Comparison of Outcomes of Conventional Septoplasty Versus Endoscopic Septoplasty using Freer's Incision in Symptomatic Deviated Nasal Septum

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ABSTRACT

Background

Septoplasty techniques have evolved over the years with endoscopic septoplasty gaining popularity in the recent times.

Objective

To compare the outcomes of conventional septoplasty with endoscopic septoplasty using Freer's incision in symptomatic deviated nasal septum.

Method

It was a prospective, randomized and comparative study done at Department of ENT-Head and Neck Surgery, Tribhuvan University Teaching Hospital, Kathmandu, Nepal from July 2018 to August 2019. A total of 70 patients with symptomatic deviated nasal septum were allocated randomly into two groups. Group A underwent conventional septoplasty whilst Group B underwent endoscopic septoplasty using Freer's incision. Sino-nasal outcome test (SNOT-10) score was recorded pre-operatively and post -operatively between four to six weeks of surgery. Paired and independent 't' test for mean was used as a statistical tool.

Result

Out of 70 patients, 57(81.43%) were males and 13(18.57%) females. The age group mostly affected was in the third and fourth decades with total 47 patients (67.14%). In the conventional group, the pre-op mean SNOT-10 score was 11.46 (SD±3.6) while post-op mean SNOT-10 score was 2.60 (SD±1.9), the difference being statistically significant (p value 0.00001). Similarly, in the endoscopic group, pre-op mean SNOT-10 score was 12.06 (SD±4.88) and post-op mean SNOT- 10 score was 3.37 (SD±2.71) with the difference being statistically significant (p value 0.00001). Comparison of post-operative mean SNOT-10 score between two techniques was not statistically significant (p value 0.17).

Conclusion

Both conventional and endoscopic septoplasty techniques using Freer's incision were equally effective in improving symptoms due to deviated nasal septum.

KEY WORDS

Conventional septoplasty, Deviated nasal septum, Endoscopic septoplasty, Freer's incision

INTRODUCTION

Symptomatic deviated nasal septum can present with nasal obstruction, rhinorrhoea, post-nasal drip, recurrent sinus pressure or pain, epistaxis and crusting for which septal surgery is indicated.[1]

Septal surgery has evolved over 100 years ever since modern septoplasty techniques were initially described by Freer and Killian in the early twentieth century.[2,3]

Although widely accepted, conventional septoplasty using headlight has limitations in illumination and visualization especially in the posterior part of the septum. Thus, there is difficulty in evaluating the exact pathology which may lead to overexposure, unnecessary manipulation and resection of the septal framework. A newer technique using endoscope, initially described by Lanza and Stammberger in 1991, has gained widespread popularity and acceptance following several reports of favorable outcomes.[4-6] It provides excellent illumination and visualization of the entire septum including the posterior septal deviation. There is accurate identification of the septal deviation hence minimal cartilage resection as per need. It also serves as an excellent teaching tool. However endoscopic septoplasty is not without drawbacks such as longer learning curve for surgeon, difficulty in correcting the deviated caudal septum, and the need for more expensive surgical tools.[7]

So, both septoplasty techniques have their pros and cons which determine how effectively septal deviation can be addressed which ultimately affects the outcome. This study was thus conducted to compare the difference in the outcomes of these two techniques if any. This would help find if one technique was better than the other in relieving the symptoms of deviated nasal septum.

METHODS

It was a prospective, randomized study conducted at Department of ENT-Head and Neck Surgery, Tribhuvan University Teaching Hospital, Kathmandu, Nepal from August 2018 to July 2019 after obtaining ethical clearance from the institutional review committee of Institute of Medicine. The minimum sample size calculated was 68.61 using the formula;

$n=Z^2pq/e^2$

where p was 93/1961 (number of septoplasties/number of elective cases under general and local anesthesia in the immediate past one year) confidence interval of 95% and 5% tolerable error.

The sample size was increased to 70 to equalize number of patients in each group. Convenient sampling was done. Patients aged 14 years and above with symptomatic deviated nasal septum were selected for the study. Revision septal surgery, septal surgery combined with any other procedures like endoscopic sinus surgery or rhinoplasty and septal surgery with bilateral flap elevation for epistaxis were excluded. All patients included in the study underwent pre-operative assessment using Sino-nasal outcome test (SNOT-10) score a day before surgery. SNOT-10 comprised of ten nose related symptoms on a score of zero (no problem) to three (problem as bad as it can be) depending upon the severity. Patients were allocated randomly into two groups by lottery method. Group A underwent conventional septoplasty whilst Group B underwent endoscopic septoplasty using Freer's incision in both groups. In conventional septoplasty, surgery was done under direct vision with headlight illumination and Killian's nasal speculum whilst in endoscopic septoplasty, Karl Storz rigid fibreoptic nasal endoscope, 4 mm '0' degree with Karl Storz light source was used for visualization. All the patients were followed up between four to six weeks post surgery and re- evaluation was done using the same SNOT-10 score. Nasoendoscopy was also performed to assess for synechiae or septal perforation.

Statistical analysis was done using SPSS 23 software. Descriptive (frequency, percentages, mean, standard deviation) and inferential statistics (paired 't' test, independent 't' test) were used. P value < 0.05 was considered to be statistically significant.

RESULTS

A total of 70 patients underwent septoplasty. Most patients (54.28%) were in their third decade of life in the conventional septoplasty group whilst in the endoscopic group, they were in their third and fourth decade (31.43% each). There were 57 males and 13 females with male to female ratio being 4.4:1. The mean pre-op SNOT-10 score was 11.46 (±3.60) for conventional septoplasty and 12.06 (±4.88) for endoscopic septoplasty. The difference was not statistically significant (p value 0.28024) hence both groups were comparable pre-operatively.

In conventional septoplasty group, the mean pre-op SNOT-10 score was 11.46 (±3.60) and the mean post-op SNOT-10 score was 2.60 (±1.943). The difference was statistically significant (p value 0.00001). In endoscopic septoplasty group, the mean pre-op SNOT-10 score was 12.06 (±4.88) and mean post-op SNOT-10 score was 3.37 (±2.71). The difference was statistically significant (p value 0.00001). Hence, there was improvement seen in both groups.

The mean post-op SNOT-10 score was 2.60 (±1.943) for conventional septoplasty and 3.37 (±2.713) for endoscopic septoplasty. The difference was not statistically significant (p value 0.1765). So, both techniques had comparable outcomes.

In both groups, the most common symptom was nasal obstruction (35/35; 100%) which all patients had whilst the least common symptom was epistaxis (8/35; 22.86%).

Based on change in the severity (grade zero to three) of individual symptoms after surgery, four outcomes were made namely, complete relief (any grading to zero), improvement (any grading to lesser grade other than zero), static (no change in grade) and worse (if grade greater than pre-op grade). In conventional group, all patients (8/8; 100%) benefited with complete relief from epistaxis. Cough was completely relieved in 14/15(93.3%) and 1/15(6.7%) had improvement. Nasal obstruction was completely relieved in 16/35(45.7%), improved in 18/15(51.4%) and in 1/15(2.9%) there was no change (table 1). In the endoscopic septoplasty, nasal obstruction was completely relieved in 13/35(37.1%), improved in 21/35(60%) whilst in 1/35 (2.9%) there was no change. Epistaxis was completely relieved in 7/8(87.5%) but it worsened in 1/8(12.5%) patient (table 2).

Table 1. Change in status of individual symptom pre and post-operatively in conventional septoplasty (n=35)

Nasal symptom (n)	Number of patients with change in status of symptoms (%)			
	Complete relief	Improvement	No change	Worse
Nasal obstruction (35)	16(45.7)	18(51.4)	1(2.9)	0
Runny nose (25)	17(68)	1(4)	6(24)	1(4)
Sneezing (31)	17(54.8)	5(16.1)	6(19.4)	3(9.7)
Facial pain/Head-ache (27)	19(70.4)	5(18.5)	3(11.1)	0
Cough (15)	14(93.3)	1(6.7)	0	0
Need to blow nose (30)	24(80)	4(13.4)	1(3.3)	1(3.3)
Post-nasal discharge (23)	13(56.5)	8(34.8)	2(8.7)	0
Thick nasal discharge (18)	11(61.1)	1(5.5)	5(27.9)	1(5.5)
Epistaxis (8)	8(100)	0	0	0
Loss of smell/taste (14)	7(50)	3(21.4)	3(21.4)	1(7.2)

The improvement in mean SNOT-10 score of individual symptom was statistically significant (p value < 0.05) in both conventional and endoscopic group (table 3 and 4). There was no statistical difference between conventional and endoscopic septoplasty for individual symptom improvement (table 5). Post-operative synechiae occurred in one case each in both groups whilst none of the patients had septal perforation.

DISCUSSION

Septoplasty is a commonly performed surgery in rhinologic practice for symptomatic deviated nasal septum. Ideally, septoplasty should fulfill the following criteria namely, i) should relieve the nasal obstruction along with other associated symptoms; ii) should be conservative iii) should not produce iatrogenic deformity; iv) should

Table 2. Change in status of individual symptom pre and post-operatively in endoscopic septoplasty (n=35).

Nasal symptoms (n)	Number of patients with change in status of symptoms (%)			
	Complete relief	Improvement	No change	Worse
Nasal obstruction (35)	13(37.1)	21(60)	1(2.9)	0
Runny nose (22)	12(54.6)	7(31.8)	3(13.6)	0
Sneezing (28)	14(50)	10(35.7)	3(10.7)	1(3.6)
Facial pain/Head-ache (23)	12(52.2)	11(47.8)	0	0
Cough (19)	13(68.4)	3(15.8)	2(10.5)	1(5.3)
Need to blow nose (30)	21(70)	6(20)	3(10)	0
Post-nasal discharge (25)	11(44)	8(32)	5(20)	1(4)
Thick nasal discharge (24)	17(70.8)	4(16.7)	2(8.3)	1(4.2)
Epistaxis (8)	7(87.5)	0	0	1(12.5)
Loss of smell/taste (19)	12(63.2)	2(10.5)	2(10.5)	3(15.8)

Table 3. Comparison of mean SNOT-10 score of individual symptom before and after conventional septoplasty (n=35)

Symptoms	Mean SNOT-10 score (±SD)		p value
	Pre-op	Post-op	
Nasal obstruction	2.57 (±0.502)	0.60 (±0.604)	0.00001
Runny nose	1.114 (±0.932)	0.31 (±0.583)	0.00027
Sneezing	1.34 (±1)	0.46 (±0.608)	0.000015
Facial pain	1.31 (±0.932)	0.29 (±0.574)	0.00001
Cough	0.63 (±0.877)	0.03(±0.173)	0.000087
Need to blow nose	1.63 (±0.942)	0.20 (±0.463)	0.00001
Post nasal drop	1.31 (±1.183)	0.31 (±0.529)	0.000011
Thick nasal discharge	0.71 (±0.894)	0.20 (±0.4)	0.001406
Epistaxis	0.29 (±0.574)	0.00	0.002161
Loss of smell/taste	0.57 (±0.883)	0.20 (±0.4)	0.013547

Table 4. Comparison of mean SNOT-10 score of an individual symptom before and after endoscopic septoplasty (n=35).

Symptoms	Mean SNOT-10 score (±SD)		p value
	Pre-op	Post-op	
Nasal obstruction	2.17 (±0.707)	0.69 (±0.583)	0.00001
Runny nose	1.14 (±1.086)	0.34 (±0.640)	0.000184
Sneezing	1.43 (±1.009)	0.46 (±0.608)	0.00001
Facial pain	1.37 (±1.236)	0.41 (±0.655)	0.000079
Cough	0.77 (±0.911)	0.20 (±0.469)	0.000781
Need to blow nose	1.69 (±1.048)	0.29 (±0.519)	0.00001
Post nasal discharge	1.34 (±1.135)	0.54 (±0.781)	0.000508
Thick nasal discharge	1.11 (±1.024)	0.20 (±0.4)	0.00001
Epistaxis	0.26 (±0.608)	0.03 (±0.173)	0.044
Loss of smell/taste	0.77 (±0.974)	0.23 (±0.489)	0.002188

Table 5. Comparison of post-op mean SNOT-10 score of individual symptom between conventional and endoscopic septoplasty.

Symptoms	Mean SNOT-10 score (±SD)		p value
	Post-conventional septoplasty	Post-endoscopic septoplasty	
Nasal obstruction	0.60 (±0.604)	0.69 (±0.583)	0.273834
Runny nose	0.31 (±0.583)	0.34 (±0.640)	0.42281
Sneezing	0.46 (±0.608)	0.46 (±0.608)	0.5
Facial pain	0.29 (±0.574)	0.41 (±0.655)	0.199024
Cough	0.03 (±0.173)	0.20 (±0.469)	0.057
Need to blow nose	0.20 (±0.463)	0.29 (±0.519)	0.236195
Post nasal discharge	0.31 (±0.529)	0.54 (±0.781)	0.07806
Thick nasal discharge	0.20 (±0.4)	0.20 (±0.4)	0.5
Epistaxis	0.00	0.03 (±0.173)	0.160428
Loss of smell/ taste	0.20 (±0.4)	0.23 (±0.489)	0.395678

not compromise the osteomeatal complex and v) must have the scope for revision surgery, if required later. The standard conventional septoplasty do not fulfill the above mentioned criteria in most instances however the current evolving endoscopic technique do fulfill most of them. Both the techniques have their own advantages and drawbacks, but the symptoms relieved and postoperative complications after septoplasty are more important for patient satisfaction.

The age range in our study was 15 to 56 years. The most affected age group was in the third and fourth decades which was in concordance with the study by Nayak et al. and Jain et al.[8,9] In our study, males were affected more than females with ratio of 4.4:1. The ratio ranged from 2:1 as reported by Nayak et al. to 7:1 as reported by Jain et al.[8,9]

The follow-up of our study (between four to six weeks) was relatively less as compared to eight weeks follow up in the study by Gulati et al.[10] The need for a longer follow has been highlighted by Jessen et al. as they found the benefits of septal surgery dropped considerably from 73% to 27% after nine years of follow-up.[11] However, this has been refuted by Bohlin and Dahlqvist who found the benefit up to ten years.[12] Ideally, longer follow up allows assessment of outcome of longer duration. However, considering the high drop-out rate, we opted for follow up between four to six weeks post-operatively. Interestingly, even with this reasonable duration of follow up, there were three patients from endoscopic group and four patients from conventional group who were lost to follow up. So, additional seven patients were enrolled in the study.

SNOT (Sino-nasal outcome test) is one of the subjective assessment tools, in which both nasal and health-related symptomatic improvements are assessed. SNOT-10, a modification by Prakash et al. has been seen to be a reliable and valid tool to assess outcomes of septoplasty hence this was used in our study.[13]

The most common symptom was nasal obstruction which all patients had (100%). This was followed by the need to blow nose (85.71%), sneezing (84.28%), headache (71.43%), post-nasal drip (68.57%), runny nose (67.14%), thick nasal discharge (61.43%), cough (48.57%), loss of smell/taste (37.14%), and epistaxis (22.86%). Jain et al. found nasal obstruction (74%) to be the most common symptom followed by anterior nasal discharge (41%), headache (20%), sneezing (15%) and postnasal drip (8%).[9] The frequency of complaints of nasal obstruction was similar to the study of Gupta et al. but headache was the second major complaint in their study.[14]

In conventional group, epistaxis was relieved completely (100%). Nasal obstruction was the second most improved symptom (97.14%) with the complete relief seen in 45.7% cases and improvement in 51.4% cases. The least improved symptom was thick nasal discharge (66.67%) with complete relief in 61.1% cases and improvement in 5.5% cases. Similarly, in endoscopic group headache/facial pain was improved in 100% patients, with complete relief observed in 52.2% cases and improvement in 47.8% cases. The second most improved symptom was nasal obstruction, which was seen in 97.14% patients, with the complete relief observed in 37.1% cases and improvement in 60% cases. In the study done by Sindwani and Wright, nasal obstruction and headache were cured in 54% patients, 38% of patients had improvement and 8% of the patients had no benefit.[15]

Regarding nasal obstruction, both techniques were found to be equally effective in overall improvement of the symptom which is in concordance with study by Gulati et al.[10] In his study nasal obstruction was relieved in 80% cases in the conventional group and 90.5% cases in the endoscopic group. Similarly, Jain et al. and Shrestha et al. also found the endoscopic group had more improvement in nasal obstruction than in conventional group.[9,16] Concomitant FESS with septoplasty in the endoscopic group could have contributed to comparatively more improvement of nasal obstruction in this group.

Harley et al. observed significant improvement in patients with headache in the endoscopic group as compared to the conventional group.[17] It was completely relieved in 70.4% (24/27) cases, improved in 18.5% cases and 11.1% cases did not benefit from the conventional septoplasty. However, in the endoscopic group, all the patients (23/23) benefited from the facial pain/headache, which was completely relieved in 52.2% cases and improvement was seen in 47.8% cases. This finding was in concordance with the study by Gulati et al. and Shrestha et al.[10,16] The improved relief of headache observed in the endoscopic group could be due to access to posteriorly located septal deviations and spurs causing contact headache.

In the conventional septoplasty, 66.6% of patients with complaints of thick nasal discharge benefited from the surgery, of which 61.1% had complete relief and 5.5% had improvement. There was no change observed in 27.9%

while it worsened in 5.5% cases. In the endoscopic group, 87.5% benefited, of which 70.8% had complete relief and 16.7% had improvement, 8.3% had no improvement and in 4.2% it worsened. More patients benefited in the endoscopic group which was similar to the finding by Shrestha et al.[16] In their study, it was relieved in 21.4%, improved in 35.7%, remained same and worse in 21.4% cases in the conventional group. In the endoscopic group, it was relieved in 11.1% cases, improved in 66.6% cases, and remained same in 22.2% cases. Overall improvement in the endoscopic septoplasty in this study could be concurrent septoplasty with FESS for chronic rhinosinusitis in 12 cases (40%) in endoscopic group as compared to 7 cases (23.3%) in conventional group.

Regarding post-nasal discharge, 91.3% (21/23) in conventional group benefited from the surgery, of which 56.5% had complete relief, 34.8% had improvement whilst there was no change in 8.7% cases. In the endoscopic group, 76% (19/25) benefited from the surgery. Among them 44% had complete relief, 32% had improvement. No change was seen in 20% cases and worse in 4% cases. Most of the patient benefited in the conventional group compared to endoscopic group. In a study done by Shrestha et al. post-nasal discharge was resolved, improved and remained same in 33.3% cases each in the conventional group.[16] In the endoscopic group, 19% cases had complete relief, 66.6% had improvement, 9.52% remained same and worse in 4.7% cases. In the study done by Jain et al. Gulati et al. Salama et al. it was relieved more in endoscopic group compared to conventional group.[9,10,18]

In the conventional group, 71.4% patients complaining loss of smell/taste benefited from the surgery of which 50% had complete relief and 21.4% had improvement. No change was seen in 21.4% cases and worsen in 7.2% cases. Similarly, in the endoscopic group, 73.7% cases benefited of which 63.2% had complete relief and 10.5% had improvement. No improvement was seen in 10.5% cases and the symptom worsened in 15.8% cases. The loss of smell/taste was benefited by both conventional and endoscopic techniques in our study, which is in concordance with the study by Gulati et al.[10] In his study hyposmia was relieved in 88.89% of cases in the conventional group and 100% of cases in the endoscopic group.

Significantly higher rate of persistence of symptoms was found with conventional septoplasty as compared to endoscopic septoplasty in a study by Nayak et al.[8] Synechiae was less common in the endoscopic group as compared to the conventional group in several studies.[16,19-22] However in our study, one patient each in both groups had postoperative synechiae, for which no intervention was required as it remained asymptomatic. None of the patient developed septal perforation. Hwang et al. in their retrospective study in 111 endoscopic septoplasties reported hematoma and asymptomatic perforation in 0.9% each and synechiae formation in 4.5% patients.[6] Post-operative bleeding in endoscopic septoplasty has been seen to range from 1.6 to 2.08%.[23,24]

There are some limitations to this study. Multiple surgeons were involved so variations in their experience might have affected the surgical outcome. Post-operative evaluation was done between four to six weeks. So, a longer follow up in a larger sample would have better addressed the outcome on a long run in larger number of patients. However, overcoming the difficulty for follow-up still remains especially for patients residing in remote area.

CONCLUSION

Both conventional and endoscopic septoplasty techniques using Freer's incision were equally effective in improving symptoms due to deviated nasal septum in our study.

REFERENCES

1. Sipilä J, Suonpää J. A prospective study using rhinomanometry and patient clinical satisfaction to determine if objective measurements of nasal airway resistance can improve the quality of septoplasty. *Eur Arch Otorhinolaryngol*. 1997;254(8):387–90.
2. Freer O. The correction of deflections of the nasal septum with a minimum of traumatism. *J Am Med Assoc*. 1902;38(10):636–42.
3. Killlan G, Foster EE. XXIII. The Submucous Window Resection of the Nasal Septum. *Ann Otol Rhinol Laryngol*. 1905;14(2):363–93.
4. Lanza DC, Kennedy DW, Zinreich SJ. Nasal endoscopy and its surgical applications. Essent Otolaryngol Head Neck Surg 5th ed N Y NY Med Exam Publ. 1991;373–87.
5. Stammberger H, Posawetz W. Functional endoscopic sinus surgery. *Eur Arch Otorhinolaryngol*. 1990 Mar 1;247(2):63–76.
6. Hwang PH, McLAUGHLIN RB, Lanza DC, Kennedy DW. Endoscopic septoplasty: indications, technique, and results. *Otolaryngol Head Neck Surg*. 1999;120(5):678–82.
7. Dolan RW. Endoscopic septoplasty. *Facial Plast Surg*. 2004;20(03): 217–21.
8. Nayak DR, Balakrishnan R, Murthy KD. An endoscopic approach to the deviated nasal septum – a preliminary study. *J Laryngol Otol*. 1998 Oct;112(10):934–9.
9. Jain L, Jain M, Chouhan AN, Harshwardhan R. Conventional septoplasty verses endoscopic septoplasty: a comparative study. *People's J Sci Res*. 2011;4(2):24–8.
10. Gulati SP, Wadhera R, Ahuja N, Garg A, Ghai A. Comparative evaluation of endoscopic with conventional septoplasty. *Indian J Otolaryngol Head Neck Surg*. 2009 Mar;61(1):27–9.
11. Jessen M, Ivarsson A, Malm L. Nasal airway resistance and symptoms after functional septoplasty: comparison of findings at 9 months and 9 years. *Clin Otolaryngol Allied Sci*. 1989;14(3):231–4.
12. Bohlin L, Dahlqvist A. Nasal airway resistance and complications following functional septoplasty: a ten-year follow-up study. *Rhinology*. 1994;32(4):195–7.
13. Prakash S, Pradhan B, Thapa NM. Reliability of Sino-Nasal Outcome Test in Measuring the Outcome of Septoplasty. *Nepal J ENT Head Neck Surg*. 2011;2(1):8–11.

14. Gupta M, Motwani G. Comparative study of endoscopic aided septoplasty and traditional septoplasty in posterior nasal septal deviations. *Indian J Otolaryngol Head Neck Surg*. 2005;57(4):309.

15. Sindwani R, Wright ED. Role of endoscopic septoplasty in the treatment of atypical facial pain. *J Otolaryngol*. 2003;32(2).

16. Shrestha I, Pokharel M, Dhakal A, Amatya RCM. Study to Compare and Evaluate Traditional vs. Endoscopic Septoplasty. *Kathmandu Univ Med J.* 2017 Feb 25;13(2):109–14.

17. Harley DH, Powitzky ES, Duncavage J. Clinical outcomes for the surgical treatment of sinonasal headache. *Otolaryngol Neck Surg*. 2003;129(3):217–21.

18. Salama MA. Endoscopic aided septoplasty versus conventional septoplasty. *WJMS.* 2014;11:33–8.

19. Park D-H, Lee J-W, Song C-H, Han D-G, Ahn K-Y. Endoscopic Application in Aesthetic and Reconstructive Facial Bone Surgery. *Plast Reconstr Surg*. 1998 Sep;102(4):1199–209.

20. Rao M. Is endoscopic septoplasty really superior than conventional septoplasty. *Natl J Otolaryngol Head Neck Surg*. 2013;1:16–8.

21. Talluri KK, Motru B, Avvaru K. Correction of deviated nasal septum: conventional vs endoscopic septoplasty. *IOSR-JDMS*. 2014;13(5):14-5

22. Garzaro M, Dell'Era V, Riva G, Raimondo L, Pecorari G, Aluffi Valletti P. Endoscopic versus conventional septoplasty: objective/subjective data on 276 patients. *Eur Arch Otorhinolaryngol*. 2019 Jun;276(6):1707–11.

23. Gupta N. Endoscopic septoplasty. *Indian J Otolaryngol Head Neck Surg*. 2005;57(3):240–3.

24. Nawaiseh S, Al-Khtoum N. Endoscopic septoplasty: retrospective analysis of 60 cases. *JPMA*. 2010 Oct 1;60(10):796.