E-ISSN: 2616-3470
P-ISSN: 2616-3462

www.surgeryscience.com
2020; 4(4): 92-96
Received: 19-08-2020
Accepted: 21-09-2020

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The role of limited septoplasty during functional endoscopic sinus surgery for chronic rhinosinusitis

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DOI: https://doi.org/10.33545/surgery.2020.v4.i4b.545

Abstract
Functional endoscopic sinus surgery (FESS) has been the most common surgery for chronic rhinosinusitis (CRS), and to accomplish surgical goals such as facilitate adequate visualization and allow room for endoscopic instrumentation, the correction of the minimally deviated septum has been advocated. Objective: To ascertain the role of limited septoplasty during functional endoscopic sinus surgery (FESS) in reducing the recurrence of the rhinosinusitis. Patients and methods: A prospective descriptive study conducted at the department of Otorhinolaryngology–Head & Neck surgery (Sulaymaniyah Teaching Hospital - College of Medicine - University of Sulaymaniyah). Patients were presented with refractory CRS, with concomitant septal deviation, and prepared for FESS were randomly divided into two groups; group A (10 patients) underwent FESS without septoplasty and group B (10 patients) underwent FESS with limited septoplasty. To determine the effectiveness of the septoplasty in concomitant with FESS, a comparison of the outcomes of FESS in both groups been done throughout utilizing the Sino-Nasal outcome test (SNOT-22) and Lund –Kennedy (LK) endoscopic score preoperatively and 6 months postoperatively. Results: Among the twenty patients included in this study, (40%) of patients in the group A and (30%) of patients in the group B had polyp extending to nasal cavity with (two score), which diminished to 0% at 6 months postoperatively. Need to blow nose, Sneezing, Runny nose, cough, postnasal discharge, ear fullness, dizziness, ear pain, facial pain/pressure, fatigue, sad, embarrassed symptoms had improved in patients undergone FESS with limited septoplasty. Conclusions: Limited septoplasty is primarily used when the septal deviation is located opposite the work area for endoscopic sinus surgery--namely, opposite the middle turbinate and/or the osteomeatal unit.

Keywords: Septal deviation, septoplasty, limited septoplasty, functional endoscopic sinus surgery

Introduction
Chronic rhinosinusitis (CRS) represents a significant disease burden worldwide, affecting at least 11% of the population and consequently carrying with it a substantial economic burden to healthcare systems, to patients and to the economy from loss of productivity in the workplace [1, 2]. In fact, 'rhinosinusitis' was cited as one of the top ten most costly physical health conditions to American businesses in 1999, as it has an increasing incidence in middle age with a significant socio-economic impact and impairment of quality of life [3, 4]. The development of the CRS is multifactorial in origin, and these might be related to host like; anatomic variants such as a concha bullosa, septal spur, and paradoxical turbinate; severity of the mucosal diseases and associated comorbidities like asthma, cystic fibrosis and immotile cilia syndrome have potential role in initiation and recurrence of the CRS [5]. Septal deviation is a common clinical finding and is often present in patients reporting nasal obstruction. It has also been implicated as a contributing factor in the development of rhinosinusitis and may impair visualization during and after endoscopic sinus surgery [6, 7]. Over the years, many surgical techniques for the correction of septal deformity have become diffuse [8]. Septoplasty remains one of the most common rhinologic surgical procedures with an estimated 340,000 procedures performed in the US every year [7]. The concept of septoplasty was firstly popularized by Freer (1902) and Killian (1904) separately more than 100 years ago [8]. In 1947, Cottle defined surgical septoplasty as a treatment to correct nasal airway obstruction, and standardized the technique [9]. Over the past 20 years, functional endoscopic sinus surgery (FESS) has been widely used as a safe and effective treatment for CRS, and to optimize nasal patency and improve surgical access, limited endoscopic septoplasty initially described in 1991 by Stammberger and since that time is commonly performed during FESS [10].

Patients and Methods: A prospective descriptive study conducted at the department of Otorhinolaryngology–Head & Neck surgery (Sulaymaniyah Teaching Hospital - College of Medicine - University of Sulaymaniyah, Kurdistan Region – Iraq) in a period between March 2018 – March 2019. The study was approved by the institutional review board of Iraqi Board of Medical Specializations.

After informed consent, patients were presented with sign and symptoms of CRS, were refractory to maximum medical treatment with concomitant septal deviation which resulted in impaired access to the middle meatus which confirmed endoscopically, and prepared for functional endoscopic sinus surgery were included in the current study. Patients presented with acute sinus disease, recurrent CRS listed for revision sinus surgery, previous conventional nasal surgery, granulomatous disease such as (sarcoidosis, granulomatosis with polyangiitis), unilateral and malignant sino-nasal diseases were excluded from the study. Patients were then randomly by means of a coin toss, divided into two groups; group A (10 patients) underwent FESS without septoplasty and group B (10 patients) underwent FESS with limited septoplasty. To determine the effectiveness of the septoplasty in concomitant with FESS, a comparison of the outcomes of FESS in both groups been done throughout utilizing the Sino-Nasal outcome test (SNOT-22) and Lund –Kennedy (LK) endoscopic score preoperatively and 6 months postoperatively. History of symptoms was taken by using a questionnaire form containing (22) questions covering most of the symptoms of sinonasal diseases (Sino-Nasal outcome test SNOT-22). Each patient was requested to fill the questionnaire two times, preoperatively and six months postoperatively. The severity of the symptoms was evaluated by a score ranging from (0- 5), then the variability statistically was analyzed. The numeric scores of all questions in pre and post- operative forms were collected for comparison and a percentage of change in score obtained.

The sinonasal cavity evaluated using rigid nasal endoscopy for the presence of polyps, mucosal edema and discharge and staged according to the Lund–Kennedy (LK) endoscopic score. For nasal polyps, 0 was given for the absence of polyps; 1, for polyps restricted to middle meatus; 2, for polyps extending to the nasal cavity. For edema, 0 was given if the finding was absent; 1, if it was mild/ moderate edema; and 2, if it was polypoid degeneration. For discharge, 0 was given if there was no discharge present; 1, for hyaline discharge; and 2, for thickened and/or mucopurulent discharge.

Results: In total, 20 patients were included in this study, 11(55%) were female and 9 (45%) were male, the age distribution ranges from 15 to 63 with mean age of 35±13.45.Regarding the comorbidities; (20%) of patients in the group A and none of them in group B had asthma, (80%) of patients in the group A and (50%) of patients in the group B had allergic rhinitis, (10%) of patients in the group A and none of them in the group B had atopic dermatitis as shown in table 1.

Table 2 illustrate the pre and postoperative LK score as follows; LK score revealed preoperatively that (20%) of patients in both group A and group B had no polyp (zero score), which changed postoperatively to 90% in both groups. (40%) of patients in the group A and (50%) of patients in the group B had polyp restricted to middle turbinate (one score), which significantly decreased postoperatively to 10% in both groups. (40%) of patients in the group A and (30%) of patients in the group B had polyp extending to nasal cavity with (two score), which diminished to 0% postoperatively. In (10%) of patients in the group A had no edema preoperatively, which changed postoperatively to 70% and 90% in both group A and B respectively. (90%) of patients in the both group A and group B had mild to moderate edema preoperatively, which diminished postoperatively to 30% and 10% in both group A and B respectively. Preoperatively, 10% of patients in the group B had polypoid degeneration, which changed postoperatively to 0% in both groups. In (30%) of patients in the group A and (60%) of patients in the group B had no discharge preoperatively which slightly decreased postoperatively to 50% in group B. (50%) of patients in the group A and (30%) of patients in the group B had hyaline discharge preoperatively which not changed postoperatively. Preoperatively, (20%) of patients in the group A and (10%) of patient in the group B had mucopurulent discharge, which change to 20% in both groups postoperatively. Table 3 shows that Nasal obstruction, loss of smell or taste, thick nasal discharge, difficulty falling asleep, waking up at night, lack of good night sleep, waking-up tired, reduced productivity, reduced concentration, frustrated/ restless/ irritable had improved in patients undergone FESS without septoplasty. Need to blow nose, Sneezing, Runny nose, cough, postnasal discharge, ear fullness, dizziness, ear pain, facial pain/pressure, fatigue, sad, embarrassed had improved in patients undergone FESS with limited septoplasty.

Table 1: Demonstrate the comorbidities distribution in both group A (FESS without limited septoplasty) and group B (FESS with limited septoplasty).

Category	FESS-without limited septoplasty		FESS-with limited septoplasty	
	Group A		Group B	
	No.	%	No.	%
Asthma				
No	8	80.0	10	100.0
Yes	2	20.0	0	10.0
Total	10	100.0	20	100.0
Allergic rhinitis				
No	2	20.0	5	50.0
Yes	8	80.0	5	50.0
Total	10	100.0	10	100.0
Atopic dermatitis				
No	9	90.0	10	100.0
Yes	1	10.0	0	0.0
Total	10	100.0	10	100.0

Table 2: Demonstrate the endoscopic Lund Kennedy score comparison between both group A (FESS without limited septoplasty) and group B (FESS with limited septoplasty).

Category	FESS-without limited septoplasty Group A				FESS-with limited septoplasty Group B			
	Preoperative		Postoperative		Preoperative		Postoperative	
	No.	%	No.	%	No.	%	No.	%
Polyp								
Absent	2	20.0	9	90.0	2	20.0	9	90.0
Restricted to MM	4	40.0	1	10.0	5	50.0	1	10.0
Extending to nasal cavity	4	40.0	0	00.0	3	30.0	0	00.0
Total	10	100.0	10	100.0	10	100.0	10	100.0
Edema								
Absent	1	10.0	7	70.0	0	0.0	9	90.0
Mild-moderate edema	9	90.0	3	30.0	9	90.0	1	10.0
Polypoid degeneration	0	0.0	0	00.0	1	10.0	0	00.0
Total	10	100.0	10	100.0	10	100.0	10	100.0
Discharge								
Absent	3	30.0	3	30.0	6	60.0	5	50.0
Hyaline	5	50.0	5	50.0	3	30.0	3	30.0
Thickened and/or mucopurulent	2	20.0	2	20.0	1	10.0	2	20.0
Total	10	100.0	10	100.0	10	100.0	10	100.0

Table 3: Demonstrate the Sinonasal Outcome Test (SNOT22) score in both group A (FESS without limited septoplasty) and group B (FESS with limited septoplasty).

Symptoms	FESS without septoplasty group A			FESS with limited septoplasty group B		
	Pre-op. No.	Post-op. No.	Change No. (%)	Pre-op. No.	Post-op. No.	Change No. (%)
Need to blow nose	7	4	3(43%)	7	3	4(57%)
Sneezing	5	3	2(40%)	4	2	2(50%)
Runny nose	6	4	2(33%)	4	2	2(50%)
Nasal obstruction	10	7	3(30%)	8	6	2(25%)
Loss of smell or taste	4	3	1(25%)	5	5	0(0%)
Cough	2	1	1(50%)	3	1	2(67%)
Post-nasal discharge	9	5	4(44%)	7	3	4(57%)
Thick nasal discharge	8	4	4(50%)	7	5	2(28.5%)
Ear fullness	1	1	0(0%)	1	0	1(100%)
Dizziness	0	0	0(0%)	4	0	4(100%)
Ear pain	1	1	0(0 %)	1	0	1(100%)
Facial pain/pressure	6	4	2(33%)	8	5	3(37.5%)
Difficulty falling sleep	8	3	5(62%)	7	4	3(43%)
Waking up at night	8	2	6(75%)	8	4	4(50%)
Lack of good night sleep	8	2	6(75%)	9	4	5(56%)
Waking up tired	8	2	6(75%)	9	3	6(67%)
Fatigue	8	4	4(50%)	10	4	6(60%)
Reduced productivity	6	2	4(67%)	4	2	2(50%)
Reduced concentration	5	1	4(80%)	4	2	2(50%)
Frustrated/restless/ irritable	5	2	3(60%)	6	5	1(17%)
Sad	6	4	2(33%)	10	5	5(50%)
Embarrassed	6	3	3(50%)	10	2	8(80%)

Discussions: Over last three decades, endoscopic sinus surgery has been widely used as a safe and effective treatment for Para Nasal Sinus (PNS) disorders. To optimize nasal patency and improve surgical access, submucosal resection (SMR) or septoplasty is commonly performed during FESS [6, 7]. Endoscopic septoplasty is an effective technique that can be performed safely alone or in combination with endoscopic sinus surgery with minimal additional morbidity. It enhances the surgical procedure and steps as the surgical assistant is able to visualize and anticipate the next surgical step and thus provide the required assistance, thus saving overall surgical time. It provides significant clinical and excellent teaching tool when used in conjunction with video monitors [11]. The fundamental requirement for achieving a good result in sinonasal endoscopic surgery is the correction of any morphological or structural abnormalities in the lateral wall and in the nasal septum when they interfere with sinus ventilation and muco-ciliary transport. Many authors from all over the world agree that deviations of the nasal septum that are contributing to inflammatory sinonasal disease, or that are impeding surgery, should be corrected; however, there is little information about the type of technique which should be used or on the timing of septoplasty in relation to the sinonasal surgery. Wigand *et al*. and Friedman *et al*. are in favor of correcting septal deviations during sinus surgery, whereas Stammberger prefers to perform the septal procedure before the sinus surgery [11]. At present, there are few studies in the literature that give the proportion of surgery performed endoscopically [12]. Our patients with limited septal deviation or spur together with chronic sinusitis first underwent functional endoscopic sinus surgery on their unobstructed side, followed by

septoplasty and then functional endoscopic sinus surgery on their obstructed side. That order was chosen so that at least the sinus surgery, when performed on the unobstructed side, had a bloodless field. Cantrell [13] and Hwang *et al.* [14], also performed the procedure in this way. Septal deviation is a common anatomical variation and it is role in the pathogenesis of chronic rhinosinusitis remains unclear [15]. The predisposing factors of sinusitis are multitudinous, including anatomic abnormalities, asthma, allergy, or genetic factors. Anatomic abnormalities were once recognized as a significant factor in the pathogenesis of rhinosinusitis. Septal deviation has been among those anomalies examined in multiple studies, and conflicting results have been reported. Some reports have described a correlation between septal deviation and the presence of rhinosinusitis, and an approximately equal number of reports have not found any such correlation. Most of these studies were rather small or examined this association indirectly, such as by investigating the role of a concha bullosa in rhinosinusitis [16]. Three possible mechanisms may explain the pathophysiology of how septal deviation may cause chronic rhinosinusitis. First, the stenosis of the osteomeatal complex due to either the anatomical configuration or edematous mucosa may cause the obstruction and stagnation of secretions, which may subsequently become infected or perpetuate infection [17]. The second potential mechanism involves aerodynamics: Septal deviation leads to an increase in nasal airflow velocity, which may cause mucosal desiccation and diminished mucociliary function [18, 19]. Third, changes in maxillary sinus pressure and ventilation in the region of the ostiomeatal complex due to septal deviations may cause chronic rhinosinusitis [20]. In our study some relationship could be proven between septal surgery combined with sinus surgery and chronic sinusitis as nasal obstruction (30%), loss of smell or taste (25%), thick nasal discharge (50%), difficulty falling asleep (62%), waking up at night (75%), lack of good night sleep (75%), waking up tired (75%), reduced productivity (67%), reduced concentration(80%), frustrated/restless/irritable (60%) had improved in patients undergone FESS without septoplasty while need to blow nose (57%), Sneezing (50%), Runny nose (50%), cough (67%), postnasal discharge (57%), ear fullness (100%), dizziness (100%), ear pain (100%), facial pain/pressure (37.5%), fatigue (60%), sad (50%), embarrassed (80%) had improved in patients undergone FESS with limited septoplasty, as a result, the most clinically relevant outcomes following septoplasty are patient-based symptoms. This result is in disharmony with a study done by Harar *et al.* [21] did not find any significant difference between chronic rhinosinusitis and septal deviation. Collet *et al.* [15] reviewed published literature and concluded that a definite role cannot be attributed to the nasal septum, either as the pathogenesis of chronic sinusitis or as a contributing factor. In the present study, according to the Lund –Kennedy endoscopic score, the patients undergone FESS with septoplasty got more improvement than patients undergone FESS without septoplasty. This result came in agreement with study done by Chan-Chi Chang *et al.* [16]. These findings may have been observed because concurrent septoplasty can provide better surgical field, reduce postoperative narrowing or synechiae of middle meatus, expand nasal space for sinus drainage and ventilation, and increase the convenience of postoperative care.

Conclusion: Septoplasty, in its myriad forms, has been used for decades as a treatment to correct nasal airway obstruction. In some cases, septoplasty is done to achieve adequate visualization for further work on the nose or paranasal area. With the onset of FESS the correction of the deviated septum has increasingly been done to facilitate adequate visualization and to allow room for endoscopic instrumentation. Limited septoplasty is primarily used when there is a specific deviation of the septum that limits the ability of the surgeon to accomplish surgical goals--namely, adequate visualization of the surgical field during surgery and during postoperative care. Decreased nasal obstruction is only a secondary consideration for limited septoplasty. The current study results suggest that limited septoplasty reduce the possibility of failed FESS and it affect some CRS-specific symptom outcomes.

Compliance with Ethical Standards.

Conflicts of interest: The authors declare that they have no conflict of interest.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: For this type of study formal consent is obtained.

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