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Research Paper

Septoplasty Pre and Postoperative Evaluation Regarding: Nasal Obstruction, Headache and Eustachian Tube Function

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ABSTRACT:

BACKGROUND:

Septoplasty is a surgical correction of the deviated nasal septum; it is one of the most common Otorhinolaryngology operations in adults. Currently the main indication to perform septoplasty is nasal obstruction. Nasal Obstruction Symptom Evaluation Scale is a tool for assessing nasal obstruction.

OBJECTIVE:

The purpose of this study is to evaluate and compare the outcome of Septoplasty regarding nasal obstruction, improvement associated headache and Eustachian Tube functions by tympanometry.

Study design: it is a prospective comparative study.

PATIENTS AND METHODS:

This prospective study was done from February 2021 to December 2021 at otorhinolaryngology department in Rizgary Teaching Hospital in Erbil City/Iraq on Overall (60) patients, (23) of them were female and (37) were male, their age ranged between (18) and (50) years old, patient undergoing septoplasty because of Deviated Nasal Septum were included. All participants were informed about the study, and written informed consents were obtained, Nasal Obstruction Symptom Evaluation Scale was used to evaluate surgical satisfaction. The preoperative headache intensity was recorded based on Visual Analogue Scale, Middle ear pressure and Eustachian Tube functions of total (120) ears were assessed by tympanometry and Functioning divided into those at side of septal deviation and ears to the opposite side of deviation. The tests were performed the day before Surgery and eight weeks after surgery.

RESULTS:

Regarding Nasal Obstruction Symptom Evaluation Scale decreased after septoplasty (11.48/4.5)($P < 0.05$).Comparing the outcome of associated headache, pain Visual Analogue Scale revealed a mean value of (5.1) preoperatively ; and (3.4) postoperatively, the difference of scores was significant ($p < 0.05$), There were (27) functional Eustachian Tube (40.9%) in the side of septal deviation preoperatively, which increased to (46) ears (49.49%) postoperatively)($P < 0.05$), while in the contralateral side increased to (47) (50.53%) from (39) (59.1%) after surgery.

CONCLUSION:

Outcome of septoplasty has a satisfactory result in most of the cases on improvement both nasal obstruction and associated headache, and this study represents that there is a relation between septoplasty and Eustachian Tube function.

KEY WORDS: Deviated Nasal septum, Septoplasty, Eustachian tube, Headache, Nasal obstruction.

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INTRODUCTION:

Nasal breathing, the typical respiration path in human beings, is a fundamental aspect of respiratory physiology. The nasal airway passage, accounting for approximately half of the total airway resistance, is necessary for optimal respiratory function. Objective and subjective tools are available to measure nasal airway patency or its resistance. Objective measurements taken before and after nasal decongestants can effectively differentiate between mucosal hypertrophy and structural deformity as the cause of nasal obstruction. However, due to their inherent

limitations, subjective tools are more commonly used in clinical and research settings. The visual analog scale, a simple and adequate tool, is a reliable choice for a subjective measure of nasal patency. [1]

The Nasal Obstruction Symptom Evaluation (NOSE) scale is a validated tool for adult nasal obstruction. The five domains score 0 (no symptoms) to 4 (severe symptoms), and the result is multiplied by 5, producing a maximum score of 100. [2]

From a practical point of view, the current technology cannot accurately determine the level or cause of nasal obstruction; clinical examination remains the mainstay of clinical diagnosis. The nasal airway comprises two nasal cavities, each with a medial, a lateral wall, and a floor

The International Classification of Headache Disorders (ICHD) defines a myriad of more than 200 different types of headaches. [3]. The ICHD includes headaches that occur secondary to nose and paranasal sinus pathology, such as acute rhinosinusitis, chronic or recurring sinusitis, and nasal turbinates or septum disorders. This concept of "Rhinogenic headache" has been present for a long time but remains a subject of considerable debate among otolaryngologists and neurologists, especially in patients with no clinical or radiographic evidence of mucosal sinus disease. Various theories exist regarding the pathophysiological basis of Rhinogenic headaches, including sinus barotrauma and contact "pressure" points within the nasal cavity. Diagnosing Rhinogenic headaches remains challenging. Frequently, patients self-diagnose their 'sinus headaches. [4,5]

Ventilation of the middle ear is facilitated via the Eustachian Tube (ET), a passageway connecting the nasopharynx with the middle ear cavity. The flow of air through the ET and the gas exchange between the middle ear mucous membrane and the circulatory system as a whole are essential to the regulation of pressure. It is essential to preserve ET function in order to keep middle ear pressure balanced. There are a number of methods for assessing ET functionality, but because sound waves must be measured as they pass through the ET, the procedure is laborious. We used tympanometry and insufflation tests (the Valsalva maneuvers) in this study because they are easy to perform and have been widely used for the clinical evaluation of ET functions and in academic research. One of the main contributing factors to middle ear inflammation is thought to be inadequate aeration of the Eustachian tube. It is thought that nasal blockage can result in a reduction in Eustachian tube function, and that pathologies of the nasal passages, paranasal sinuses, and nasopharynx can affect Eustachian tube performance. On this point, nevertheless, the research findings are not entirely in agreement. While some authors have urged waiting several months following septoplasty before doing ear surgery, others have stated that the success rate of middle ear surgery is comparable to that of nose surgery when done in conjunction with it. Our objective was to investigate the effect of nasal septal deviation on Eustachian tube function in this prospective comparative study. [6]

PATIENTS AND METHODS:

Study Setting and time:

This prospective study was done from (February to December) 2021 at the otorhinolaryngology department in Rizgary Teaching Hospital in Erbil City/Iraq; this study was done on 60 patients and included both males and females. Patients 'ages ranged from (18) to (50) years; a patient data information sheet was filled, including name, age, sex, occupation, phone No., and address.

All patients were informed about this study, and written informed consent was obtained.

Inclusive Criteria:

1. Age ≥ (18) years and who has deviated nasal septum (moderate, severe).
2. Patients who complain of nasal obstruction with or without the headache of Rhinogenic origin for more than one year with no response to medical treatment.
3. The Rhinogenic headache was diagnosed by exclusions, meaning try to exclude any other possible causes of headache clinically, by investigation, or by consultation.

Exclusive criteria:

1.age < 18 years
2.Patients with a history of bleeding complications, any serious underlying condition that may conflict with anticipated healing, and those with physical incompetence.
3- Pregnant Patient
4.Septal perforation, nasal polyps, nasal mass, allergic rhinitis, chronic sinusitis.
5.Patients with signs and symptoms of non-rhinogenic headache
6.Patient with a perforated tympanic membrane, serous otitis, or an active upper respiratory tract infection.

7.Those who had a previous septoplasty, endoscopic sinus surgery, myringoplasty, tympanoplasty, or who have a history of nose trauma (less than six months).

Preoperative evaluation

Clinical examination, including general condition and otorhinolaryngology examination, is done first by inspection, then by local examination of the nose by (anterior rhinoscopy done), and then nasal endoscopic examination done after applying local anesthesia and local decongestant for better examination and avoiding from pain due to rigidity of instruments, the type, side of septal deviation obtained clinically, in order to assess the severity of the septal deviation, The nasal obstruction symptom evaluation (NOSE) scale [(2)] used, it consists of (0 – 4) Rating Scale in which 0 = NOT a problem, 1 = Very mild problem,2 = Moderate problem,3 = Fairly bad problem,4 = Severe problem, this scale was used to assess each patient prior to surgery.

The NOSE scale questionnaire includes Nasal congestion or stuffiness., Nasal blockage or obstruction, trouble breathing through the nose, trouble sleeping, and Inability to get enough air through my nose during exercise or exertion. The findings were recorded for each patient given a score according to the NOSE scale; the scores were multiplied by 5, resulting in a balanced scale ranging from (0 to 100); nasal obstruction was classified as mild (0-25), moderate (26-50), or severe (>50). Mild cases were not included in the study.

Patients with nasal blockage and headache were referred to neurologists, ophthalmologists, and dentists to evaluate the headache.

The preoperative headache intensity, a crucial aspect of our study, was meticulously measured using a 10-point visual analog scale (VAS) (7). This scale, with 0 representing no pain and 10 representing the most severe discomfort, provides a precise and reliable method for assessing pain levels.

Each patient underwent a comprehensive ear examination, including inspection, otoscopic, endoscopic, and microscopic examination. The eustachian tube function was assessed for 120 ears using a tympanometry device. This involved obtaining basal tympanometric peak pressures (TPPs) and Conducting Valsalva maneuvers to obtain Valsalva tympanometric peak pressures (TPPs). The data was meticulously analyzed, and the eustachian tube was deemed functional when a change between basal and Valsalva (TPPs) of 10 Deca pascals (daPa) or greater was observed. If the change was less than 10 daPa, the eustachian tube function was judged poor [(6)].

Ears were divided into those to the side of deviated nasal septum and contralateral side.

All patients got a preoperative evaluation, which included a review of their current illnesses. Following the taking detailed information about Past medical and surgical history and drug history with complete ENT examination, the patients were sent for these investigations: full blood count, blood type, and Rh, bleeding and clotting time, virology andPCR for Covid 19.

Ethical considerations, the informed surgical consent was taken.

All preoperative data, including the results of the ear examinations, eustachian tube function assessments, and the various investigations, were collected and recorded. This comprehensive data collection was crucial for comparing the preoperative results with the postoperative outcomes, thereby providing a comprehensive understanding of the study's findings.

Intra operative period:

All patients underwent septoplasty, a procedure that was performed under the safety and comfort of general anesthesia and endotracheal intubation. The surgical procedures were carried out by surgeons who used the same approaches. This included classical septoplasty in Supine Positioning, where the head of the bed is elevated 20 to 30 degrees and tilted 15 degrees to the surgeon’s side. The mucoperichondrial flap was elevated bilaterally, and the deformed part (bony or cartilaginous part) was corrected. Suturing the site of incision and through and through suturing was done with good hemostasis, followed by the use of intranasal Silicone splints with airway.

Post operative Management:

1. Patients are typically discharged on the day of surgery.
2. Systemic Antibiotic coverage for Staphylococcus aureus (penicillin group usually amoxiclav tab 1 gm 1*2 used for ten days) If the patient has Allery to penicillin it is replaced by macrolide antibiotics, also analgesic given to the patients (on need).
3. Patients are instructed to irrigate the intranasal splints with saline solution 3 to 4 times daily. This is done by gently squirting the saline solution into each nostril, allowing it to flow out naturally. After each rinse, the nasal vestibule is cleaned of any

loose or clotted blood. A local antibiotic ointment is then applied inside the nares to moisturize the nose. This regimen helps keep the splints clear, thus maximizing comfort and enabling the patient to breathe through the splints.

4.The intranasal splints, which are used to support the nasal structure during the initial healing phase, are typically removed at 7 days postoperatively. This is to ensure that the patient's nasal passages are clear and to promote further healing.

Eight weeks after the operation:

All the patients for which septoplasty was undergoing further evaluation, including:

1.Evaluation of the nasal obstruction and the outcome of the operation by (NOSE) Scale and clinical examination by anterior rhinoscope and Rigid endoscope.

2.The associated headache was evaluated for all patients who complained preoperatively from rhinogenic headache. (VAS) scale does this.

3.Regarding the assessment of Eustachian tube function, ear examination by otoscopic and endoscopic examination, then tympanometry is done for all the patients, and the postoperative data are collected and compared with Preoperative one.

Data Analysis:

The Data were statistically analyzed using SPSS v26 for Windows

•Samples were compared and evaluated by means of a Paired T-test, chi-square, fisher exact test, binominal test, cross-tabulation

•A P value of < 0.05 was considered statistically significant. The confidence interval was set at 95%.

•The device used in the tympanometry study was Otopront

RESULTS:

In this prospective study, a total of 60 patients were enrolled, with ages ranging from (18-50) years, with a sex distribution of 23 (38.3%) females and 37 (61.6%) males, with mean age (of 27.63) years, which is a not significant and Std. Deviation (± 8.44) as shown in table 1.

Table 1: Distribution of sample by Sex.

Sex	No.	Mean	Percentage (%)	Std Error Mean	Std. Deviation	T-Test P. Value
Male	37	27.22	61.6	1.458	± 8.44	0.631
Female	23	28.30	38.3	1.636		0.622
Total	**60**		100 %			

The age range is divided into 5 Groups for statistical purposes, and it shows most of the cases in the second and third decades, according to Table 2.

Table 2: Distribution of sample by age.

Age Range (Years)	No.	Percentage (%)
< 20	**15**	**25**
21-30	**24**	**40**
31-40	**16**	**26.66**
41-50	**5**	**8.33**
Total	**60**	**100**

All the patients who had septoplasty done for them showed a common type of septal deviation was the S shape in 25 cases (41.6%) and the C shape in 17 cases (28.3%), while the spur and caudal dislocations were fewer common types in 10,8 cases (16.6%, 13.3%) respectively as seen in figure 1.

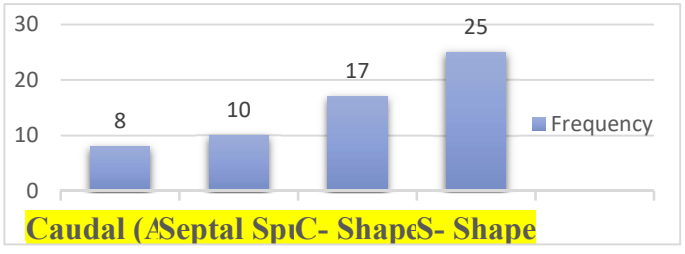

Figure 1: Distribution of sample by type of septal deviation.

In our study, more than half (58.3%) of patients (35) with septal deviation had a Moderate form, and 25 cases (41.6 %) had a Severe form of deviation. (Severity of nasal obstruction measured by **NOSE** scale) as seen in figure 2.

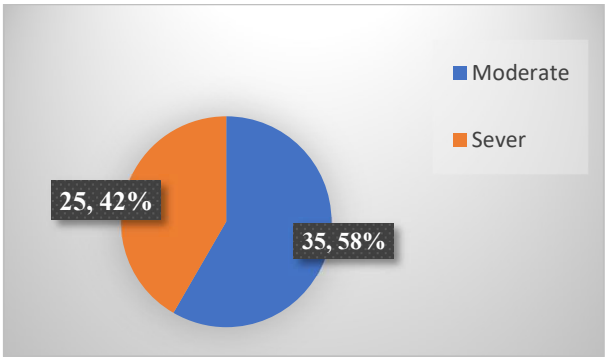

Figure 2: Distribution of sample by severity of septal deviation.

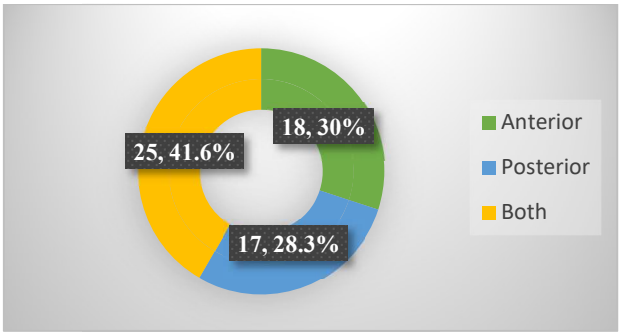

Figure 3: Distribution of sample according to location of septal deviation

Regarding the location of the septal deviation, it was on both sides for (S-Shape) 25 cases (41.6%), was anterior in 18 cases (30 %) of patients and posterior in 17 cases (28.3%) of patients with septal deviation seen in figure 3.

Regarding headaches, in this prospective study, about (37) of all patients complained of headaches of Rhinogenic origin, which represent about (61.6 %) of the cases, while (23) had **NO** headache; and in this study we found that these headaches were to be in **frontal (30%)** in about (18) patients**, periorbital (15%) temporal** (**10%**) and **parietal (6.6%),** these results were shown Distribution of sample by site of headache as in table 3.

Table 3: Distribution of sample by Site of headache.

Type of Headache	Frequency	Percentage (%)
Frontal	**18**	**30**
Periorbital	**9**	**15**
Temporal	**6**	**10**
Parietal	**4**	**6.66**
No Headache	**23**	**38.33**
Total	**60**	**100**

The result shows that represents there is a relation between the type of septal deviation and the site of the headache in which the frontal was in (S)shape represented by (13) cases, then (C) shape by (5) cases, periorbital was (7) in (S) shape and 2 in C-shape, temporal was 3 in both Sand C shape, parietal was 2 in both (S and caudal) septal deviation, none of super case have headache, all data was analyzed by Chi-Square tests and was highly significant p-value < 0.05(<0.000)*** As seen in figure 4.

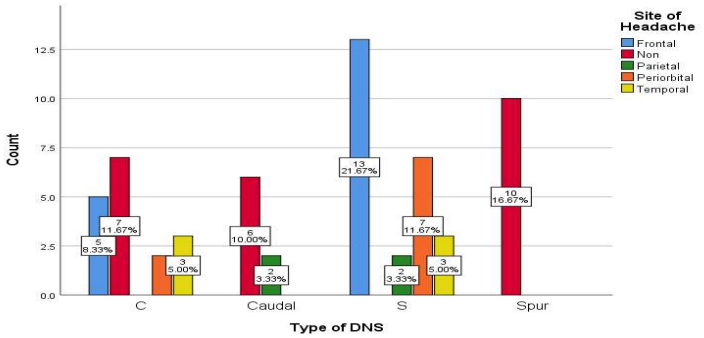

Figure 4: Relation between types of septal deviation and site of headache.

The quality of the pain in our study is classified into **pulsatile, sharp, and compressive**. The majority of the cases of headache had pulsatile pain, which is represented by (22) patients out of (37), while sharp and compressive have less frequency by (8) and (7), respectively, as shown in Table 4.

Table 4: Distribution of sample by Quality of the Pain.

Quality of the Pain	Frequency	Percentage (%)
Pulsatile	**22**	**36.66**
Sharp	**8**	**13.33**
Compressive	**7**	**11.66**
No Pain	**23**	**38.33**
Total	60	100

According to this study, we found that there is a relation between the side of the deviated nasal septum and quality of the pain in which most of the pulsatile pain was in (S)shape in about (15) cases (5) in (C) shape, all (6) case of compressive was in (S)shape, sharp was (4) in both (C and S) shape as seen in figure 5
all data was analyzed by Chi-Square Tests and was highly significant P value < 0.05 (<0.000) ***.

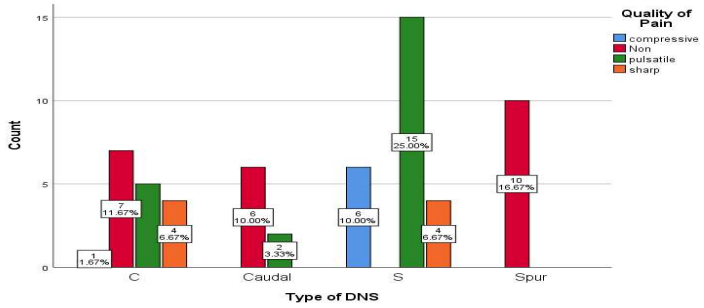

Figure 5: Relation between types of septal deviation and quality of pain.

In this study, we found that all sharp compressive pain was in the frontal site while pulsatile was distributed in periorbital and temporal by (9,5) cases, respectively and 4 in both parietal and frontal site, all data analyzed by Chi-Square tests and was highly significant p-value < 0.05 (<0.000) *** as seen in figure 6.

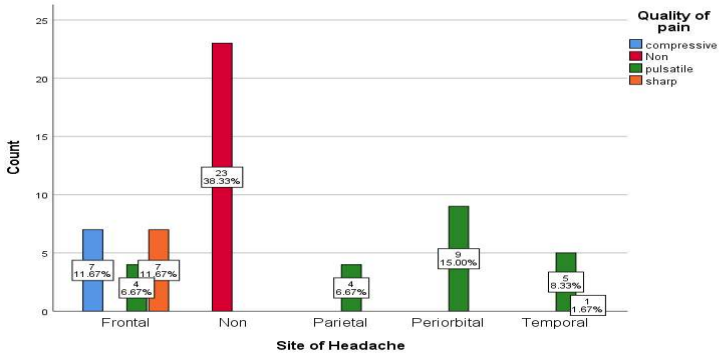

Figure 6: Relation between the quality of the pain and site of headache.

Post operative result:

Regarding the post-operative result of nasal obstruction, the mean of **the NOSE** scale was (57) pre-operatively and became (22.5) post operatively or after dividing by (5) Mean from (11.4) became (4.5) and it was a highly significant p-value < 0.05 (<0.000) *** as seen in table 5.

Table 5: Pre and Postoperative NOSE scale (Mean).

NOSE Scale	Mean	No.	Std. Deviation	Std. Error Mean	t-test
Pre Op.	**57.00 (11.4)**	**60**	**14.386**	**1.857**	**P value**
Post Op.	**22.50 (4.5)**	**60**	**8.949**	**1.155**	**(< 0.000) *****

The outcome of the severity of nasal obstruction was assessed by the NOSE Scale of each patient according to their score classified into moderate sever DNS pre-operatively, the post-operative result analyzed by **Fisher's Exact test,** which represents a decrease in the moderate case from (35) to (12) case those have Improvement but their severity still in the moderate level while the severe cases from (25) cases more than halve has full recovery and (11) of them got Improvement and became in moderate level, the post-operative outcome was significant (P< 0.05) as seen in table 6.

Table 6: Pre and Postoperative (NOSE) Scale evaluation Fisher's Exact Test was used.

Severity of DNS	**Pre -Operative**	**Change in quality of nasal obstruction in postoperative follow up**	
	No. of patients preoperative	No. of patients with full recovery	No. of patients reduced
Moderate	35(58.3%)	23(62.16%)	12(52.17%)
Severe	25(41.6%)	14(37.83%)	11(47.82%)
Total	60(100%)	37(61.66%)	23(38.33%)

The 2nd part of this study was about the associated headaches with the patients of DNS, and a total of 37 cases who have headaches classified according to their VAS scale, each one given a score operatively of 9,21,7 for mild, moderate, and severe, respectively and compared to postoperative result there was a better improvement in sever group and only one case has just reduced headache and other 6 cases have a full recovery, while moderate case 3 of them reduced their headache and 4 of them has no change other got full recovery, the last group of mild case 3 of them reduced their headache, other got full recovery while only one patient has no change in his or her headache all data are analyzed by **Fisher's Exact Test** the P value was significant < 0.05 as in table 7.

Table 7: Preand Postoperative Visual Analog Scale (VAS) for patients with headache(*Fisher's Exact Test was used.)

	Pre -Operative	Change in headache quality in Post Op. follow up		
Degree of headache by VAS scale (0-10) mm	No. of Pts. has headache preoperative	No. of pts with full recovery	No. of pts reduced headache	No. of patients with no changes
Mild (1-3) mm	9(24.3%)	5(20%)	3(42.85%)	1(20%)
Moderate (4-6) mm	21(56.7%)	14(56%)	3(42.85%)	4(80%)
Severe (7-10) mm	7(18.9%)	6(24%)	1(14.28%)	0(0%)
Total No. of pts. has headache	37(100%)	25(67.56%)	7(18.91%)	5(13.51%)

In **our study** the mean of **VAS** scale was (5.14) Preoperatively and (1.03) Postoperatively this improvement was highly statistically significant. **(P value <0.05<0.000)** ***The data was analyzed by t-test. As in table 8.

Table 8: Pre and Postoperative VAS score (Mean).

Vas Scale	Mean	Std. Deviation	Std. Error Mean	t-test
Pre	**5.14**	**2.016**	**0.331**	**P value <0.05 (<0.000) *** **
Post	**1.03**	**1.708**	**0.281**	

The 3rd part of this study was about the assessment of the E.T. function of all 60 patients undergoing septoplasty by tympanometry in which 120 ears were tested and the result came as the following (27) ears to the side of DNS preoperatively, which became (46) ears which were significant (p-value <0.05) regarding the side of DNS while in contrast, the opposite side of deviation has increased in the No. From (39) ears to (47) postoperatively, this increase was not significant; this was done using the **Binomial Test,** as shown in Table 9.

Table 9: Number of Functional (ET) Before and After operation.

Functional (E.T.)	Pre Op.	Post Op.	Binomial Test P Value
Functional ET to the Side of DNS	27	46	< 0.05
Functional ET to contralateral side	39	47	(0.45)

For tympanometry peach pressure (TPP), which was done as basal Valsalva for pre and post-operative results, there was improvement and The changes in the tympanometry results were in both basal and Valsalva peak pressure in the affected side (-7.14 daPA/ 12.14 daPA) and contralateral side (-5.89 daPA/11.89daPA) preoperatively and (-3.47daPA/16.56 daPA) in the affected side and (-2.46 daPA / 13.61 daPA) to the contralateral side postoperatively, but all was non-significant p-value (> 0.05) this data analyzed by t-test. as seen in table 10.

Table 10: Pre and Postoperative TPP.

TPP	To the side of deviated septum		To the contralateral side	
	Basal	Valsalva	Basal	Valsalva
Pre operative	(-7.14)	(12.14)	(-5.89)	(11.89)
Post operative	(-3.47)	(16.56)	(- 2.46)	(13.61)
P Value	0.465	0.447	0.238	0.289

DISCUSSION:

The deviated nasal septum is a widespread issue with serious effects on one's quality of life. Septoplasty is typically performed to provide qualitative and quantitative benefits to people who have nasal obstruction due to Deviated nasal septum (DNS).

In this prospective study of 60 patients, females were (23) (38.3%), males (37) (61.6%), and the patient's age ranged between (18) and (50) years, representing the population sample which has been taken for the research in which both genders female and male included in study, and preponderance in males can be reasoned out by the fact that most common etiology of deviated nasal septum is nasal trauma which occurs more frequently in males.

In a study done by **Janovic N et al** (2020) [8] of (386) patients, about (153) (39.6%) were males, and (233) (60.4%) were females. The mean age was (55) years. This is unmatched by our study, most probably due to the large number taken by the last. Also, population density plays a role in this difference.

In a study done by **Sam A. et al.** (2012) [9] On (63) patients (63%) were males and (37%) were females the age group (16-65) years mean (34.7) years. The difference between our study and the last study regarding the age group is that they included younger and older patients with a larger sample, but the sex distribution matched our study. In a study done by **Nayak et al** (2002), [10] the age of the patients ranged from (6 – to 54) years, with a mean of 26.4 years and an M: F ratio of 2:1. The range of age unmatched our study because the last include cases with age less than (18) which are excluded in our study.

Regarding the age group **in our study**, the second and third decades are the most commonly affected age group; there is a similarity in age group between males and females, which means equal variances sample; this makes the comparison between them better in which there are no age gaps. In a study done by **Sam A. et al.** (2012) [9] a maximum number of patients in the fourth decade (34%), followed by (29%) in the second decade.

Also, **Jain et al.** (2011) [11] and **Rao et al**. (2005) [12] found that the most common age groups were those in their second and third decades of life, which is similar to our study.

Concerning the type of septal deviation **in our study,** the (S) shape was the most common type of deviation present in (25) patients (41.66%), C-shaped deviation was present in (17) patients (28.33%), the spur was present in (10) patients (16.66%), and caudal dislocation was present in 8 patients (13.33%).

And this is different from a study done by **Moorthy et al.** (2014) [13], in which C- shaped deviation was in (40%) of patients, S-shaped deviation in (30%), the spur was (20 %), caudal deviation in (16%), Ant. in (11%) of cases, Post (4%),

while **Rao et al.** (2005) [12] in their study found S-shaped deviation in (50%) which is somewhat equal to our study.

In a study done by **Nayak et al.** (2002) [10] on 480 patients (39%) have C-shape, (20%) S. shape, (36%) with Spur DNS.

These differences with our study are most probably due to racial factors and also possibly due to a large number of cases included in other studies.

Regarding nasal obstruction 8-week follow-up after surgery, the patients' **NOSE** questionnaire scores improved statistically significantly ($p<0.05$), and there was a correlation between the improvement in preoperative and postoperative scores.

In a study done by **Kaya M. et al.** (2018) [6] on (50 patients, they a NOSE Scale of more than (10) that included only moderate and severe cases, which is similar to our study and regarding the mean of the NOSE scale it was (12.4) before surgery and (7.5) after surgery compared to our study which was (11.4), (4.5) before and after operation respectively.

This is also comparable to the study done by **Stewart et al.** (2004) [14], which employed the NOSE scale for subjective evaluation and found that septoplasty results in a significant improvement in disease-specific QL, high patient satisfaction, and decreased medication use in patients with septal deformity. The result of improvement of nasal obstruction according to the NOSE scale implies possibly a strong management effect (the surgical approach and expert senior surgeon who does the operation), fewer post-operative complaints, good follow-up, and the severity of the NOSE scale in which the more score has better improvement in which majority of the cases is ranging between (moderate to severe) this is possibly due to patients in our locality did not seek for operation unless the complaint from persistent nasal obstruction.

Regarding associated headaches, many theories have been offered throughout the years to explain the pathophysiology of primary headaches with a probable nasal source.

In our study, Mucosal contact between the septum and a part of the lateral wall of the nose was found in (37) patients.

This supports the findings of **Abdel Tawab et al**. (2014) [15], who found that septal-turbinate contact indicates that the pathologic process in rhinogenic headache occurs in the nasal cavity rather than the sinus cavity.

However, it is in contrast to the study done by **Behin et al**. (2005) [16] on patients with only contact between the septum, superior turbinate, and/or ethmoid the patients who demonstrated contact between the septum and middle turbinate on CT scan which were excluded in this study.

In our study with DNS, about (37) of the patients (61.6%) has a headache.

This is matched with a study conducted by **Harraldson PO et al.** (1987) [17], where They found nasal obstruction (100%), headache (58%)

And that possibly explains why not all patients in this study with nasal obstruction who underwent septoplasty had headaches of rhinogenic origin. Also, the type of septal deviation has a role in this result, as most of the patients with (S) shape deviation had a headache, and there was a statistically significant relationship between them.

Regarding the site of the headache **in our study**, headaches were to be in the frontal (30%), periorbital (15%), temporal (10%), and parietal (6.66%) of cases, while a study conducted by **Harely et al.** (2003) [18] where overall (71) patients complaining of [headaches and DNS] were included. Their headaches were reported to be in the frontal in (73%), periorbital in 38%, temporal in 28%, and in the face in (26%) of cases in which most of the patients experience their headache in more than one anatomical location.

The difference in results between both studies is that half of Harely's cases had contact point headaches; also, in our study, this is possible due to the fact that most of the cases have S-shaped deformities with ants. and Post. Obstruction and stimulation of various regions of the nasal mucosa may cause pain in different parts of the face.

Regarding the Quality of the pain **in our study** classified into pulsatile, sharp, and compressive (36.66%), (13.33 %), (and 11.66 %) respectively

and this is in accordance with the study conducted by **Behin F et al**. (2006) [19] in which headaches caused by contact points in the sinonasal region have been reported to be pulsatile, sharp, or compressive; the pain in our study is subjective which described by the patients, and it is possible the reason of this result.

In our study about (75%) of the patient had full recovery from the headache and (10%) with significant reduced in headache intensity.

In a study conducted by **Behin F et al.** (2005) (2006) [16] [19] in a 10-year follow-up after the surgery, (30%) of the patients had a full recovery, and (35%) had significant recovery.

The difference between the two studies is that the latter has suggested that contact points can trigger headaches in individuals with migraine, so they took patients with migraine headaches and not pure contact headaches, while in our study, migraine is excluded.

In a study conducted by **Behin F et al**. (2005) (2006) [16] [19] After the surgery (91%) of patients reported reduced headache intensity and (85%) reduced headache frequency.

Here, the difference between this study and our study is that they took patients with refractory migraine, which is excluded in our study, with a longer duration of patient follow-up in comparison to our duration of follow-up.

In a study conducted by **Welge-Luessen A** (2003) [20], there is an agreement with our study (65%) of the patients reported complete disappearance of the headaches or marked improvements in the symptoms.

In a study conducted by **Ramadan HH et al.** (1999) [21] in a three-month follow-up, (60%) of people who had undergone surgery were cured of headaches, and this is comparable to our study.

In **our study**, the VAS scale mean was (5.14) Preoperatively and (1.03) Postoperatively this improvement was statistically significant.

In a recent study done by **Folic, Miljan M. et al.** (2021) [22], Surgery gave a statistically significant reduction in the intensity and frequency of headaches, which was assessed six months after Surgery. Surgery was found to be superior to nonsurgical treatment in the management of CP headache, and there was a statistically significant decrease in the mean of the VAS scale between pre- and postoperative results, which matched our study.

In another study done by **Altin, Fazilet et al.** (2019) [23], there was statistically significant VAS scale improvement between pre and post-op. Result (8.3) to (4.9) respectively.

However, the difference was in the duration of follow-up and the location of the contact point, which was not specified in our study because our cases were randomly selected and not classified into groups.

Regarding Eustachian tube function, Patients with middle ear ventilation issues are frequently admitted to otorhinolaryngology clinics that are accompanied by nasal obstructive diseases.

In our study on (120) ears of (60) patients for those who consented to septoplasty done for them, it found that the No. Functional ET rose after septoplasty, as the following ears on the deviated side increased from (27) to (46) while on the contralateral side, from (39) to (47) ears.

The postoperative result shows there is an improvement in ET function on the side of DNS with significant change, while the change on the

contralateral side is not statistically significant. Compared to a study done by **Kaya M. et al.** (2018) [6] of total (50) pts. There were (20) functional ETs (40%) in the affected side preoperatively, which increased to 36 ears (72%) postoperatively, and functional tubes increased to 35 (70%) from 29 (58%) after surgery in the contralateral side which is somewhat similar to this study.

A study done by **Akyıldız et al**. (2017) [24] observed higher rates of ET dysfunction in patients with nasal septal deviation, and they detected an improvement in the results after septoplasty.

This explained that individual with a nasal septum deviation experienced poorer ET functions and lower middle ear pressure on the affected side, but these measures remained within acceptable limits.

Salvinelli et al. (2005) [25] conducted a study involving 40 patients to assess the function of the Eustachian tube using the Toynbee and Valsalva maneuvers both before and after nasal septal surgery. After the operation, there was a significant improvement in the tube functional tests.

Regarding Tympanometry peak pressure (TPP), The changes in the tympanometry results were for both basal and Valsalva middle ear pressure in the affected side (-7.14 daPA/ 12.14 daPA) and contralateral side (-5.89 daPA/11.89daPA) preoperatively and (-3.47daPA/16.56 daPA) in the affected side and (-2.46 daPA / 13.61 daPA) to the contralateral side post-operatively which indicate improvement of middle ear pressure but it is statistically not significant p-value> 0.05. Which is unmatched by the study done by **Kaya M. et al.** (2018) [6].

The changes in the tympanometry results were statistically significant for both the affected side (−33.56 daPA/−21.18 daPA) and contralateral side (29.24daPA /−24.96 daPA) ($p<0.05$), but the alteration in the side of deviation was more evident.

On the contrary, **Akyldz et al**. (2017) [24] claimed that individuals with DNS had poor ET function in general, but that did not impair the tympanoplasty outcome.

The middle ear pressure also improved after septoplasty but with no significant change in (pre/post) operative tympanometry peak pressure (basal and Valsalva); this is possibly due to that most of the TPPs were within the normal range as device accuracy and patient's cooperativity while doing the tympanometry test especially post-operatively when most of the patient hesitating while applying the Valsalva maneuver even after eight weeks of surgery. Also, the size of the external auditory canal plays a role in this (TPP) Reading. One of the study's limitations was that we only had an eight-week follow-up period. However, regardless of time, our findings show a substantial difference in the tympanometry results of deviated and non-deviated sides of the nasal septum.

In research done by **Sereflican et al**. (2015) [26], 60 candidates for septoplasty were split into two groups at random: one group received an applied model, while the other received an applied intranasal splint with the airway. This is unmatched by our study, in which only a silicon nasal splint was used, and this was the possible reason for the difference between the two studies.

In contrast, a study done by **Davari** and**Behnoud** (2014) [27] evaluated the ET functions of (70) patients undergoing septoplasty. They found no significant changes in the middle ear pressure. Also, they found no significant change in the ET functionality.

Yilmaz et al. (2012) [28] proposed using silicon intranasal splints with the airway because they allow inhalation through the nose and induce less ET dysfunction than model packings, which is similar to our findings.

Maier and Krebs (1998) [29] published a study on the need for nose surgery and when it should be done before tympanoplasty. They evaluated ET functioning in (50) patients undergoing septoplasty by performing dynamic tubal tests using the dual-impedance technique. ET. Preoperatively and postoperatively (first, sixth, and eighth weeks) functions were measured and compared. Dynamic tube parameters were abnormal prior to surgery; they were worse in the first few weeks following the procedure and returned to normal in the sixth and eighth weeks.

Maier and **Krebs** (1998) [29] recommended that chronic otitis surgery be preceded by septoplasty.

Our study also matched with a study done by **Deron et al**. (1995) [30]. It revealed the connection between deviated nasal septum surgery and tubal functions using a tubal compliance manometric test during the Valsalva maneuver. Both the contralateral and deviated sides showed improvements in their tubal opening pressure in the early and late post-septoplasty intervals.

While **Low** and **Willett** (1993) [31] showed the results of 40 individuals who didn't get a

septoplasty. Following surgery, the mean TPP dramatically dropped. ($p<0.001$).

CONCLUSION:

- Our research revealed that patients with high preoperative NOSE scores experienced greater improvement following septoplasty compared to those with low NOSE scores.
- These findings are crucial for both patients and surgeons in managing expectations for surgical outcomes. Surgical correction of a deviated nasal septum consistently led to improved rhinogenic headaches.
- This suggests that addressing nasal septal deviation can have a significant clinical impact, potentially alleviating pain in the right patient group.
- Furthermore, our findings indicate that nasal septum deviation may adversely affect middle ear ventilation and Eustachian tube function.
- This highlights the importance of considering septal abnormalities in individuals experiencing frequent ear problems.

Recommendation and Limitation :

- For a patient presenting with nasal obstruction, mainly if the cause is septal deviation, it is crucial to consider their preoperative NOSE scale.
- This assessment tool is a reliable predictor of the outcome and the likelihood of achieving a satisfactory result, underscoring its importance in patient care.
- For a patient experiencing a prolonged headache that is unresponsive to medical treatment, the possibility of it being of Rhinogenic origin should be considered. This can be confirmed after neurological and ophthalmic consultation to exclude other sources or causes of the headache.
- The **VAS** scale is a valuable tool in this assessment, and it is recommended to extend the duration of follow-up to ensure a more comprehensive evaluation. While the findings of this study are insightful, it is important to note that the number of patients was not sufficient to draw definitive conclusions about the relationship between deviated nasal septum and Eustachian tube function.
- To ensure robust and comprehensive research in our field, it is imperative that we strive for larger sample sizes in future studies.Before deciding on middle ear surgery, a thorough evaluation of the nasal cavity is recommended. If the ear condition is diagnosed on the deviated side, so clinicians should be aware of septum deviation.
- Most of the patient afraid while applying the Valsalva maneuver for post operative follow up so it is recommended longer duration for applying this test.

REFERENCES:

1. Anari S, Natt RS. Nasal septum and nasal valve. InScott-Brown's Otorhinolaryngology and Head and Neck Surgery 2018 :1135-48. CRC Press.
2. Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, Hannley MT. Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) scale. Otolaryngology—Head and Neck Surgery. 2004;130(2):157-63.
3. Headache Classification Committee of the International Headache Society (IHS). The international classification of headache disorders, (beta version). Cephalalgia. 2013;33(9):629-808.
4. Eross E, Dodick D, Eross M. The sinus, allergy and migraine study (SAMS) CME. Headache: The Journal of Head and Face Pain. 2007;47(2):213-24.
5. Cady RK, Schreiber CP. Sinus headache or migraine? Considerations in making a differential diagnosis. Neurology. 2002 ;58(9_suppl_6):S10-14.
6. Kaya M, Dağlı E, Kırat S. Does nasal septal deviation affect the eustachian tube function and middle ear ventilation?. Turkish archives of otorhinolaryngology. 2018;56(2):102
7. Haefeli M, Elfering A. Pain assessment. European spine journal. 2006:S17-24.
8. Janovic N, Janovic A, Milicic B, Djuric M. Relationship between nasal septum morphology and nasal obstruction symptom severity: computed tomography study. Braz J Otorhinolaryngol. 2020 Oct 10.S1808-8694(20)30157-9. doi: 10.1016/j.bjorl.2020.09.004. Epub ahead of print. PMID: 33132090.
9. Sam A, Deshmukh PT, Patil C, Jain S, Patil R. Nasal septal deviation and external nasal deformity: a correlative study of 100 cases. Indian J Otolaryngol Head Neck Surg. 2012 Dec;64(4):312-8. doi: 10.1007/s12070-011-0311-x. Epub 2011 Oct 5. PMID: 24294569; PMCID: PMC3477430.
10. Nayak DR, Balakrishnan R, Murty K D, Hazarika P. Endoscopic septoturbinoplasty: Our update series. Indian J Otolaryngol Head

Neck Surg. 2002 Jan;54(1):20-4. doi: 10.1007/BF02911000. PMID: 23119846; PMCID: PMC3450682.

11. Jain L, Jain M, Chouhan AN, Harshwardhan R. Conventional septoplasty verses endoscopic septoplasty: a comparative study. People J Sci Res. 2011 Jul;4(2):24-8.
12. Rao JJ, Kumar EC, Babu KR, Chowdary VS, Singh J, Rangamani SV. Classification of nasal septal deviations-Relation to sinonasal pathology. Indian J Otolaryngol Head Neck Surg. 2005 Jul;57(3):199-201. doi: 10.1007/BF03008013. PMID: 23120171; PMCID: PMC3451341.
13. Moorthy, P. , Kolloju, S. , Madhira, S. and Jowkar, A. (2014) Clinical Study on Deviated Nasal Septum and Its Associated Pathology. *International Journal of Otolaryngology and Head and Neck Surgery*, 3, 75-81. doi: 10.4236/ijohns.2014.32016.
14. Stewart MG, Smith TL, Weaver EM, Witsell DL, Yueh B, Hannley MT, Johnson JT. Outcomes after nasal septoplasty: results from the Nasal Obstruction Septoplasty Effectiveness (NOSE) study. Otolaryngol Head Neck Surg. 2004 Mar;130(3):283-90. doi: 10.1016/j.otohns.2003.12.004. PMID: 15054368.
15. Tawab HM, Gharib FM, Raafat SA, Mohamed MH. Surgical outcomes for Rhinogenic contact point headache. PAN. 2014 Mar;4
16. Behin F, Behin B, Bigal ME, Lipton RB. Surgical treatment of patients with refractory migraine headaches and intranasal contact points. Cephalalgia. 2005 Jun;25(6):439-43. doi: 10.1111/j.1468-2982.2004.00877.x. PMID: 15910568.
17. Haraldsson PO, Nordemar H, Anggård A. Long-term results after septal surgery--submucous resection versus septoplasty. ORL J Otorhinolaryngol Relat Spec. 1987;49(4):218-22. doi: 10.1159/000275939. PMID: 3627735.
18. Harley DH, Powitzky ES, Duncavage J. Clinical outcomes for the surgical treatment of sinonasal headache. Otolaryngol Head Neck Surg. 2003 Sep;129(3):217-21. doi: 10.1016/S0194-5998(03)00623-5. PMID: 12958570.
19. Behin F, Lipton RB, Bigal M. Migraine and intranasal contact point headache: is there any connection? Curr Pain Headache Rep. 2006 Aug;10(4):312-5. doi: 10.1007/s11916-006-0038-7. PMID: 16834948.
20. Welge-Luessen A, Hauser R, Schmid N, Kappos L, Probst R. Endonasal surgery for contact point headaches: a 10-year longitudinal study. Laryngoscope. 2003 Dec;113(12):2151-6. doi: 10.1097/00005537-200312000-00019. PMID: 14660919.
21. Ramadan HH. Nonsurgical versus endoscopic sinonasal surgery for rhinogenic headache. Am J Rhinol. 1999 Nov-Dec;13(6):455-7. doi: 10.2500/105065899781329656. PMID: 10631401.
22. Folic MM, Barac AM, Ugrinovic AB, Jotic AD, Trivic AS, Milovanovic JP, Borozan NN, Peric AR, Stevanovic G, Krejovic-Trivic SB, Cvorovic L, Stojkovic GM. Effectiveness of the Treatment of Rhinogenic Headache Caused by Intranasal Contact. Ear Nose Throat J. 2021 Jun 2:1455613211019706. doi: 10.1177/01455613211019706. Epub ahead of print. PMID: 34077274.
23. Altin F, Haci C, Alimoglu Y, Yilmaz S. Is septoplasty effective rhinogenic headache in patients with isolated contact point between inferior turbinate and septal spur? Am J Otolaryngol. 2019;40(3):364-367. doi: 10.1016/j.amjoto.2019.02.002. Epub 2019 Feb 18. PMID: 30799208.
24. Akyildiz MY, Özmen ÖA, Demir UL, Kasapoğlu F, Coşkun HH, Basut OI, Siğirli D. Impact of Septoplasty on Eustachian Tube Functions. J Craniofac Surg. 2017;28(8):1929-1932. doi: 10.1097/SCS.0000000000003927. PMID: 28922249.
25. Salvinelli F, Casale M, Greco F, D'Ascanio L, Petitti T, Di Peco V. Nasal surgery and eustachian tube function: effects on middle ear ventilation. Clin Otolaryngol. 2005;30(5):409-13. doi: 10.1111/j.1365-2273.2005.01052.x. PMID: 16232243.
26. Şereflican M, Yurttaş V, Oral M, Yılmaz B, Dağlı M. Is Middle Ear Pressure Effected by Nasal Packings after Septoplasty? J Int Adv Otol. 2015;11(1):63-65. doi: 10.5152/iao.2015.1085. PMID: 26223721.
27. Davari R, Behnoud F. Study the Effect of Nasal Obstruction Surgery (Septoplasty) on Eustachian Tube Function and Middle Ear Pressure. Journal of Ardabil University of Medical Sciences. 2014;14(4):322-30.
28. Yilmaz MS, Guven M, Buyukarslan DG, Kaymaz R, Erkorkmaz U. Do silicone nasal septal splints with integral airway reduce postoperative eustachian tube dysfunction?

Otolaryngol Head Neck Surg. 2012 ;146(1):141-5. doi: 10.1177/0194599811421595. Epub 2011 Sep 7. PMID: 21900536.

29. Maier W, Krebs A. Ist die Chirurgie der inneren Nase vor Tympanoplastik indiziert? Auswirkungen einer nasalen Obstruktion und ihrer Sanierung auf die Ohrtrompete [Is surgery of the inner nose indicated before tympanoplasty? Effects of nasal obstruction and reconstruction on the eustachian tube]. Laryngorhinootologie. 1998;77(12):682-88. German. doi: 10.1055/s-2007-997224. PMID: 10036670.

30. Deron P, Clement PA, Derde MP. Septal surgery and tubal function: early and late results. Rhinology. 1995;33(1):7-9. PMID: 7540315.

31. Low WK, Willatt DJ. The relationship between middle ear pressure and deviated nasal septum. Clin Otolaryngol Allied Sci. 1993;18(4):308-10. doi: 10.1111/j.1365-2273.1993.tb00854.x. PMID: 8877192.