Original Article

Learning curve of septoplasty procedure

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ABSTRACT

Objectives: The aim of this study was to investigate possible relationship between surgical experience and septoplasty-related data and to determine the learning curve based on surgery duration.

Patients and Methods: The first 60 septoplasty patients of four Ear, Nose and Throat residents who completed an 18-month residency training in our clinic between August 2015 and December 2017 were included in the study. A total of 240 patients (155 males, 85 females; mean age 32.8±10.6 years; range, 17 to 60 years) were evaluated. The first 10 patients were grouped as Group A, 11-20 patients as Group B, 21-30 patients as Group C, 31-40 patients as Group D, 41-50 patients as Group E, and 51-60 patients as Group F. The patients' files were retrospectively reviewed to obtain information on demographics, postoperative hospital stay, complications, revision operation requirements, and operation time. The mean operation time was calculated. Duration of surgery was used to evaluate the maturity of surgical skills.

Results: The mean operation time was 60.0±17.3 min. The mean operation times of the patients in Group A and Group B were significantly longer than that of the patients in Group C, Group D, Group E, and Group F. There was no significant difference between the groups in terms of length of hospital stay, complications, and revision rates.

Conclusion: As the surgeon's experience increases, the operation time decreases, and after 20 patients, it reaches the plateau level. Based on these data, it can be concluded that ENT residents should practice more than 20 patients to learn the septoplasty procedure sufficiently.

Keywords: Experience, nasal obstruction, resident, septum deviation.

Septoplasty is one of the most common otorhinolaryngology procedures used to relieve nasal obstruction.[1] Septoplasty, which is often left to inexperienced surgeons, is seen as a simple procedure. However, it is challenging to learn and teach septoplasty due to the limited surgical view, different deviation of the nasal septum in each patient, and relatively insufficient number of surgical septoplasty courses.[2] Also, according to young surgeons, septoplasty is a complicated procedure to learn and should not be considered as a simple procedure where a single approach fits all cases.[3,4] A learning curve is used to determine a stable operation time and the number of patients required to achieve surgical outcome. Inexperienced surgeons can use learning curves to contribute to their learning processes.[5]

In the present study, we aimed to determine the possible relationship between surgical experience and septoplasty-related data and to

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determine the learning curve based on surgery duration.

PATIENTS AND METHODS

This retrospective study included patients who underwent septoplasty in the Ear, Nose and Throat (ENT) clinic of Bakırköy Dr. Sadi Konuk Training and Research Hospital between August 2015 and December 2017. During this period, four ENT residents (Surgeons 1, 2, 3, and 4) completed their 18-month training, started to perform septoplasty procedures, and continued to do so until the end of their training. The first 60 patients of each resident were included in the study. Thus, a total of 240 patients (155 males, 85 females; mean age 32.8±10.6 years; range, 17 to 60 years) and four inexperienced surgeons (3 males, 1 females; mean age 27.5 years; range, 26 to 29 years) were evaluated. Surgery was performed in patients with chronic nasal obstruction due to nasal septum deviation. Preoperative paranasal sinus computed tomography was performed in all patients to exclude other causes of nasal obstruction. Patients of columella subluxation, and deviation of the caudal part of the septum requiring inferior turbinate reduction and concha bullosa resection was performed primarily by a senior surgeon in our clinic; therefore, these patients were excluded from the evaluation. Patients whose postoperative follow-up period was less than one year and those for whom sufficient information could not be obtained from the patient files were also excluded. The mean operation time of the residents was calculated (Figure 1).

The patients were divided into six groups for each surgeon to compare the surgical results: the first 10 patients were grouped as Group A, 11-20 patients as Group B, 21-30 patients as Group C, 31-40 patients as Group D, 41-50 patients as Group E, and 51-60 patients as Group F. Patients' files were retrospectively scanned to obtain information including age, gender, postoperative hospital stay, complications, revision operation requirement, and surgical time. Follow-up examinations of the patients were performed at one week, one month, six months, and one year postoperatively. If persistent septum deviation was detected in patients whose nasal congestion symptoms continued during follow-up, revision septoplasty surgery was performed by a senior surgeon. Surgical complications were postoperative bleeding, septal hematoma, septal perforation, synechia, and saddle nose deformity. The time between draping of the patient and packing of the nasal cavity was determined in min and recorded as the duration of surgery. There was no bias in the patient selection, as the patients were sequentially assigned to the surgeons.

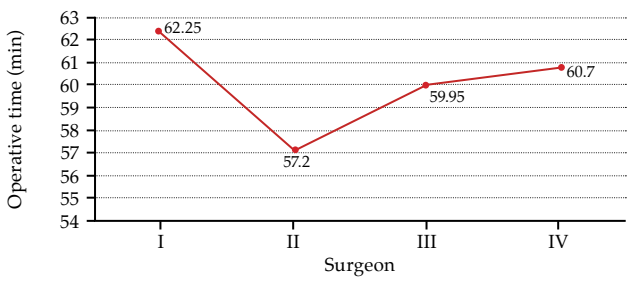

Figure 1. *Mean operative time of residents.*
Min: Minute.

A written informed consent was obtained from each patient. The study protocol was approved by the Bakırköy Dr. Sadi Konuk Training and Research Hospital Ethics Committee (Protocol No. 2019/05). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Surgical technique

All septoplasty procedures were performed under general anesthesia. In the first three patients of each resident, the senior surgeon guided the operation and taught the surgical techniques of septoplasty. After local anesthetic infiltration of the nasal septum from the posterior to the anterior, and inferior to the superior, a hemitransfixion incision was made on the left side approximately 2-mm posterior to the caudal border of the septum using a No. 15 blade. Mucoperichondrial and mucoperiosteal flaps were elevated and enlarged to reveal the maxillary crest at the nasal floor. The cartilage septum was separated from the perpendicular lamina. The inferior border of the septum was separated from the maxillary crest. Deformation and deviations narrowing the nasal passage of the perpendicular lamina and vomer were removed,

and the deviated parts of the cartilage septum were removed. In the presence of a deviation in the maxillary crest, the deviated parts were removed using an osteotome. Finally, using a 4/0 rapid Vicryl suture, the mucoperichondrial flap was sutured from posterior to anterior to the septum, and the hemitransfixion incision was sutured. A Doyle internal silicone nasal splint was placed in the bilateral nasal passages and fixed to the anterior part of the septum, and the operation was terminated with external dressing.

Statistical analysis

Statistical analysis was performed using the Number Cruncher Statistical System (NCSS) version 11.0 (NCSS LLC, Kaysville, UT, USA). Descriptive data were expressed in mean ± standard deviation (SD), median (min-max), or number and frequency. The normal distribution of continuous variables was analyzed using the Kolmogorov-Smirnov test. The relationships between categorical variables were evaluated using the one-sample chi-square and Fisher-Freeman-Halton test. The Kruskal-Wallis H test was used for the comparisons of more than two groups of variables that did not fulfill the assumption of normal distribution. The Bonferroni Dunn's multiple comparison test was used to examine the source of significant difference. A p value of <0.05 was considered statistically significant.

RESULTS

Of all patients, 225 (93.75%) were discharged on the first postoperative day, 13 (5.42%) on the second postoperative day, and two (0.83%) on the third postoperative day. No complications were observed in 229 (95.82%) of 240 patients.

Ten patients (4.18%) developed postoperative complications: severe bleeding in one, septal hematoma in one, septal perforation in three, nasal synechiae in four, and saddle nose deformity in one patient after six months. The patient who developed postoperative bleeding was re-admitted to the operating room, and the bleeding center was found and controlled using bipolar cauterization. For the patient who developed a septal hematoma, the hematoma was evacuated under local anesthesia in the outpatient setting, and the patient was re-hospitalized, but discharged three days later and no additional complications were observed. Since septal perforations did not cause any complaints, the patients were informed about perforation and followed without intervention. For the patients who developed nasal synechiae, synechiae were removed under local anesthesia. The patient who had saddle nose deformity after septoplasty underwent open revision septoplasty with costal cartilage, which was performed in the ninth postoperative month.

Seventeen patients (7.08%) whose nasal obstruction did not regress in the postoperative period and had persistent septum deviation during follow-up underwent revision septoplasty at six months postoperatively.

The mean surgical time was 60.0±17.3 min. There was no statistically significant difference among the surgeons in terms of surgical time (Kruskal-Wallis H test p=0.554). However, there was a statistically significant difference in the surgical time among the groups (Kruskal-Wallis H test p=0.002) (Table 1). Binary analyses revealed that the mean surgical times of the patients in Group A and Group B were significantly longer than those of patients in Groups C, D, E, and F. There was no statistically significant difference among the other groups (Bonferroni Dunn's multiple comparison test p<0.001). Although the experience of the surgeon improved and the time until discharge was shorter, no statistically significant difference was observed (Fisher-Freeman-Halton test

Table 1. Comparison of surgery durations of patient groups

	Surgery duration (min)		
	Mean±SD	Min-Max	p*
Patient groups			
Group A	85.8±11.9	65-115	0.002
Group B	69.7±12.3	49-96	
Group C	54.6±10.9	35-72	
Group D	51.7±12.7	35-102	
Group E	49.9±10.0	29-74	
Group F	48.6±6.9	24-64	

Min: Minute; SD: Standard deviation; Min: Minimum; Max: Maximum; * Kruskal-Wallis H test.

Table 2. Postoperative hospital stay. Presence of complications and revision rates

	Patient groups												
	Group A		Group B		Group C		Group D		Group E		Group F		
	n	%	n	%	n	%	n	%	n	%	n	%	*p**
Postoperative hospital stay (day)													
1	33	82.50	39	97.50	37	92.50	38	95.00	40	100.00	38	95.00	
2	6	15.00	1	2.50	3	7.50	2	5.00	0	0.00	1	2.50	0.063
3	1	2.50	0	0.00	0	0.00	0	.00	0	0.00	1	2.50	
Complication													
-	37	92.50	38	95.00	40	100	37	92.50	39	97.50	39	97.50	0.521
+	3	7.50	2	5.00	0	0.00	3	7.50	1	2.50	1	2.50	
Revision													
-	35	87.50	36	90.00	37	92.50	39	97.50	37	92.50	39	97.50	0.476
+	5	12.50	4	10.00	3	7.50	1	2.50	3	7.50	1	2.50	

* Fisher-Freeman-Halton test.

p=0.063). In addition, there was no significant difference in the length of hospital stay, presence of complications, and revision rates among the groups (Fisher-Freeman-Halton test p=0.063, p=0.521, and p=0.476, respectively) (Table 2).

DISCUSSION

Septum deviation is a common anatomic variation and usually does not cause airway problems; however, it may cause at least 50 to 60% obstruction in the inferior anterior part of the nasal passage. In the presence of airway problems, a septoplasty procedure is necessary to eliminate the disturbing symptoms of nasal obstruction.[6] Possible complications of septoplasty include bleeding/septal hematoma, septal perforation, adhesion/synechia, structural deformities (i.e., saddle nose, nasal tip falls, nasal dorsum opening), anosmia/hyposmia, infection/septal abscess/toxic shock syndrome, dental anesthesia, intracranial complications, ocular complications, and cardiac complications.[7] In a study including 5,636 patients to examine complications of septoplasty, the complication rate due to septoplasty was found to be 3.42%.[7] In our study, postoperative complications (i.e., bleeding, hematoma, septal perforation, synechia, and saddle nose deformity) were observed in 10 patients, and similarly, the complication rate was 4.18%.

Although septoplasty is one of the most common basic procedures of otorhinolaryngology, it is difficult to learn and teach due to the limited surgical view and the fact that both the senior surgeon and assistant surgeon cannot see the surgical field at the same time. Septum deviation also varies among individuals. Therefore, it may be necessary to apply different techniques in different cases.[8,9] Heo et al.[2] included six inexperienced surgeons in their study and analyzed the surgical results in the order of the operations performed. They reported that as surgical experience increased, surgical times became shorter and revision rates remained unchanged. The authors also reported that the decrease of surgical times was not significant after the 30th case and that the surgical time reached a plateau level after the 30th case. They concluded that the complication rates decreased significantly after the 30th case,

compared to the first 10 cases and that 30 cases were required for a surgeon to become relatively skilled in septoplasty and lower turbinate radiofrequency.

In our study, we analyzed four inexperienced surgeons and the first 60 septoplasty patients. We found that as surgical experience increased, surgical times decreased. However, this decrease was not statistically significant after 20 patients. In our study, a plateau level was reached after the first 20 patients. Heo et al.[2] reported that senior surgeons only guided inexperienced surgeons during the first case, teaching the surgical techniques, and that all septoplasty procedures were performed under local anesthesia, except for the first case of each surgeon. In our study, all septoplasty procedures were performed under general anesthesia, and for the first three patients, the senior surgeon accompanied the inexperienced surgeon during all surgeries and taught surgical techniques.

Although there are several advantages of being able to communicate with the patient under local anesthesia, unexpected sudden movements of the patient may impair the comfort of the surgeon. Besides, intraoperative hemorrhage may cause discomfort both in the patient and the surgeon, resulting in prolongation of the operation and limitation of the surgical view.[10-13] We believe that the learning process of inexperienced surgeons may be delayed with local anesthesia, which may explain the difference between the number of cases required to reach the plateau level. Similar to the studies of Heo et al.,[2] no significant difference in the revision rates was found among the patient groups. Also, contrary to their studies, no significant difference was found among the patient groups in terms of the complication rates. The lack of significant differences in the complication rates can be explained by the fact that inexperienced surgeons are more careful and slower in the first cases and more experienced in the following cases. Liu et al.[14] included four assistant surgeons who were in the second, third, fourth, and fifth years of their training and found a significantly decreased length of hospital stay in septoplasty operations performed by surgeons in the fourth and fifth years of their residency. Consistently, we found that the length of hospital stay decreased with increased surgeon experience, although no significant difference was observed among the groups. Our revision surgery rate was 7.08%, and surgery was considered successful in our patients who did not undergo revision surgery.

The main limitations of our study are the lack of acoustic rhinomanometry findings and patient satisfaction evaluation using such as the Nasal Obstruction and Septoplasty Effectiveness (NOSE) scale or Sino-Nasal Outcome Test-22 (SNOT) questionnaire, which provide important data for the success of surgery. With the inclusion of these data in further studies, surgical success can be evaluated more accurately.

In conclusion, as the surgeon's experience increases, the surgical time decreases, and after 20 patients, it reaches a plateau level. Based on these data, it can be concluded that ENT residents should practice more than 20 patients to learn the septoplasty procedure sufficiently. Since there is no significant relationship between complication rates, revision rates, hospital stay, and surgeon's experience, it can be concluded that young surgeons starting to learn septoplasty can perform this procedure without being worried about failure and fear of complications.

Declaration of conflicting interests

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