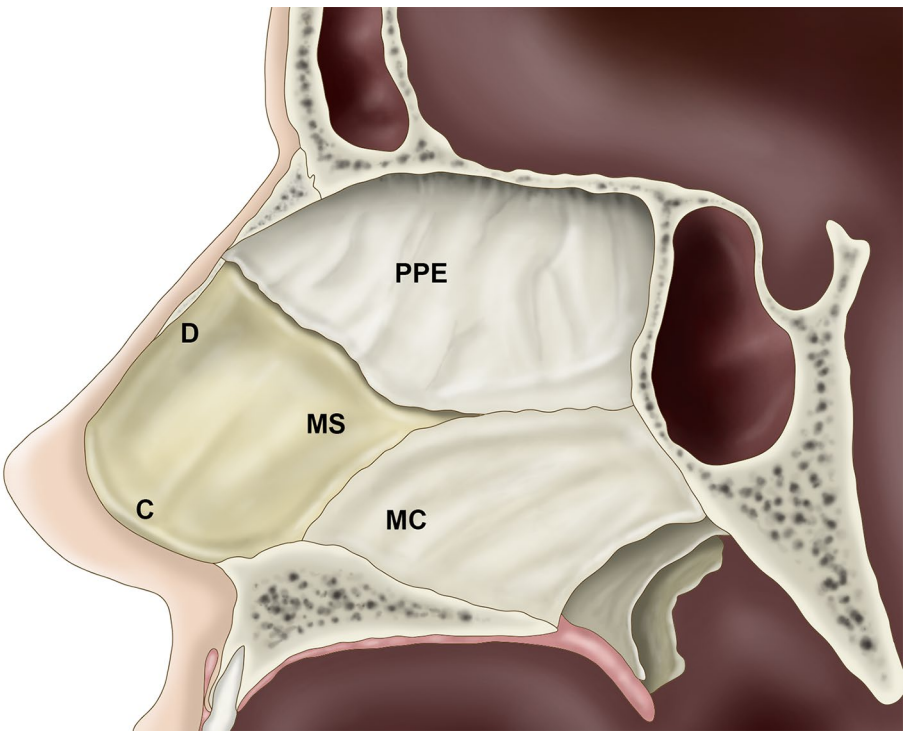

Fig. 1 Categorization of the sites of septal deviation. (from Ref. [9]) *C* caudal deviation, *D* dorsal septal strut, *MC* maxillary crest (inferior septum), *MS* mid-septum, *PPE* perpendicular plate of ethmoid bone (bony septum)

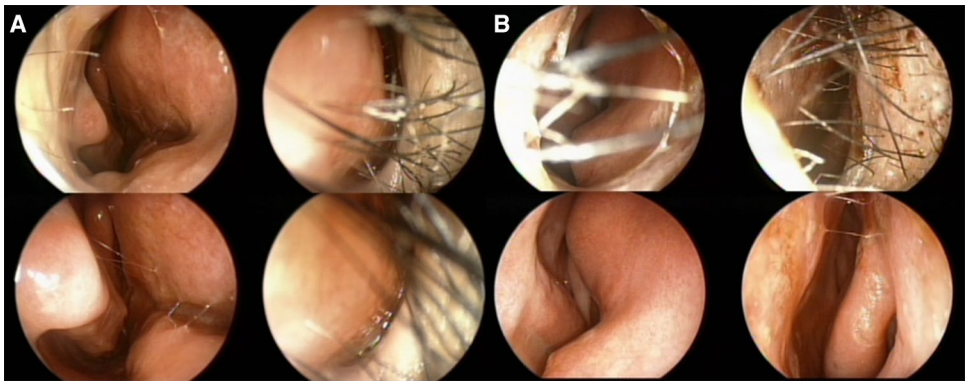

Fig. 2 Examples of caudal deviation. **a** Severe caudal deviation: inferior turbinate is not visible. **b** Non-severe caudal deviation: inferior turbinate is visible

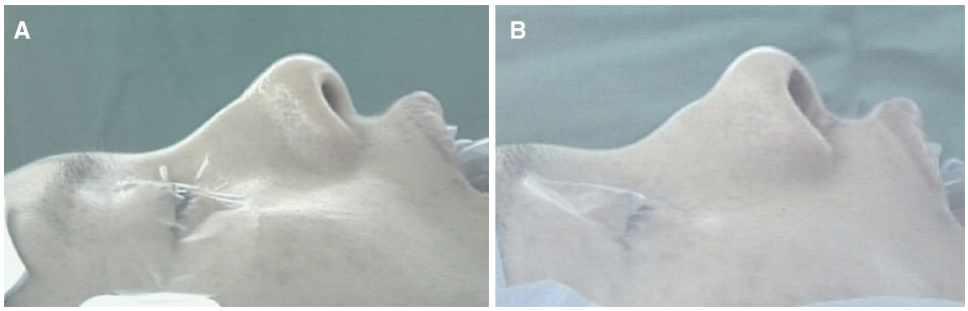

Fig. 3 **a** Preoperative lateral view of a septoplasty patient. **b** Intraoperative saddle nose deformity after surgery

All septoplasty cases in our study groups were carried out with an endonasal approach. Hemitransfixion incision was routinely used with unilateral or bilateral septal mucosal flap elevation. After flap elevation, we examined the site of septal deviation and corrected the deviation using various techniques including resection of surplus septal cartilage or bone and horizontal mattress suture [10], but we preserved as much cartilage or bone as possible. A silastic sheet was used to prevent a synechia and was removed between one and 2 weeks postoperatively. From the medical record, demographic features of patients including age, gender, and previous operation history were extracted for analysis. We also performed a review of surgical records to determine the surgical procedure.

Statistical analysis

Descriptive analysis was performed using mean and percentage of characteristic findings, and the results are presented as mean ± standard deviation (SD). The independent *t* test was used to compare the mean age and follow-up period of the two groups. The Chi-square test or Fisher's exact test was used to compare the percentages of characteristic findings between the saddle and control groups, including gender, previous trauma history, previous septoplasty history, and follow-up period. Univariate and multivariate logistic regression analyses were used to identify associations between possible clinical variables and intraoperative saddle nose events. The results are presented as odds ratio (OR), 95% confidence interval (CI), and *p* value. Statistical significance was accepted at $p < 0.05$. All statistical analyses were performed using SPSS ver. 20.0 (IBM CO., Armonk, NY, USA).

Results

Demographic data of the saddle and control groups are presented in Table 1. A total of 324 subjects were enrolled, with 108 (81 men, 27 women) in the saddle group and 216 (193 men, 23 women) in the control group. The proportions of female gender in the saddle and control groups were 25.5% and 10.6%, respectively, which is significantly different ($p = 0.001$). The mean ages (± standard deviation) in the saddle and control groups were 34.8 ± 13.2 years and 33.2 ± 13.1 years, respectively, and showed no significant difference. The saddle group had more frequent history of trauma than the control group ($p = 0.029$). Previous operation history and duration of follow-up period were not statistically different between the two groups.

The locations of septal deviation according to preoperative CT scan are presented in Table 2. There was no statistically significant difference between the saddle and control group except in the incidence of caudal septal deviation; the saddle group had more caudal deviation than the control group (88% vs 61%, $p < 0.01$).

The risk factors for intraoperative saddle nose are shown in Table 3. Multivariate logistic regression analysis was

Table 1 Demographic findings of the saddle group and control group ($n=324$)

Characteristics	Saddle ($n=108$)	Control ($n=216$)	p value
Gender			
Male	81 (75.0%)	193 (89.4%)	0.001
Female	27 (25.0%)	23 (10.6%)	
Age, years (mean ± SD)	34.8 ± 13.2	33.2 ± 13.1	0.306
History of trauma	35 (32.4%)	46 (21.3%)	0.029
History of previous operation	15 (13.9%)	28 (13.0%)	0.817
Follow-up period, months (mean ± SD)	5.9 ± 3.1	6.4 ± 3.4	0.222
CT evaluation	72 (66.7%)	176 (81.5%)	0.895

SD standard deviation

Table 2 Sites of septal deviation according to CT evaluation

Site	Saddle ($n=72$)	Control ($n=176$)	p value
Caudal	63 (88%)	107 (61%)	< 0.001
Dorsum	59 (82%)	156 (89%)	0.159
Mid-septum	56 (78%)	156 (89%)	0.077
PEP (bony septum)	49 (68%)	140 (80%)	0.054
Maxillary crest (inferior septum)	60 (84%)	135 (77%)	0.248

PEP perpendicular ethmoid plate

performed to adjust for confounders on the associations between saddle nose and potential risk factors. In multivariate logistic regression analysis, clinical risk factors associated with intraoperative saddle nose were female gender (OR 3.39; 95% CI 1.76–6.54; $p<0.01$), severe caudal septal deviation (OR 2.22; 95% CI 1.30–3.79; $p=0.003$), and fracture of septal cartilage (OR 3.96; 95% CI 1.92–8.19; $p<0.01$). We also determined if there was any difference in incidence of intraoperative saddle nose deformity according to direction of fracture line in septal cartilage between cephalocaudal and dorsoventral directions. However, Table 4 shows no difference in saddle nose incidence related to direction of fracture line ($p=0.858$).

Discussion

The nasal septum has an important physiologic role in maintaining airflow, but also supports the dorsum of the nose and contributes to aspects of nose shape such as height, length, tip, and position in the center of the face. Septal deviation is a common condition, with prevalence ranging from 22% in newborns to 90% in adults [11, 12]. Surgical correction can be considered in the management of patients who have continuous nasal obstruction despite medical treatment. However, the overall incidence of unfavorable esthetic outcomes after septoplasty is reported to be 1–8% [13, 14]. Saddle nose deformity,

Table 4 Direction of intraoperative septal cartilage fracture lines

	Dorsoventral	Cephalocaudal	p value
Saddle ($n=26$)	8 (30.8%)	18 (69.2%)	0.858
Control ($n=15$)	5 (33.3%)	10 (66.7%)	

Table 3 Risk factors for predicting intraoperative saddle nose

	Saddle ($n=108$)	Control ($n=216$)	Univariate OR (95% CI)	p value	Multivariate OR (95% CI)	p value
Gender						
Male	81 (75%)	193 (89%)	Reference		Reference	
Female	27 (25%)	23 (11%)	2.94 (1.18–7.37)	0.021	3.39 (1.76–6.54)	< 0.01
Trauma history	35 (32%)	46 (21%)	1.77 (1.06–2.98)	0.03	1.67 (0.95–2.93)	0.077
Previous surgery history	15 (14%)	28 (13%)	1.083 (0.552–2.13)	0.817	1.11 (0.37–3.32)	0.851
Severe caudal deviation	46 (43%)	52 (25%)	2.34 (1.43–3.83)	< 0.01	2.22 (1.30–3.79)	0.003
Fracture of septal cartilage	26 (24%)	15 (7%)	4.25 (2.14–8.43)	< 0.01	3.96 (1.92–8.19)	< 0.01
PEP/Vomer resection	107 (99%)	210 (97%)	3.06 (0.36–25.72)	0.304	2.97 (0.287–30.72)	0.362
Septal cartilage removal	105 (97%)	203 (94%)	2.324 (0.63–8.04)	0.216	2.86 (0.701–11.67)	0.143
Maxillary crest reposition	46 (43%)	114 (53%)	0.664 (0.42–1.06)	0.085	0.622 (0.37–1.04)	0.067

PEP perpendicular ethmoid plate

supratip depression, columellar retraction, and alar cartilage collapse can occur after septoplasty [15]. Of these, saddle nose is reported to be the most common unfavorable esthetic deformity. In general, patients undergo septoplasty to improve nasal obstruction and usually do not consider external deformity after surgery. Failure to provide sufficient explanation and obtain consent to the possibility of unfavorable postoperative esthetic outcomes can cause serious problems for both surgeon and patient. Given that cosmetic changes, whether significant or not, often result from septoplasty, Bateman and Woolford recommend preoperative photo-documentation for more accurate comparison, analysis, and informed preoperative and postoperative comparisons and planning [16].

Some previous studies have explained the causes of saddle nose. Because the dorsal strut may not be sufficient to support the normal nasal anatomy after septoplasty if the width of remnant cartilage is less than 10–15 mm, loss of caudal septal support appears to be a major reason for nasal deformity after septoplasty [6]. Another paper similarly said that one of the main causes of saddle nose deformity is over-resection of cartilage [7]. Therefore, preservation of adequate dorsal and caudal struts is important to prevent saddle nose deformity. Our study also showed that the saddle nose group had a higher proportion of severe caudal septal deviation in endoscopic examination and preoperative CT scan than the control group. Patients with severe caudal septal deviation might have more chance of postoperative saddle nose deformity because correction of caudal septal deviation often weakens the septal supporting system. However, caudal septal deviation is not likely to be the only reason for saddle nose deformity. We hypothesized that there were relationships between saddle nose and demographics, preoperative endoscopic findings, and surgical procedure.

The present study found that female gender, severe caudal deviation on nasal endoscopy, and fracture of septal cartilage are risk factors for intraoperative saddle nose deformity. Here, 25% of the saddle group and 10.1% of the control group were females. Female gender is a significant risk factor in our study (OR in multivariate analysis 3.39; 95% CI 1.88–6.90; $p < 0.01$). The reason for this difference is thought to be that the septal cartilage of men and women differs in thickness and size; therefore, the force of caudal septal support is lower in females than in males. During septoplasty, after elevation of the mucosal flap, it is important to assess the bearing capacity or thickness before removing surplus cartilage. If the caudal septal supporting force is weak, it is important to maintain the stability of the nasal septum by resecting the surplus septal cartilage minimally. Another risk factor for intraoperative saddle nose was fracture of septal cartilage, which showed an OR of 3.96 in multivariate analysis ($p < 0.01$). Fracture of septal cartilage often involves the L-strut, which is important for septal stability, and manipulation of this fracture line might be associated with saddle nose.

Our study has several limitations. First, because it is a retrospective study based on medical records, it may have an information bias. Second, it is difficult to judge the degree of septal deviation because a method for determining the degree of septal deviation has not been established yet. For this reason, in this study, we could only classify patients according to location of septal deviation on CT scan, not the degree of septal deviation. More accurate research can be done if the measurements of the degree of septal deviation are uniform. Despite these limitations, to our knowledge, this is the first study to identify risk factors for intraoperative saddle nose deformity. This study found that patients with severe caudal septal deviation, fracture of septal cartilage, and female gender had high risk for intraoperative saddle nose deformity.

Conclusions

Severe caudal deviation, intraoperative finding of septal cartilage fracture, and female gender were identified as possible risk factors for predicting intraoperative saddle nose deformity in our study population. A careful surplus cartilage resection in these patients might be helpful in lowering the incidence of saddle nose deformity.

Funding This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (MEST) (2017R1A2B4006453).

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

Ethical approval This study was reviewed and approved by the Institutional Ethics Committee at the Samsung Medical Center (IRB number: SMC 2018-05-136).

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